

Exploring the Integration of China's Digital Economy and Sports Industry: A Systematic Measurement Study in the Yangtze River Delta Region

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Abstract. With the rapid advancement of technology, the integration of digital economy and sports industry has become a prominent phenomenon. This research focuses on the Yangtze River Delta, a key economic zone in China, to systematically measure the degree of integration between digital economy and sports sector from 2015 to 2021. The findings reveal an overall upward trend in the integration of the two sectors in Yangtze River Delta from 2015 to 2021. This favorable trend is ascribed to the collaborative synergy between digital technologies and sports, opening avenues for robust economic expansion. However, regional variations and occasional fluctuations are observed, particularly in 2021, indicating the influence of structural changes in sports. The Gini coefficients for sports industry and digital economy integration in Yangtze River Delta reveal substantial regional disparities. To ensure balanced development, there is a call for simultaneous enhancement of overall integration and promotion of integrated growth in Yangtze River Delta. This study contributes to the understanding of the dynamic relationship between digital economy sector and sports sector, offering valuable insights for policymakers, researchers, and industry practitioners.

Keywords: Digital Economy, Sports Industry, Industry Integration, Coupling Coordination Model

1 Introduction

The integration of digital economy and sports industry is a hot topic in today's research. The Yangtze River Delta, a prominent locus of China's economic dynamism, has garnered scholarly interest due to its compelling amalgamation of the digital economy and sports. The swift rise of digital tech breathes new life into sports, offering rich opportunities for the digital economy^[1]. Exploring the integration of the two sectors in Yangtze River Delta is crucial for pushing regional economic innovation and advancement.

Despite there is a robust growth, a key challenge persists: How do we measure the relationship, integration levels, and regional differences between digital economy and sports in this merging process? Contemporary scholarly investigations predominantly center on theoretical frameworks elucidating the nexus between digital economy and the high-caliber advancement of the sports industry^{[2][3]}. These inquiries delve into the rationale, mechanisms, challenges^[10], and strategic approaches^[11] associated with their integration^[4]. While there are some empirical studies, most start at the national level, providing initial insights into integration^[12], like using

entropy methods to gauge regional digital economy and sports development^[5] or studying national sports and digital economy integration from an input-output perspective^{[6][7]}.

To fill this research gap, our study concentrates on the Yangtze River Delta, delving into the dynamics of digital economy and sports integration. By deeply researching this vibrant region, we aim to understand the local interplay between the two sectors, offering specific reference points for regional economic improvement. For a more comprehensive measurement of integration in Yangtze River Delta, we use a Coupling Coordination Model with entropy-weighted TOPSIS to determine indicator weights. This method, compared to national-level explorations, reveals a nuanced relationship between the realms of digital economy and sports sector in Yangtze River Delta, providing local decision-makers with concrete policy suggestions.

2 Method

2.1 Research Design

This study is focused on the Yangtze River Delta from 2015 to 2021. We chose this region because it's a leader in both digital economy sector and sports sector development in China. The seven-year span lets us track the evolving trends between the two sectors in this area.

2.2 Data Collection

The study collected data from diverse sources, such as the "China Statistical Yearbook," "China Electronic Information Yearbook," "China Information Yearbook," "Sports Industry Yearbook," and the "Blue Book on the Development of Sports Industry in Yangtze River Delta Region." Missing data was addressed through interpolation.

2.3 Research Indicators

Building on existing literature, this study creates a comprehensive model to assess digital economy (Table 1) and sports integration (Table 2) in Yangtze River Delta.

Table 1. Digital Economy Development Evaluation Indicators

Primary Indicators	Secondary Indicators
Basic Resources	Optical Cable Length
	Internet Broadband Access Ports
	Mobile Telephone Exchange Capacity
	Total Telecommunication Service Volume
Output Scale	Software Service Revenue
	E-commerce Sales Volume
Development Potential	Number of Granted Information Technology Patents
	Technology Market Transaction Volume
	R&D Expenditure as a Percentage of GDP

Table 2. Sports Industry Development Evaluation Indicators

Primary Indicators	Secondary Indicators
Economic Efficiency	Proportion of Added Value of the Sports Industry to GDP
	Proportion of the Sports Industry to GDP
Industrial Scale	Total Output of the Sports Industry
	Added Value of the Sports Industry
Structural Sophistication	Proportion of the Sports Service Industry to the Sports Industry
	Proportion of Added Value of the Sports Service Industry to the Added Value of the Sports Industry

2.4 Data Analysis

In this investigation, the analysis employs the Coupling Coordination Model alongside the Entropy Weight-TOPSIS method. The Coupling Coordination Model assesses the degree of integration between the digital economy and the sports, whereas the Entropy Weight-TOPSIS method allocates weights to indicators, enhancing the precision of the assessment.

2.4.1 Entropy Weight-TOPSIS Method

Entropy Weight determines indicator weights by analyzing data dispersion^[8]. TOPSIS ranks regional integration levels. Entropy Weight-TOPSIS provides a balanced result, enhancing accuracy in assessing digital economy and sports integration.

2.4.2 Coupling Coordination Model

This model evaluates the integration of digital economy and sports through a comprehensive multi-indicator system, reflecting their synergy through the coupling coordination value^[9].

2.4.3 Gini Coefficient

The Gini coefficient, a statistical gauge of regional development inequality, reflects higher internal differences with increasing values. Analyzing Gini coefficient trends allows an in-depth understanding of the overall equality in sports and digital economy integration across various years in the Yangtze River Delta.

3 Results

3.1 Integration Level

CDDI values for digital economy and sports integration in Yangtze River Delta from 2015 to 2021 were obtained through the Coupling Coordination Model analysis (Figure 1).

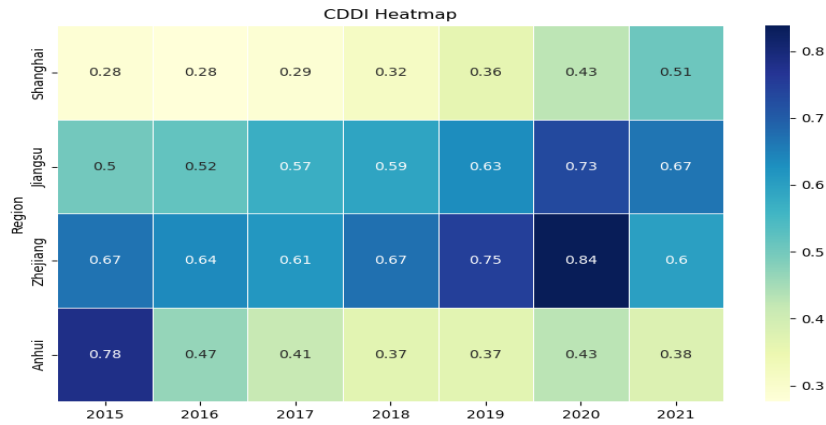


Fig. 1. Integration Index of Digital Economy and Sports Industry in Yangtze River Delta Region

The study compares sports and digital economy integration in sub-regions of the Yangtze River Delta. Through ranking and trend analysis, strengths and weaknesses are identified. Factors like basic resources and industrial scale will be explored to explain regional differences (Figure 2 & Figure 3).

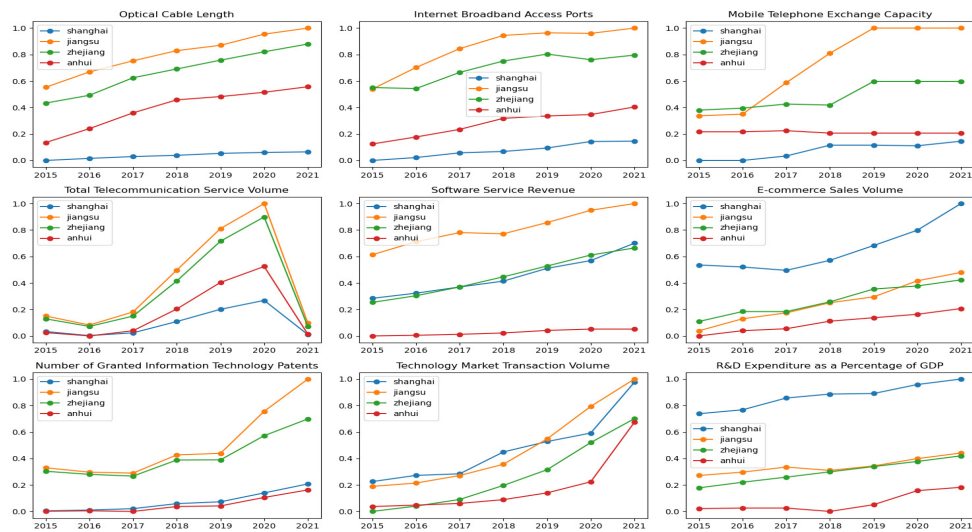


Fig. 2. Digital Economy Development TOPSIS Score in Yangtze River Delta

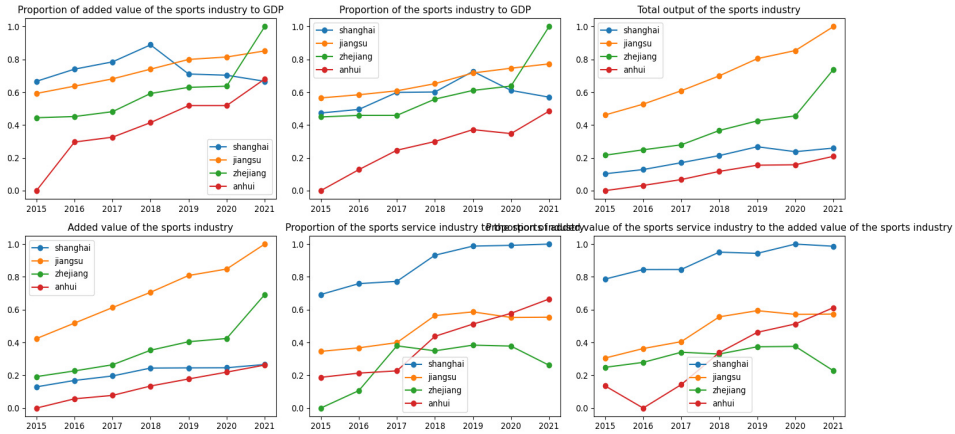


Fig. 3. Sports Industry Development TOPSIS Score in Yangtze River Delta

Regional disparities in sports and digital economy integration are evident in three provinces and one municipality. Over the seven years, Shanghai’s integration index consistently rose from 0.285 to 0.508, with notable spikes in 2020 (0.427) and 2021 (0.508). As a highly developed city, Shanghai’s robust tech and sports service sector growth forms a solid foundation for high-quality convergence of digital economy and the sports. Jiangsu’s integration index has risen, especially after 2017, peaking at 0.732 in 2020. Supported by government, the province excels in combining digital economy and sports. Zhejiang’s integration index shows fluctuations but an overall increase, hitting highs in 2019 (0.749) and 2020 (0.838), slightly dropping to 0.599 in 2021. Zhejiang’s consistently high level of digital economic development, coupled with its emphasis on innovation, has propelled the growth of the sports industry. The fluctuations in 2021 can be attributed to structural adjustments within the sports industry. Anhui’s integration index is steady but lower. Compared to Shanghai and others, its less-developed economy poses challenges for digital and sports integration, requiring more policy support and investment.

3.2 Regional Differences in Sports Industry and Digital Economy Integration

Figure 4 depicts overall disparities in sports sector and digital economy integration across Yangtze River Delta. Gini coefficients, ranging from 0.724 to 0.739, highlight substantial spatial imbalances. The trend indicates a downward trajectory from 2016 to 2019, succeeded by a swift upsurge from 2019 to 2021. The ongoing integration of Yangtze River Delta facilitates collaborative efforts within the industry, while the 2019 COVID-19 outbreak amplifies regional disparities in sports industry development.



Fig. 4. Gini Coefficients for the Overall Integration of Sports Industry and Digital Economy in Yangtze River Delta from 2016 to 2021

4 Conclusions

4.1 Upward Trend in Digital Economy-Sports Industry Integration

Between 2015 and 2021, Yangtze River Delta has witnessed a discernible upward trend in the amalgamation of the digital economy with the sports. This reflects the increasing use of digital tech in sports, pushing the sports sector to upgrade within the digital wave.

4.2 Mutual Boost: Digital Economy and Sports Industry

Digital technology driving the advancement of the sports industry. Rapid tech growth transforms sports, from virtual reality to smart gear, enhancing the game experience and driving industry innovation. Sports industry creating opportunities in the digital economy. A thriving sports scene sparks digital growth—events, merchandise, and digital training energize the digital economy, creating new avenues for expansion. The synergy between sports and the digital realm propels continuous development.

4.3 Regional Development Differences

There are provincial disparities in the Yangtze River Delta Region. While overall rising, provinces differ. Shanghai steadily grows in integration. Jiangsu sees consistent growth with a solid foundation. Zhejiang fluctuates but generally rises. Anhui, with potential constraints, maintains a lower integration level. Breaking provincial barriers is crucial for enhanced regional communication and development. The Gini coefficients for sports industry and digital economy integration in Yangtze River Delta from 2016 to 2021 reveal substantial regional disparities. To ensure balanced development, there is a call for simultaneous enhancement of overall integration and promotion of integrated growth in the Yangtze River Delta.

4.4 Structural Shifts Impacting Short-Term Fluctuations

In 2021, shifts in the sports industry's structure caused brief ups and downs in the integration of digital economy sector and sports sector. This highlights that structural adjustments might bring short-term instability. To maintain stability in Yangtze River Delta's digital economy and sports integration, policymakers should closely monitor these structural changes. They need to address potential short-term fluctuations in their policies, ensuring the ongoing sustainability of development.

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