

Research Article

# The Way of Governance: Smart Shift in the Modernized and Innovative Urban Development

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## Abstract

Against the backdrop of the "artificial intelligence" era, this study sets the mechanism of action between new types of productive forces and the construction of modern innovative cities as its core theme. It systematically explores this topic in conjunction with domestic differentiated design, international comparisons, identification of real-world challenges, and practical solution paths. This exploration is of significant practical importance for promoting high-quality urban development and fostering new momentum through intelligent transformation. Notably, different regions in China display significant disparities in nurturing new productive forces. For example, the eastern region needs to strengthen original innovation and global resource integration, while the central and western regions should focus on industrial absorption and green transformation. By comparing international innovation models such as Silicon Valley in the United States, Industry 4.0 in Germany, and Tokyo in Japan, and examining both positive and negative cases, this study offers insights into how China can cultivate new productive forces and effectively promote urban innovation. Furthermore, addressing the real challenges in the development of new productive forces, it is recommended to strengthen the role of technological innovation as the source of initiatives, build a modern industrial system, create hubs for high-level talent aggregation, and deepen institutional reforms. These measures provide theoretical support and policy reference for overcoming bottlenecks in the development of new productive forces and stimulating the vitality of modern innovative cities.

## Keywords

Intelligent Steering, New Quality Productivity, Modern Innovative City, Practical Challenges, Differentiated Design, International Comparative Identification

## 1. Introduction

Against the backdrop of profound adjustments in globalization and the accelerated evolution of digital civilization, scientific and technological innovation has emerged as the core domain where nations vie for future developmental supremacy. The concept of "new-type productive forces" proposed by General Secretary Xi Jinping emphasizes driving industrial upgrading through technological innovation, rep-

resenting a significant advancement of Marxist productive forces theory in the new era [1]. Concurrently, modern innovation city development—as a vital vehicle for national spatial strategy—is transitioning from scale expansion to quality enhancement, aiming to build high-quality spaces for production, living, and governance. New-type productive forces and modern innovation city development mutually reinforce

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each other: the former provides the core driving force for urban development, while the latter offers the foundational environment and application scenarios for the former. Existing research can be categorized into three main types: the core-factor-driven perspective focuses on the impact of individual elements such as technology, talent, capital, and data; the industrial transformation and upgrading perspective examines development pathways for strategic emerging industries; and the regional and spatial governance perspective emphasizes the coordination of holistic systems and diverse stakeholders. However, these studies still exhibit three limitations: fragmented analytical perspectives lacking an integrated cross-factor framework; neglect of urban heterogeneity, failing to adequately consider differentiated pathways for areas of varying levels and types; methodological limitations, with a predominance of qualitative research lacking quantitative analysis and international comparisons. Addressing these gaps, this paper constructs an integrated analytical framework of “mechanisms—real world challenges—practical pathways.” It systematically explores the intrinsic mechanisms linking new-quality productive forces with modern innovative urban development, integrating differentiated development paths and international experiences to provide systematic, actionable theoretical support and policy references for advancing high-quality urban development.

## 2. The Mechanism of New Quality Productivity in Modern Innovative City Development

New quality productivity and modern innovative city development share a symbiotic relationship, mutually reinforcing each other. Although their bidirectional driving mechanism has been thoroughly validated in domestic and international practices, there remains a lack of differentiated analysis across city types and systematic international comparisons. To address this gap, this section systematically explores the operational mechanisms of both through four dimensions: theoretical logic, operational mechanisms, differentiated pathways, and international comparisons.

### 2.1. Theoretical Logic of New Quality Productivity Driving Modern Innovative Urban Development

New quality productivity and urban innovation share a highly unified value objective, both fundamentally oriented toward achieving high-quality economic and social development [2, 3]. While cities provide application scenarios and ecosystem support for new quality productivity, the latter serves as the core driving force for urban innovation, propelling industrial upgrading and efficiency enhancement. This driving relationship achieves synergistic de-

velopment through the following four-dimensional mechanisms.

First, technological innovation drives injects a continuous source of innovation into cities by strengthening their capacity for original innovation and the commercialization of technological achievements [4, 5]. Among these, digital technological innovation and breakthroughs in key core technologies jointly determine a city's strategic position within the new competitive landscape [4, 6]. Simultaneously, industrial upgrading drives the construction of modern industrial systems by fostering emerging industries and transforming traditional ones [7, 8]. In this process, the integration of digital and physical economies [9] and the clustering of strategic emerging industries [10] emerge as key pathways for industrial advancement. Further analysis reveals that talent aggregation drives a virtuous cycle through the “siphon effect” [11], attracting high-end talent to stimulate innovation and lead industrial development. Platform-based science parks [12] and other carriers, together with the “trinity” mechanism of education, technology, and talent [13], collectively provide essential support for modern innovation cities [13, 14]. Finally, the green and smart driver systematically enhances resource utilization efficiency through smart city development [15] and green technology application [16], highlighting the “green” essence within high-quality development [17].

These four dimensions mutually reinforce and empower each other: technological innovation provides technical support for industrial upgrading, industrial upgrading offers application scenarios for technological innovation, talent aggregation serves as the core of innovation, and green intelligence delivers infrastructure safeguards. Through synergistic collaboration, they collectively propel urban innovation from factor-driven to innovation-driven transformation, ultimately achieving high-quality development goals [3, 18].

### 2.2. Operational Mechanisms Between New-quality Productivity and Modern Innovative City Development

A multi-layered operational mechanism exists between new-quality productivity and modern innovative city development, with its impact pathways primarily manifested across three key dimensions: technological innovation, industrial upgrading, and institutional innovation.

In the technological innovation dimension, digital technology serves as the core driver, significantly enhancing the development level of new-quality productivity through three key pathways. Specifically, digital technology exerts a promotional effect through three pathways: human capital accumulation (coefficient 0.32), urban functional division (0.28), and entrepreneurial dynamism stimulation (0.35). All three pathways are highly significant at the 1% level ( $p < 0.01$ ) [19], indicating the stability of digital technology's promotional

role as the core driver of new-type productive forces. Among these, the path of stimulating entrepreneurial vitality exhibits the greatest marginal effect, indicating that digital technology significantly enhances new-quality productivity by lowering barriers to entrepreneurship and fostering innovative enter-

prise clusters. Together, these three pathways form a synergistic mechanism of “talent enhancement—division of labor optimization—entrepreneurial incentives,” systematically reshaping the urban productivity ecosystem.

**Table 1.** Mechanisms Through Which Digital Technological Innovation Influences Urban New Quality Productivity.

| Impact Path                         | Mechanism of action                                                                                | Impact Factor | Significance level |
|-------------------------------------|----------------------------------------------------------------------------------------------------|---------------|--------------------|
| Human capital accumulation          | Enhance innovation capabilities by improving workers' digital literacy and skill levels            | 0.32          | *( $p < 0.01$ )    |
| Urban Functional Division           | Promote professional division of labor in cities and improve the efficiency of resource allocation | 0.28          | *( $p < 0.01$ )    |
| Entrepreneurial Vitality Activation | Lower the barriers to entrepreneurship and cultivate clusters of innovative enterprises            | 0.35          | *( $p < 0.01$ )    |

\* Based on Yang Yang, Guo Jiaqin, and Wang Shaoguo's "New Quality Productivity, Entrepreneurial Activity, and High-Quality Urban Development", drawn from Issue 22 of 'Science & Technology Progress and Policy', 2024.

In terms of industrial upgrading, new-quality productive forces drive the transformation of urban industrial systems toward high-end development by fostering strategic emerging industries and digitizing traditional sectors. Taking the digital cultural and creative industry as an example, it exhibits high compatibility with dimensions such as creative capital accumulation, digital technology empowerment, and cultural value conversion [7]. Hefei's “Keli Keqi” development model exemplifies the importance of systematic industrial restructuring by establishing a new cultural productivity system centered on “algorithms-computing power-data” [8]. Furthermore, smart city development serves as a crucial vehicle, driving the growth of new-quality productive forces through a dual-mechanism of technological innovation effects and industrial upgrading effects. However, structural differences emerge across different city types: large cities leverage their advantages in aggregating innovation factors to achieve more pronounced technological innovation effects, while resource-based cities primarily realize industrial upgrading effects through the digital transformation of traditional industries [20].

In the dimension of institutional innovation, intellectual property protection, talent recruitment policies, and data element market development form three major support systems. The National Intellectual Property Demonstration City policy

promotes the development of new productive forces through breakthrough innovation and digital industrialization pathways [21], exhibiting significant intermediary effects at the enterprise level. It not only incentivizes technological innovation investment but also enhances corporate quality and efficiency by optimizing resource allocation [22]. Concurrently, talent attraction policies foster the growth of new-quality productive forces by enhancing a city's appeal to talent, with this effect being more pronounced in cities with favorable market environments and strong fiscal self-sufficiency [11]. Meanwhile, the development of data element markets generates positive driving effects through three mechanisms: promoting human capital accumulation, advancing industrial structure upgrading, and enhancing economic agglomeration levels. This conclusion has been validated in quasi-natural experiments conducted through data trading platform pilots [23].

These three dimensions are interconnected and synergistic: technological innovation provides the technical foundation for industrial upgrading, industrial upgrading creates application scenarios for technological innovation, and institutional innovation offers environmental safeguards for both, collectively fostering a virtuous cycle between new-quality productive forces and the development of modern innovative cities.

### 2.3. Differentiated Development Pathways for Regions of Different Levels and Types

**Table 2.** Comparison of New Quality Productivity Development Levels Across China's Four Major Regions (2012–2021).

| Region | 2012 Index | 2021 Index | Average Growth Rate (%) |
|--------|------------|------------|-------------------------|
|--------|------------|------------|-------------------------|

| Region          | 2012 Index | 2021 Index | Average Growth Rate (%) |
|-----------------|------------|------------|-------------------------|
| Eastern region  | 0.45       | 0.95       | 21.5                    |
| Central region  | 0.32       | 0.82       | 20.0                    |
| Western region  | 0.28       | 0.78       | 22.0                    |
| Northeast China | 0.35       | 0.85       | 19.5                    |

\*Based on Lu Jiang, Guo Zi'ang, and Wang Yuping, 'Development Level, Regional Differences, and Improvement Paths of New-Quality Productivity,' *Journal of Chongqing University (Social Science Edition)*, 2024, Issue 3.

The cultivation pathways for new-quality productive forces exhibit significant variations across regions of different levels. Based on regional development data from 2012 to 2021 (Table 3), all regions have achieved substantial improvements in their levels of new-quality productive forces, yet pronounced gradient differences persist between regions.

Based on the table above, the eastern region consistently leads (with an index of 0.95 in 2021), followed by the central and northeastern regions (0.82 and 0.85 respectively). Although the western region has a weaker foundation, it exhibits the fastest growth rate (22.0% annually), demonstrating strong “late-mover potential” [24]. This east-to-west gradient pattern, particularly the “dual-leader” dynamic of Guangdong and Jiangsu, constitutes a prominent feature of the spatial differentiation in new productive forces [25]. The development path of eastern regions focuses on strengthening original innovation capabilities and building future industry innovation clusters.

Take the “platform-driven + ecosystem incubation” model exemplified by Shenzhen's Yinxing Science Park. By establishing a “1+2+4” service system, it demonstrates the pioneering role of eastern cities in building innovation ecosystems [12]. Simultaneously, advancing high-level opening-up, deep integration into global innovation networks, drawing on Silicon Valley's experience to refine technology-finance service systems, and guiding the clustered development of specialized, refined, distinctive, and innovative enterprises have become key pathways to enhancing international competitiveness [26].

Central and western regions face dual challenges of industrial transformation and talent shortages, exhibiting growth patterns characterized as “imitation-catchup” (central regions) and “potential-breakthrough” (western regions) [27]. Development pathways should focus on three aspects: First, accelerating the intelligent transformation of traditional industries, particularly for resource-based cities that must achieve structural transformation by building modern industrial systems [28]; second, leveraging green transition advantages to convert ecological resources into new productive forces [16]; Third, strengthen talent recruitment and cultivation to build a high-quality talent ecosystem [14].

Notably, resource-based cities must overcome path dependence to shift from traditional development models toward

innovation-led growth. Core pathways include: deep processing of existing resources and value chain upgrading; proactive cultivation of successor and substitute industries; and accelerated digital transformation to enhance resource and energy security through digital empowerment [28, 16]. The significant catalytic effect of new-quality productive forces on resource-based cities provides core momentum for transformation and upgrading [16]. Concurrently, the dual pilot policies for national innovation cities and smart cities serve as crucial policy vehicles, substantially elevating new-quality productive forces through dual mechanisms of technological advancement and openness [29]. These policies effectively boost total factor productivity by increasing government R&D expenditure, promoting economic agglomeration, and improving the business environment [6]. However, attention must be paid to their regionally uneven effects, as they have a particularly pronounced stimulating impact on cities in central and northern China. This disparity is a key factor that must be considered when formulating future optimization pathways [29].

## 2.4. International Comparisons and Insights on Developing New Quality Productivity

The development of new quality productivity must be examined within a global context, and international comparisons offer valuable insights. The development models of major innovative nations hold significant reference value for China in cultivating new quality productivity.

First, the success of the Silicon Valley model in the United States lies in establishing a comprehensive innovation ecosystem that forms a complete chain: “basic research—venture capital—startup incubation—industrial integration.” Core elements of this model include an active venture capital market, a dense concentration of universities and research institutions, a deep-rooted entrepreneurial culture, and a complete innovation industrial chain [18]. Tesla's development journey exemplifies the operational mechanism of this ecosystem. The implications for Chinese cities are clear: deepen industry-academia-research integration, strengthen venture capital markets, and foster an innovation ecosystem that embraces trial and error.

In contrast, Germany's Industry 4.0 strategy offers vital

insights for the digital transformation of traditional industries. Take Siemens' Amberg factory as an example: by deploying digital twin technology, production line automation reached 75%, while product defect rates dropped to 0.01% [26]. This achievement stems from highly skilled professionals trained through the dual vocational education system, technology transfer services from Fraunhofer Institutes, and the systematic compatibility of DIN standards. Germany's experience demonstrates that cultivating high-quality skilled talent, advancing digital transformation in SMEs, and establishing industry standard systems are key to enhancing industrial competitiveness.

Additionally, Japan's Tokyo metropolitan area achieves efficient innovation output through intensive development and nurturing an innovation-driven culture. The Keihin Industrial Belt's "mother factory system," rooted in a culture of relentless craftsmanship, ensures continuity of technical expertise through lifetime employment contracts while leveraging compact urban spatial layouts to facilitate knowledge spillover. This offers a viable three-pronged approach—"cultural drive, institutional safeguards, and spatial support"—to address the challenge of "large but not excellent" innovation ecosystems in megacities.

**Table 3.** Comparison of Key Indicators for New Quality Productivity Among Major Countries.

| Country       | Main mode                 | Global Innovation Index Ranking | Proportion of emerging industries | Pattern characteristics                                                                     |
|---------------|---------------------------|---------------------------------|-----------------------------------|---------------------------------------------------------------------------------------------|
| United States | The Silicon Valley model  | 2                               | 35%                               | Innovation ecosystem (venture capital and university collaboration)                         |
| China         |                           | 12                              | 28%                               | Government guidance and support from industrial policies                                    |
| Germany       | Germany Industry 4.0      | 8                               | 32%                               | Digital Transformation of Traditional Industries (Dual Education System Standard Framework) |
| Japan         | Compact Urban Development | 13                              | 25%                               | Intensive Development and Innovative Culture (Craftsmanship Spirit, Spatial Layout)         |

\*Based on Huo Weidong and Li Jintao, "New Quality Productivity from an International Comparative Perspective: Lessons Learned and Practical Pathways," *International Trade*, Issue 8, 2024; Liu Mingli, "Understanding New Quality Productivity from an International Perspective," *Modern International Relations*, Issue 7, 2024.

However, international experiences also offer lessons from failures. For instance, France's Sophia Antipolis Science Park suffered from insufficient innovation vitality due to excessive reliance on government funding; Dubai's Silicon Oasis project became detached from local industrial foundations, leading to "park hollowing"; and Bangalore, India, saw its sustained innovation capacity weakened by infrastructure overload [27, 26]. These cases highlight three critical pitfalls China must avoid: blindly following trends and replicating models without local roots; imbalanced hardware investment and software development that neglects nurturing the innovation ecosystem; and homogenized competition lacking distinctive positioning. In summary, international experiences offer crucial insights for Chinese cities cultivating new productive forces: innovation activities must deeply integrate with local industrial foundations; innovation ecosystems require coordinated development of both soft and hard environments; and urban development should leverage unique strengths for differentiated positioning. Systematically drawing on both positive and negative international experiences will empower China to

cultivate new productive forces more efficiently.

2.5. Policy Implications from Differentiated Pathways and International Comparisons

The development of new-quality productive forces and modern innovation cities creates synergistic effects through a closed-loop system of "scientific and technological innovation—industrial upgrading—institutional innovation." Specifically, the application of digital technologies, industrial restructuring, and optimization of the institutional environment form a core interactive mechanism that drives the upgrading of regional innovation systems. Differentiated development pathways are further established based on regional characteristics: Eastern regions should strengthen their role as innovation hubs, prioritizing foundational research and future industries; Central and Western regions should advance the intelligent transformation of traditional industries, fostering synergy between industrial transfer and upgrading; Resource-based cities must overcome path dependencies by

cultivating new-quality productive forces through green transitions. Concurrently, pilot policies for smart cities and innovation-driven cities demonstrate significant catalytic effects in underdeveloped areas [29], warranting their demonstration and leadership role. Particularly noteworthy is that international experiences offer crucial insights for cultivating new quality productive forces in China. The Silicon Valley model in the United States demonstrates pathways for building innovation ecosystems, Germany's Industry 4.0 highlights the value of vocational education and digital transformation for SMEs, and Japan's experience reflects the advantages of intensive development and enterprise-led innovation. These all suggest that China needs to improve its innovation ecosystem, promote the coordinated development of education, science and technology, and talent as a "trinity" [13], and optimize the relationship between government and market.

To this end, a tiered guidance strategy is recommended: Eastern innovation hubs should establish themselves as highlands for new productive forces; central and western regions should cultivate growth poles by leveraging industrial clusters; while resource-based cities should advance green and intelligent transformations. At the policy level, emphasis should be placed on institutional innovation to invigorate market entities, while maintaining openness and cooperation amid deglobalization trends and actively integrating into global innovation networks.

### 3. Real Challenges in the Development of New Quality Productivity

The advancement of new quality productivity in modernizing innovative cities faces multidimensional systemic challenges. At the technological innovation level, critical core technologies pose "chokepoint" risks, with insufficient independent innovation capabilities in high-end chips and foundational software hindering secure and controllable development [30, 5]. simultaneously, chronic underinvestment in fundamental research weakens foundational innovation. Combined with inefficient channels for translating scientific achievements into practical applications, obstacles persist in bridging the final mile from "lab to market" [13]. Regarding factor allocation, lagging market-oriented reforms in data elements have led to widespread "data silos." A notable example in healthcare is that tertiary hospitals, constrained by data compliance regulations, can only deploy AI diagnostic models to use one-third of effective data; cross-border transmission constraints on hospital-enterprise collaborations have reduced new drug trial efficiency by 40% [9, 31, 20]. Simultaneously, barriers to the interregional flow of innovation factors also hinder resource allocation efficiency. Industrial transformation exhibits pronounced regional disparities. Eastern regions leverage comprehensive industrial chains to establish leadership advantages—for instance, Suzhou at-

tracts foreign-funded R&D centers to achieve full-chain innovation. In contrast, Northeast China's legacy industrial bases, hampered by talent shortages, resort to "component enclave" collaborations that significantly fragment profit margins [31, 4, 28]. This gradient disparity underscores the need for traditional industrial zones to prioritize innovation ecosystem cultivation. Regarding talent support, a significant structural contradiction exists. Specifically, the shortage of multidisciplinary talent has become a key constraint, with the current education system showing clear shortcomings in cultivating cross-disciplinary professionals [7]. Furthermore, talent evaluation mechanisms overly emphasize static metrics like publications and patents while undervaluing actual innovation contributions, severely limiting the full release of talent potential [13]. Moreover, at the institutional level, inadequate intellectual property protection undermines the motivation of innovation actors [21, 22]. Simultaneously, regulatory frameworks for emerging industries struggle to balance inclusivity with effectiveness. Insufficient coordination across departments and regions exacerbates fragmented governance [24]. These interconnected challenges collectively form systemic barriers to developing new-quality productive forces, necessitating integrated solutions through deepening reforms and institutional innovation.

### 4. Practical Pathways for New Quality Productivity to Stimulate Urban Innovation Vitality

To systematically address challenges in developing new quality productivity, a multi-tiered, organically integrated practical framework must be established. First, at the top-level design stage, the role of technological innovation as a source of breakthroughs should be strengthened. Major scientific and technological initiatives should focus on frontier fields like artificial intelligence and biomedicine to overcome bottlenecks in core technologies. For instance, Shanghai's Zhangjiang Science City has established Asia's most complete integrated circuit industry chain through a "national major science and technology project + local matching funds" model [5, 24]. Simultaneously, enterprises must be reinforced as the primary drivers of innovation, supporting leading companies to form innovation consortia. Shenzhen, for example, has integrated over 500 SMEs into its information technology innovation industry chain, achieving an R&D intensity of 5.8% [28, 12]. Furthermore, a government-led support mechanism for basic research should be established, with major scientific infrastructure deployed [13]. Building upon this foundation, the critical step is constructing a modern industrial system. On one hand, strategic emerging industries like next-generation information technology and new energy vehicles should be cultivated, while future industries such as brain-inspired intelligence should be proactively developed [1, 10]. On the other

hand, the integration of digital and physical economies must be deepened. For instance, Hangzhou's "Industrial Brain" has reduced R&D cycles by 35% and defective product rates by 60% through AI algorithms [8, 9, 32]. Simultaneously, it leverages regional strengths to foster industrial clusters in digital culture, green low-carbon industries, and other sectors [7, 16, 17]. Furthermore, talent support forms the foundation for cultivating new productive forces. Open talent policies should be implemented, such as Suzhou Industrial Park's "Jinji Lake Talent Plan" which attracted Nobel laureate laboratories, raising the proportion of overseas talent in the biopharmaceutical sector to 37% [11, 14]. Deepening supply-side reforms in education is essential to establish interdisciplinary talent cultivation models [13]. Optimizing talent evaluation systems and establishing innovation-value-oriented incentive mechanisms are also crucial [3]. Finally, institutional safeguards are key to unleashing innovation vitality. Accelerate the development of data element markets [31, 20]; strengthen full-chain intellectual property protection, such as Shenzhen Intellectual Property Court reducing patent litigation cycles from 18 months to 6 months [21, 22]; foster "patient capital" to support long-term R&D, like Suzhou Industrial Park's "investment-lending linkage" tool facilitating ¥1 billion in financing for biopharmaceutical enterprises [16, 12]; and implement inclusive and prudent regulation [12].

Through systematic advancement and coordination across these four dimensions, institutional barriers will be effectively dismantled, comprehensively elevating the level of new-quality productive forces and modern innovation-driven urban development.

## 5. Conclusions and Outlook

New-type productive forces and modern innovative city development share a relationship of theoretical coupling and practical mutual reinforcement. However, they currently face multiple challenges, including constraints on core technologies, lagging marketization of data elements, regional development imbalances, and insufficient institutional coordination. To address these challenges, a systematic practical pathway must be established: Specifically, efforts should focus on strengthening technological innovation and fundamental research, nurturing emerging industries, improving talent recruitment and cultivation mechanisms, and optimizing data element and intellectual property systems. Implementation requires tailored approaches based on regional conditions—for instance, eastern regions should emphasize original innovation, central and western regions should advance industrial intelligence and green transformation, while resource-based cities must overcome path dependencies to achieve diversified transformation.

Building on this foundation, future research should further explore differentiated pathways, broaden international comparative perspectives, and enhance policy evaluation and dynamic interactive analysis. Aligned with the goals of Chi-

nese-style modernization, we must consistently uphold systemic thinking, differentiated guidance, and open-minded principles. Through multidimensional coordination, we will advance high-quality development, ultimately empowering new productive forces to become a robust pillar of modernization.

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## Conflicts of Interest

The authors declare no conflicts of interest.

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