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Article

Enhancing the New Productivity of Jianghuai Region Based on the Core City Collaboration

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Abstract: This paper constructs a three-dimensional evaluation system of "new-quality labor force - new-quality labor objects - new-quality means of labor" and uses the entropy weight-TOPSIS method to measure the development level of new productive forces in the Jianghuai region from 2018 to 2022. The results show that the overall new productive forces in the region showed a trend of fluctuating rise followed by a slight decline, and spatially presented a "core-periphery" gradient distribution, with Hefei, Yancheng, and Nantong as high-value areas, and Xinyang, Huainan, etc. as low-value areas. Regional differences stem from resource endowments, industrial structure, policy support and other factors. The radiation of core cities has boundary limitations, and the overall differences have converged but local ones have expanded. Based on this, suggestions for coordinated development such as optimizing resource allocation and promoting industrial upgrading are put forward.

Keywords: New productive forces; Regional differences; Jianghuai region

1. Introduction

In September 2023, General Secretary Xi Jinping put forward the concept of new productive forces for the first time during his inspection and research in Heilongjiang [1]. This concept is an innovative development of Marxist productive forces theory in the new era. It originates from technological breakthroughs, innovative allocation of factors, and industrial transformation and upgrading. It takes the leap of productive factors and their optimized combination as its connotation, and has the characteristics of high technology, high efficiency, and high quality, with a significant improvement in total factor productivity as its core symbol [2]. It provides important guidance for promoting industrial innovation through scientific and technological innovation and building competitive advantages. At present, the new round of scientific and technological revolution and industrial transformation intersect with the transformation of China's economic development mode, bringing strategic opportunities for the development of new productive forces. The Central Economic Work Conference has clearly made relevant arrangements, and all regions have actively responded [3]. The Jianghuai region, covering most of Anhui Province and most of Jiangsu Province, has a good foundation in terms of location, economy, industry, and scientific and technological innovation, which lays the foundation for the development of new productive forces [4]. However, the differences in the development of internal cities restrict coordinated advancement, and the radiating and driving role of core cities has not been fully exerted, and related issues need to be solved urgently. Based on this, this paper focuses on the Jianghuai region, explores the development level and improvement path of its new productive forces from the perspective of core city-driven and regional difference coordination, analyzes the current situation, reveals problems, and puts forward targeted strategies, so as to provide theoretical and practical support for the high-quality development of the region and China's economic development.

Foreign research on productivity transformation has long focused on technological progress and factor restructuring. Solow proposed the theory of technological progress driving productivity growth. By constructing the Solow model, he quantified the core contribution of technological progress to productivity growth, laying a solid foundation for neoclassical growth theory [5]. Aghion expanded the perspective to the synergy of innovation ecosystems. In recent years, research has focused on the digital economy and green transformation. Goldfarb emphasized the role of data factors, and Nordhaus paid attention to the value of green technological innovation. However, foreign countries have not yet formed a unified concept of "new productive forces", and relevant research is scattered and lacks systematic integration. Domestic research started with policy responses and theoretical exploration. Huang Qunhui defined the core characteristics of new productive forces, and Liu Zhibiao provided a research perspective from the angle of factor integration [6]; there have been many explorations in the construction of evaluation systems, but there are obvious differences in indicator selection and no consensus has been reached. Regional research focuses on the Yangtze River Delta, Pearl River Delta and other regions, while systematic analysis of the Jianghuai region, especially the discussion on factor interaction mechanisms and spatial difference characteristics, is relatively scarce, which is difficult to meet the theoretical needs of coordinated regional development.

The new productive forces are the core driving force for promoting the quality improvement and quantity growth of China's economy. They can be regarded as an organic integration covering various aspects such as new-type labor force, new-type labor objects, and new-type means of labor [7]. Based on this, this paper constructs a comprehensive evaluation system including 3 first-level indicators, 11 second-level indicators, and 17 third-level indicators to scientifically assess its development level. The research comprehensively applies the entropy weight-TOPSIS method, spatial analysis method, and comparative analysis method: The entropy weight-TOPSIS method assigns weights objectively through the entropy weight method (for example, the weight of "whether there is a data trading platform" is 13.53%, and the weight of "the number of artificial intelligence enterprises" is 12.09%), and combines the TOPSIS method to calculate the comprehensive score to avoid subjective deviations; The spatial analysis method relies on ArcGIS to draw spatial distribution maps and introduces the local Moran's I index to reveal the laws of agglomeration and diffusion; The comparative analysis method captures dynamic trends and regional gaps through vertical and horizontal comparisons, and analyzes the deep-seated causes of the gaps [8]. The three methods work together to present the overall picture of the development of new productive forces from the dimensions of quantitative evaluation, spatial pattern, and spatio-temporal evolution.

2. Comprehensive Evaluation System of New Quality Productivity

The new-type labor force dimension comprises three key components: workforce size in emerging industries, individual employee competencies, and workforce quality. The workforce size reflects regional investment in emerging industries and industrial structure optimization, with a 10.08% weighting that underscores the importance of talent scale. Individual competencies are measured by average wages of employed workers, with a 0.98% weighting that indirectly reflects individual contributions. Workforce quality is gauged by the number of higher education institutions, which serve as the cradle for cultivating high-caliber talents. Their quantity impacts regional talent reserves, and a 5.08% weighting highlights the positive role of the foundational environment for talent development [9].

The new quality labor object dimension encompasses infrastructure, future development, and ecological environment factors. In terms of infrastructure, internet broadband users (weight 3.17%) and total telecom service volume (weight 4.29%) reflect a region's digitalization foundation, serving as a critical safeguard for new quality productivity development [10]. Future development is measured by robot installation density (weight 2.47%), highlighting the significance of advanced equipment adoption and industrial intelligent transformation. Ecological environment is assessed through indicators such as environmental pollution control investment (weight 5.01%) and carbon trading volume (weight 5.10%), with a substantial total weight that underscores green and sustainable development. The key influence in this dimension.

The new quality means of labor is assessed through five dimensions: technological R&D, innovation output, intelligentization, green transformation, and data elements. Technological R&D is measured by the proportion of scientific expenditures in local fiscal budgets (2.58%), reflecting regional investment intensity. Innovation output is quantified by annual invention patents (8.87%) and utility model patents (7.63%), with the high weighting emphasizing the value of innovation outcomes. Intelligentization is gauged by the number of AI enterprisess (12.09%), underscoring its pivotal role. Green transformation is evaluated through annual green inventions (9.64%) and utility model patents (7.98%), highlighting the significance of green innovation. The data element comprises data utilization level (1.37%) and the presence of data trading platforms (13.53%). The high-weight platform indicators underscore the critical importance of the data trading environment.

3. Results and Analysis

3.1 Characteristics of Temporal Evolution

Using the measurement method developed by Lu Jiang and Guo Zi'ang [11], the assessment results of new productive forces and primary indicators in the Jianghuai region are presented in Table 1.

From 2018 to 2023, the overall level of new-type productivity in the Jianghuai region exhibited a fluctuating upward trend followed by a slight decline (Figure.1). It rose from 0.980 in 2018 to 1.018 in 2022, then dropped to 0.935 in 2023, maintaining a relatively high level and demonstrating positive development momentum. The new-type labor force level steadily increased from 3.331 to 3.367, providing stable human resources support for productivity growth. The new-type labor object level gradually declined from 7.000 to 6.886, though still remaining at a relatively high level, laying a solid foundation for development. The new-type labor material level in 20 From 2018 to 2022, the index rose steadily from 9.881 to 9.969, then dipped to 9.851 in 2023, maintaining a high level overall. The earlier growth was notably strong, demonstrating a significant boost to new-type productive forces.

Table 1. Level of New Productivity in Jianghuai Region.

Year	New quality productive forces	New quality labor force	New type of labor object	New material of labour
2018	0.980	3.331	7.000	9.882
2019	0.963	3.334	6.968	9.929
2020	1.008	3.341	6.935	9.956
2022	1.018	3.356	6.908	9.969
2023	0.935	3.367	6.886	9.851

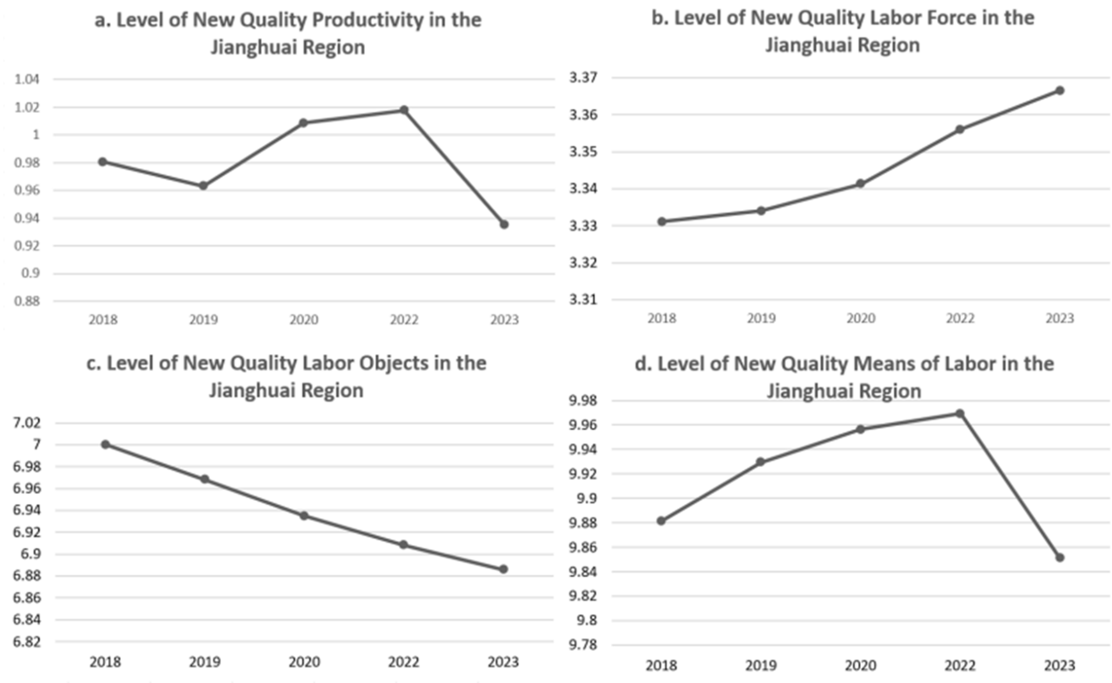

Fig. 1. Development level of New Quality Productivity in Jianghuai Region。

3.2 Spatial Distribution Pattern

The Jianghuai region exhibits a "core-periphery" gradient decline in new-type productivity, with high-value zones concentrated in the eastern coastal areas and provincial capitals, while low-value zones are located in the central-western regions and peripheral areas (Figure.2). Hefei leads the first tier with a score of 0.315, serving as the core engine. Its advantages stem from the capital's resource concentration—As the political, economic, and cultural center of Anhui, it boasts a leading number of universities, providing ample reserves of new-type labor [12], along with a high proportion of AI enterprisess and data platforms that enhance factor circulation. Yancheng (0.203) follows closely, distinguished by its ecological and green innovation ecosystem, making it a representative of "green transformation".

The second-tier cities of Nantong (0.091), Yangzhou (0.071), and Taizhou (0.060) in Jiangsu Province form the "Yangtze River Innovation Belt," characterized by robust industrial foundations, high robot density, and deep integration of information and intelligence technologies. As the northern hub of the Yangtze River Delta, Nantong leverages its port advantages to develop high-end manufacturing, leading in invention and utility model applications, and demonstrating strong innovation output capabilities [13].

The third tier includes Huai'an (0.047), Chuzhou (0.041), and Bengbu (0.037), primarily regional centers with established industrial foundations but uneven development. For instance, Bengbu excels in ecological governance but lacks universities, resulting in a shortage of high-quality labor and constraining its development.

The fourth-tier cities like Xinyang (0.028) and Huainan (0.027) are on the periphery of the regional development. They exhibit low levels of new productive forces, with traditional industries dominating. Emerging industries have limited workforce and low R&D investment, while innovation and intelligentization remain underdeveloped, constituting a weak link in the region.

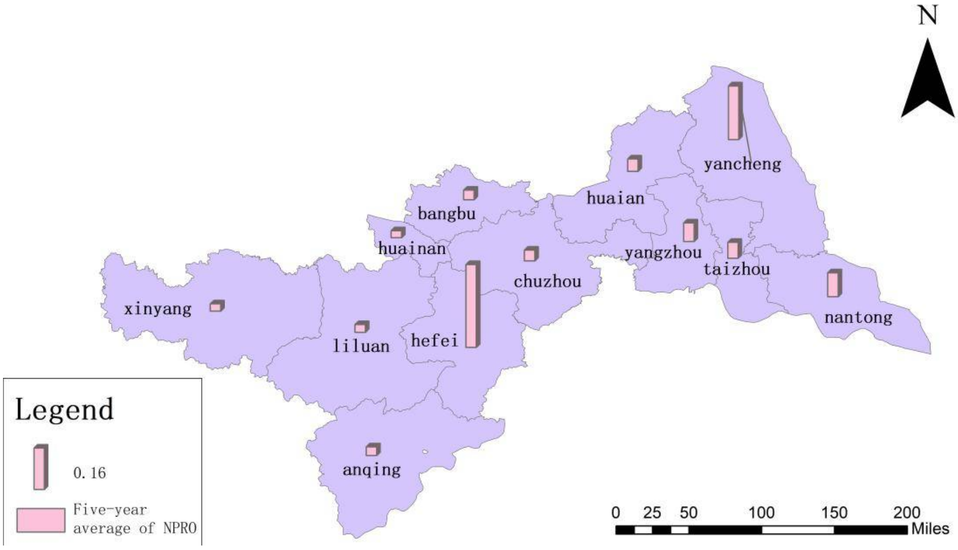

Fig. 2. Five-year average NPRO(New Productivity of Regions) in the Jianghuai region

3.3 Causes of Regional Differences

The uneven spatial distribution stems from the combined effects of multiple factors including resource endowment, policy orientation, and industrial foundation [14]. When considering the indicator weights in the evaluation system and regional characteristics, significant disparities emerge in resource endowment and location conditions: Hefei, leveraging its provincial capital status and the policy support of the 'Comprehensive National Science Center', has seen an increase in innovation output driven by a higher proportion of scientific expenditure (Figure.3). Meanwhile , Nantong and Yancheng have capitalized on their Yangtze River Delta location to absorb technological spillovers and industrial transfers from Shanghai, with advanced information infrastructure supporting new types of labor. However, cities in central and western China such as Xinyang and Lu'an, located inland, face high transportation and logistics costs, lagging behind in indicators like robot installation density and the number of AI enterprisess, resulting in a slow pace of intelligent transformation.

Industrial structure and innovation ecosystems serve as key determinants: High-value zones are predominantly driven by strategic emerging industries. For instance, Hefei's new energy vehicle and integrated circuit clusters have created a virtuous cycle of talent aggregation, industrial upgrading, and income growth. Yancheng City, with its focus on green energy, demonstrates notable advantages in green innovation and carbon trading volume scale. In contrast, low-value zones are dominated by traditional industries. As a resource-based city, Huainan has long relied on coal. Despite increased investments in environmental pollution control, the sluggish industrial transformation has hindered the upgrading of new-generation labor resources, thereby constraining development.

Policy support and institutional innovation have demonstrated significant guiding effects [15].Hefei's data trading platform has achieved remarkable progress in data utilization through the strategic focus of the "Digital Anhui" initiative, while Yancheng's carbon trading volume pilot program has driven the integration of green innovation with ecological economy under the national low-carbon city policy. In contrast, peripheral cities like Xinyang face limited policy support. As major agricultural hubs, they exhibit low scientific expenditure ratios and lack specialized policies for emerging industries, resulting in insufficient investment in new-type labor and production resources, which weakens their development momentum.

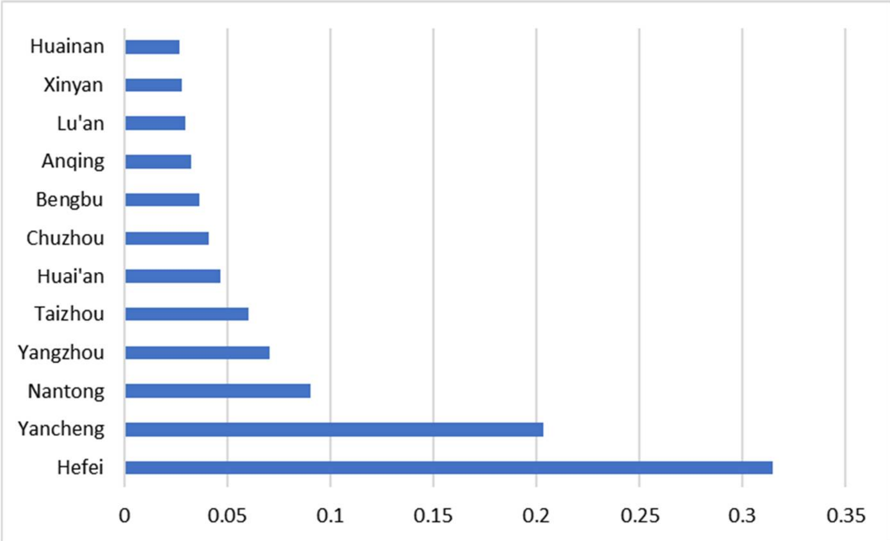

Fig. 3. New Quality Productivity Levels in Prefecture-Level Cities of Jianghuai Region

3.4 Core Urban Development Characteristics

From the perspective of the "core-periphery" gradient pattern of the spatial distribution of new productive forces in the Jianghuai region, Hefei City (core of high-value area), Huai'an City (representative of middle-low value area) and Xinyang City (typical of low-value area) are located in three levels of regional development, and there are significant differences in development foundation, advantages and disadvantages, and driving mechanisms (Figure.4).

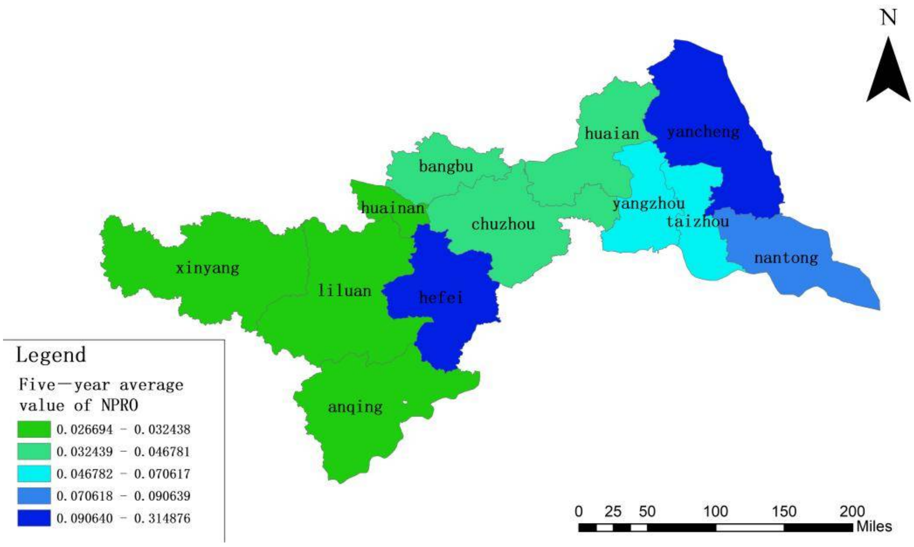

Fig. 4. Five-year average of NPRO(New Productivity of Regions) in core cities

3.4.1 Hefei: Core Engine of High-Value Zones, Innovation Agglomeration Drives New Productivity Leadership

Hefei City achieved a five-year average of 0.315 in new quality productivity development from 2018 to 2022, ranking first in the Jianghuai region. This leadership stems from its three-dimensional driving model: "aggregation of innovation factors → industrial ecosystem upgrading → breakthrough in data elements." As the capital of Anhui Province, Hefei boasts over 20 universities ensuring a steady supply of new quality labor. In 2022, the city employed 328,000 people in strategic emerging industries, accounting for 18.3% of the total workforce, with an average salary of 86,000 yuan—both figures significantly exceeding regional averages and Xinyang City's levels. The city excels in intelligentization and data elements, with 156 AI enterprisess in 2022, representing 31.2% of the regional total. Data trading platforms have driven a 42.7% annual growth in factor circulation scale, with 18,000 invention patent applicationss and 4,200 green invention patents filed. Scientific expenditure accounted for 3.8% of local fiscal revenue, both ranking first in the region. Innovation resources have spillovered through industrial chains, boosting robot installation density in Chuzhou and facilitating data circulation in cities like Lu 'an, while exerting minimal impact on distant cities such as Xinyang. In 2022, Xinyang's data factor utilization level was merely 17.6% of Hefei's.

3.4.2 Huaian City: A Hub of Medium and Low Value Areas, Embracing Dual Forces of Transfer and Endogenous Upgrading

Huai'an City, with a five-year average of 0.047, has emerged as a regional coordination "transit hub" through its "industrial transfer + local industrial upgrading" model. As a transportation hub in Northern Jiangsu, it had 1.86 million broadband internet users and 4.23 billion yuan in telecom service revenue in 2022, supported by robust infrastructure. Its robot installation density of 19 units per 10,000 people surpassed Xinyang. Leveraging the Yangtze River Delta integration, the city has attracted industries such as semiconductor packaging and testing from Nantong and new energy battery components from Hefei. From 2018 to 2022, strategic emerging industry employees grew from 52,000 to 98,000, with an average annual growth rate of 17.2% [16]. However, six universities Hefei's talent pool stands at merely 30% of Yancheng's, with a shortage of high-caliber professionals hindering its development. The city also faces notable deficiencies: its 2022 environmental pollution control investment accounted for 1.2% of GDP, lower than Yancheng's, while its 2,100 utility model patent applicationss represented just 11.7% of Hefei's. Weak local innovation and heavy reliance on external technology transfer resulted in a 3.2% growth rate for new quality productivity in 2022,2.6 percentage points below Hefei's.

3.4.3 Xinyang City: A City on the Edge of Low-Value Areas, with Prominent Bottlenecks in Traditional Path Locking and Transformation

Xinyang City recorded a five-year average of 0.028, ranking last in the Jianghuai region, constrained by the dual factors of "traditional agriculture dominance and lack of innovative elements." As a major agricultural city, it employed only 31,000 workers in strategic emerging industries in 2022, accounting for 3.8% of the total workforce. The concentration of five universities in teacher education led to a shortage of technical talent. Scientific research expenditure accounted for merely 0.8% of local fiscal revenue, with only three AI enterprisess and no data trading platforms. The level of new-type labor materials was just 12.3% of Hefei's. Despite its strong ecological foundation, Hefei struggles with green transition. In 2022, its environmental pollution control investment accounted for merely 0.9% of GDP, with carbon trading volume volume virtually nonexistent. The primary sector, which makes up 19.7% of the economy, is 3.2 times larger than Hefei's, while the number of large-scale industrial enterprises is only 42% of Huai' an's. Located on the western edge of the Jianghuai region, about 300 kilometers from Hefei, the area receives weak radiation. In 2022, its total telecom business volume was merely 6.8% of Hefei's, with an internet penetration rate of 62.3%. High factor mobility costs have created a' low-level lock-in,' and the average annual growth rate of 1.7% from 2018 to 2022 was the lowest in the region.

3.5 Spatial Agglomeration and Dynamic Evolution

Based on the local Moran's I index and the five-year average NPRO(New Productivity of Regions) (New Productivity of Regions) data from 2018 to 2022 in the Jianghuai region, the spatial clustering of new productivity can be classified into four categories (Figure.5).

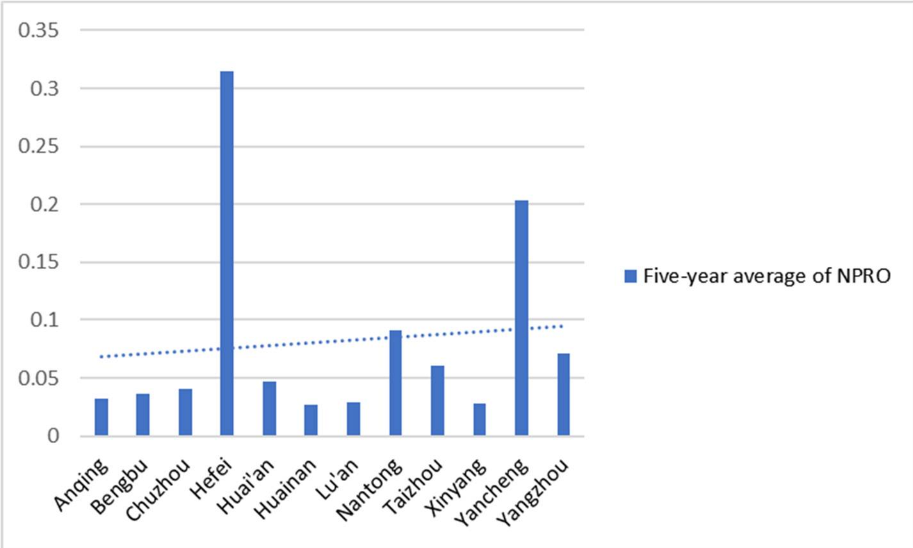

Fig. 5. Five-year average of NPRO(New Productivity of Regions) in Jianghuai region (2018-2022)

High-High Agglomeration (HH) is primarily concentrated in Hefei City and its neighboring regions of Chuzhou and Lu'an. Through talent mobility and technological collaboration, Hefei has fostered a "innovation hub-hinterland" synergy model in the surrounding areas. From 2018 to 2022, the annual average growth rate of new-quality labor input indicators in the region reached 1.2%, with enhanced industrial linkage effects between core and hinterland sectors.

The high-low agglomeration (HL) is concentrated in Yancheng and Nantong, where these two cities, as high-value zones, exhibit a "core island" characteristic. Due to the disconnect between their industrial advantages in green energy and high-end manufacturing and the traditional industries of neighboring cities like Huai'an and Taizhou, the insufficient industrial chain integration hinders the outflow of technical talent.

The low-high agglomeration (LH) is located in the western part of Hefei and some areas of Lu 'an. As a big agricultural city, Lu' an has a low level of new quality productivity, but it relies on Hefei to undertake the transfer of labor-intensive industries. The average wage of on-the-job workers (weight 0.98%) increases with the increase of Hefei's talent demand, forming a "low level-high radiation" dependent characteristic.

The Low-Low Agglomeration (LL) region, encompassing central and western cities such as Xinyang, Huainan, and Anqing, suffers from low internal development levels and lacks high-value regional radiation, resulting in a "low-level stagnation." From 2018 to 2022, the average annual growth rate of scientific expenditure (accounting for 2.58% of total expenditure) was less than 0.5%, with innovation output growing slowly. This has trapped the region in a vicious cycle of "resource scarcity, insufficient investment, and lagging innovation."

4. Strategy System of Promoting the Coordinated Development of New Productive Forces in Jianghuai Region

4.1 Establishing a Gradient Resource Allocation Mechanism to Resolve Regional Imbalance

To establish a tiered resource allocation mechanism, regional imbalance must be addressed. High-value zones should break through "innovation silos" and implement a "reverse nourishment" radiation mechanism. Hefei may leverage its comprehensive national science center to set up cross-regional joint laboratories, transferring R&D achievements in fields like artificial intelligence and quantum information to neighboring cities such as Chuzhou and Lu'an, with an annual output of no fewer than 50 industrializable technologies [17]. Yancheng could lead the formation of the Jianghuai carbon trading volume Alliance, while Nantong could collaborate with Yangzhou and Taizhou to develop the "Yangtze River Intelligent Manufacturing Corridor." For low-value zones, a "foundational development" strategy is required. Xinyang could build a "digital agriculture" framework. Under the "Industrial Innovation Pilot Zone" initiative, Huainan City may collaborate with Yancheng to implement low-carbon retrofitting projects for coal-fired power plants. Meanwhile, the provincial government may establish special transfer payment funds to provide targeted support to cities with scientific expenditure ratios below 1.5%, ensuring an annual growth rate of over 15% in the workforce of emerging industries [18].

4.2 Building an Industrial Synergy Upgrade Matrix to Activate Innovation Momentum Across the Region

To establish an industrial synergy upgrade matrix, it is essential to activate innovation momentum across all regions. High-value zones should focus on the high-end segments of industrial chains to build a closed-loop system of "innovation chain—industrial chain—capital chain". Hefei City could establish a collaborative innovation body for the new energy vehicle industry and set up a 10-billion-yuan industrial fund, aiming to form a trillion-yuan industrial cluster within three years [19]. Yancheng City could develop a national-level green energy equipment manufacturing base, while Nantong City could deepen industrial collaboration with Shanghai and establish a high-end equipment R&D center in the northern wing of the Yangtze River Delta. For low-value zones, the "specialized integration" approach should be explored. Chuzhou City could leverage Hefei's smart home appliance industry to radiate and develop supporting industries, and Liu'an City Can Develop Health Industry by Using Ecological Advantage.By leveraging its ecological advantages to develop the health industry, Huai'an City can utilize its transportation hub advantages to establish a regional digital logistics hub, achieving industrial synergy with high-value areas.

4.3 Innovating Policy Support System to Break Regional Synergy Barriers

To strengthen the innovation policy support system, regional coordination barriers must be dismantled. At the institutional level, a Jianghuai New Quality Productivity Development Alliance should be established to formulate a unified catalog for sharing innovation resources, implement a cross-city "innovation voucher" system, and allocate 1 billion yuan annually for inter-regional scientific research cooperation [20]. A data element circulation collaboration mechanism should also be established. Policy tools require "precision irrigation": high-value zones should receive tax incentives such as additional deductions for cross-border R&D expenses, while medium-and low-value zones should implement "industrial transfer tax-sharing" policies. For enterprises relocating from high-value to medium-and low-value zones, the local tax retention portion for the first three years should be equally divided between the two regions [21]. Meanwhile, establish a cross-city ecological compensation mechanism and promote Yancheng's carbon trading volume experience.

4.4 Enhancing Infrastructure Connectivity to Expand Core Coverage Radius

To strengthen infrastructure connectivity, we must expand core radiation ranges by establishing a "three-dimensional connectivity" framework for transportation and information networks. Accelerating high-speed rail upgrades and extending 5G networks to county-level areas are essential, alongside creating "innovation enclaves" for collaborative models. For talent mobility, the "Jianghuai Talent Card" system should enable mutual recognition of qualifications within the region, while establishing a sharing mechanism for "silver-aged talents." Through infrastructure integration and free talent flow, we can shift core cities' innovation radiation from "partial penetration" to "full-domain coverage," ultimately forming a spatial pattern of new productive forces with coordinated development.

5. Conclusion

This study establishes a three-dimensional evaluation system of "new-type labor force, new-type labor objects and new-type labor materials" to measure the development level of new-type productivity in Jianghuai region from 2018 to 2022. The results show that the overall development level of new-type productivity in Jianghuai region has a trend of "fluctuating upward and then slightly declining". The comprehensive score of new-type productivity in Jianghuai region has increased from 0.980 to 1.018 from 2018 to 2022, and then dropped to 0.935 in 2023.Within the sub-dimensions, the new-type labor force demonstrated steady growth (3.331→3.367), while the new-type labor objects showed a marginal decline (6.999→6.886). The new-type labor resources initially experienced significant growth (9.882→9.969), but... In 2023, R&D investment saw a contraction and decline. Spatially, the distribution follows a "core-periphery" gradient: Hefei leads with a five-year average of 0.315, followed by Yancheng (0.203) and Nantong (0.091) forming a high-value belt, while Xinyang (0.028) and Huainan (0.027) constitute low-value zones. These disparities stem from differences in resource endowment, industrial structure, and policy support. Regarding coordinated development, the core city's radiation exhibits a "boundary effect" —Hefei significantly boosts Chuzhou and Lu' an (with robot installation density growing at an average annual rate of 14.3%), but its impact on peripheral cities like Xinyang remains minimal (data element utilization levels are merely 17.6% of Hefei's [22], with regional disparities exhibiting a pattern of "overall convergence and localized widening". The standard deviation across 12 cities decreased from 0.087 to 0.076, while the gap between Hefei and the second-highest-performing city widened from 0.111 to 0.114.

This study has limitations. The proxy variables for certain quantitative indicators (e.g., data element utilization level) in the indicator system require optimization, and more precise micro-level data support is lacking. Future research could be deepened in three aspects: First, extending the observation period to over 10 years and employing machine learning methods to analyze the dynamic relationships between new quality productivity and economic cycles/technological revolutions, thereby revealing their long-term evolution mechanisms. Second, refining the evaluation indicator system by incorporating corporate micro-level data (e.g., R&D investment of listed companies, digital transformation levels) to enhance measurement accuracy [23]. Third, expanding the research scale by comparing the Jianghuai region with the Yangtze River Delta. Thirdly, the Pearl River Delta's development path differences, and the cultivation model of new quality productivity with regional characteristics.

In practical terms, as digital and green technologies become increasingly integrated, the Jianghuai region should prioritize three key areas: First, fostering innovation through the convergence of "digital + green" technologies, such as developing digital twin factories and smart energy systems. Second, establishing a networked framework of "core cities + specialized nodes" to break down administrative barriers through institutional reforms, enabling complementary synergies between Hefei's innovation resources, Yancheng's green technologies, and Nantong's manufacturing infrastructure [24]. Third, implementing a dynamic monitoring and evaluation mechanism to regularly publish the New Quality Productivity Development Index, providing a scientific basis for policy adjustments.Through continuous exploration, the Jianghuai region is expected to establish a new model of productive forces development characterized by innovation-driven, regional coordination, and green low-carbon practices, serving as a practical reference for coordinated regional development nationwide.

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