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Sustainable Coupling Coordination and Influencing Factors of Sports Facilities Construction and Social Economy Development in China

Lin-Hong Zheng [1,2], Nor Eeza Zainal Abidin [1,*], Mohammad Nazri Mohd Nor [3], Yue-Yun Xu [4,*] and Xiao-Wei Feng [1]

1 Faculty of Sports and Exercise Science, Universiti Malaya, Kuala Lumpur 50603, Malaysia
2 Fine Art and Design College, Quanzhou Normal University, Quanzhou 362000, China
3 Faculty of Business and Economics, Universiti Malaya, Kuala Lumpur 50603, Malaysia
4 School of Physical Education, Quanzhou Normal University, Quanzhou 362000, China
* Correspondence: eezazainal@um.edu.my (N.E.Z.A.); xyyulk@qztc.edu.cn (Y.-Y.X.)

Abstract: Sports facilities are a crucial physical safeguard and means of sustaining sporting activities. The steady and healthy development of sports facilities can promote the sustainable development of the social economy. In order to explore the coordination status and influencing factors between sports facilities construction and the social economy, this paper built a coupling coordination evaluation index system and dynamic factor index system for the sports facilities construction and social economy development by using the entropy method, coupling coordination model and random effect model. This paper assessed the comprehensive level, coupling coordination relationship, and influencing factors of the sports facilities and social economy development of nine cities in the Fujian Province across China from 2016 to 2020. The results show the overall level of sports facilities construction in Fujian is better than the social economy development, and the two systems are interacting with each other. The level of coupling and coordination gradually changes from good coordination to quality sustainable coordination. The coupling coordinated relationship between the two systems is developing in a positive way. In addition, industrial development, the level of urban development, and environmental development as influencing factors have a clear positive effect on the degree of coupling coordination. This study provides several recommendations for cities to achieve sustainable coordinated development. This paper also may provide a direction and path for future research.

Keywords: sports facilities construction; social economy development; coupling coordination; influencing factors

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1. Introduction

With the rapid development of the social economy and the improvement of people's living standards, the demand and desire for fitness are increasing. Participation in sports becomes an indicator of the active lifestyle of people among the world. Sports facilities are places for sports activities such as stadiums, halls, fields, courts, and support facilities [1]. Sports facilities are the basis for the development of the sports business and sports industry in China. The State Council's "Health China 2030" plan outlines a basic working target of 2.6 square meters of sports facilities per capita by 2020, 2.2 square meters by 2025 and no less than 2.5 square meters by 2030 [2]. The construction, management, development trend and other issues of sports facilities have become the focus of public service for governments and important research topics for scholars. In addition, sustainable development has become an important indicator for judging social development when it was proposed as a national strategy at the 15th National Congress in 1977 [3]. Determining how to deal with sports facilities construction and social economy development sustainability has become a topical issue of concern for all sectors of society.

In recent years, studies on sports facilities mainly focus on the current situation of construction and policy measures [4], resource allocation [4,5], management [6], and development dynamics [7], which are based on China's national conditions. For example, some scholars such as Cui (2017) based on the data from the national sports facilities census, the basic situation of the number, type, scale, and investment of regional sports facilities have been analyzed, and corresponding constructive countermeasures and suggestions have been put forward according to their development status. Additionally, Wei (2018) and other scholars have analyzed the dynamic characteristics of the development of sports venues in China, exploring the patterns of changes in the development of sports venues and making suggestions for the future development dynamics of sports venues [7,8]. As for the relationship between sports facilities construction and social economy, some scholars have focused on structural settings [8,9], developmental assessments [10,11], and influencing factors [12]. For example, Kou and Mehr (2019) and other scholars used the factor analysis method to evaluate the construction of sports venue resources and socioeconomic development, respectively. On the basis of this, a regression model was used to evaluate the coordinated development of sports venue resources and the economy [12–14]. In addition, Xia and Brad (2018) believe that factors such as population density, government policies, and funding are important factors affecting the coordinated development of sports venue resources and the social economy [15].

In summary, many scholars have conducted extensive research on sports facilities from different perspectives and achieved fruitful results, which provide important theoretical guidance and methodological inspiration for the study of this topic. However, there are several issues with the available research results. Firstly, most studies have explored the relationship between sports facility construction and social economy development and its influencing factors through macro-level and qualitative analysis. Secondly, although some scholars have constructed indicators for the synergistic development of sports facilities construction and social economy development, it is obvious that the indicators are not comprehensive and relevant enough, and there is a large lag in the data. Thirdly, in terms of research methods, most studies are conducted with the help of individual models such as classical grey correlation and regression analysis, but few coupled coordination models are used to measure the impact factors, and few spatial panel regression models are used to explore the impact factors. The inadequacy of existing research leaves room for depth and innovation in the content, dimensions, and methods of this research [16–18]. This study will draw on coupling coordination models and spatial panel regression models to measure the coupling synergy between sports facilities construction and social economy development in Fujian's municipalities. It also will empirically test the influencing factors. The study will enrich the academic vision of sports venue construction research and expand a new paradigm in the methodology of sports industry research. Through the coupling coordination degree model, it can also help the government to solve the practical problems of high-quality development of sports facilities construction and provide references and useful enlightenments.

2. Study Region

Fujian Province is located on the southeast coast of China. It is bordered by Zhejiang Province to the northeast, Jiangxi Province to the west and northwest, Guangdong Province to the southwest, and Taiwan Province across the Taiwan Strait to the east (Figure 1). It is also an important window and base of China's relations with the world and is a famous overseas Chinese province. The total population of Fujian Province was 41,540,100 in 2021. Fujian Province's GDP was RMB 488,036 million, an increase of 8.0%, consumer prices would rise by 0.7%, and urban residents' per capita disposable income was RMB 51,140, an 8.4% increase over last year [19]. Compared with other Chinese coastal provinces, Fujian province has enhanced rapidly in both urbanization and economic development. Based on these characteristics, Fujian Province has seen a rapid increase in urbanization and economic development, particularly in terms of infrastructure development, the development of various industries, and the exploration of foreign import and export trade.

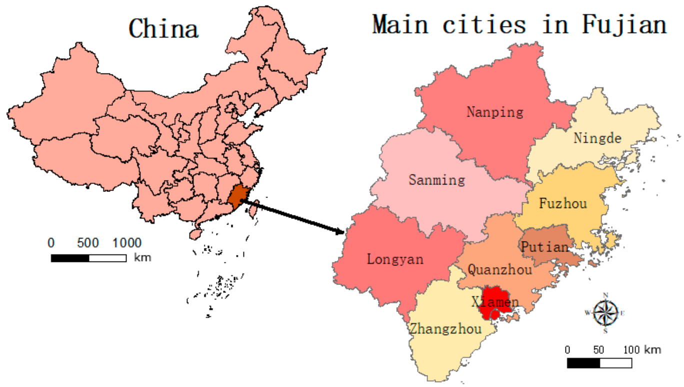

Figure 1. Location of study area and distribution of main cities.

In addition, Fujian Province had 119,401 sports facilities in 2020, covering a total area of 94,053 million square meters. Its sports facilities' per capita area of 2.28 square meters was higher than the national average [19]. The total production value of the sports industry in Fujian Province accounts for approximately one-fifth of the total national sports industry production value; in this respect, the region is ranked first in the country.

3. Research Methods

3.1. Entropy Method

In order to solve the problem of the different scales of each indicator being difficult to synthesize, it is generally necessary to categorize the raw data and adopts a normalization process after the data collection.

Step 1: The evaluation indicators are divided into positive and negative indicators. When the selected indicator is a positive indicator, the normalization formula is $x'_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}}$, when the selected indicator is a negative indicator, the normalization formula is $x'_{ij} = \frac{\max x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}}$. In the formula, x_{ij} represents the actual value of the j index of the i year, $\max x_{ij}$ and $\min x_{ij}$ represent the maximum and minimum values of the index j, x'_{ij} represents the standardized data of the j index of the i year. The size of the values after standardization is in the range of 0–1, and the numerical and logical units among the data remain consistent [20].

Step 2: the entropy method was used to calculate the weights of the sports facilities' construction and social economy evaluation indicators. Entropy is a physical unit of measurement; the greater the entropy, the more disordered the data, the less information it carries, the smaller the utility value, and therefore the smaller the weight. The entropy method is a research method that combines the information value provided by the entropy value to determine the weights [21]. The calculation formula is as follows: $p_{ij} = \frac{x'_{ij}}{\sum_{ij}^{n} x_{ij}}$, p_{ij} indicates the weight of indicator j in year i. $E_j = -k \sum_{i=1}^{n} p_{ij} \ln p_{ij}$, E_j indicates the entropy value of the j indicator. Where $k = \frac{1}{\ln n}$ and and n is the number of years. $D_j = 1 - E_j$, D_j Indicates indicator entropy redundancy. $w_j = \frac{D_j}{\sum_{j=1}^{m} D_j}$, where w_j indicates weights [22].

3.2. Coupling Coordination Model

Based on the concept and principle of coupling in physics, we analyze the coupling effect and the degree of coordination between sports facilities construction and the process of social economic development. Because of the strong permeability and relevance of sports facilities construction and social economy development, the theory can be used to study the coupled coordination of the interactions between them [23,24]. The coupling coordination model used to analyze the coordinated development level of things. It consists of the coupling degree and the coupling coordination degree; the coupling degree is used to measure the strength of the interactions among the systems and the virtuous circle between the coupling coordination systems. It not only reflects the degree of interdependence and mutual restriction between systems, but also reflects the quality of coordination. The calculation formula of the coupling degree is $C = \frac{X*Y}{(X+Y)^2}$. X and Y represent the comprehensive level index of the sports facilities' construction and social economy development. The calculation formula for the degree of coupling coordination is $D = \sqrt{C*T}$. In the formula, T is the overall comprehensive evaluation index of the sports facilities and social economic development, $D = \alpha F(x) + \beta G(y)$, α and β are undetermined coefficients and, after consulting five relevant field experts, both α and β are assigned a value of 0.5. In order to intuitively reflect the coordination of the sports facilities construction and social economy development, refer to Shi et al. for a study on the classification of the degree of coupling coordination of the three major categories and ten sub-categories which are shown in Table 1 [25–28], according to the magnitude of the coupling coordination degree D value obtained from the study and the magnitude of the sports facilities system F(x) and the social economy development level system G(y).

Table 1. The degree of coupling coordination and level classification.

Coupling Coordination Level	Coupling Coordination Degree (D)	Level Classification
Coordination Development	0.90–1.00	Quality coordinated development
	0.80–0.89	Good coordinated development
	0.70–0.79	Intermediate Coordinated Development
	0.60–0.69	Primary coordinated development
Excessive Development	0.50–0.59	Barely coordinated development
	0.40–0.49	On the verge of dysfunctional decline
	0.30–0.39	Mild dysregulation recession
Dysfunctional Decline Development	0.20–0.29	Moderate dysregulation recession
	0.10–0.19	Severe dysregulation recession
	0.00–0.19	Extremely dysfunctional recession

4. Index System Construction

The interaction between sports facilities construction and social economic development is relatively complex and is not one-to-one linear relationship [29]. Scholars believe that research on complex systems' coupled coordination and interactions should be based on a comprehensive evaluation of the two systems and multiple indicators (Figure 2).

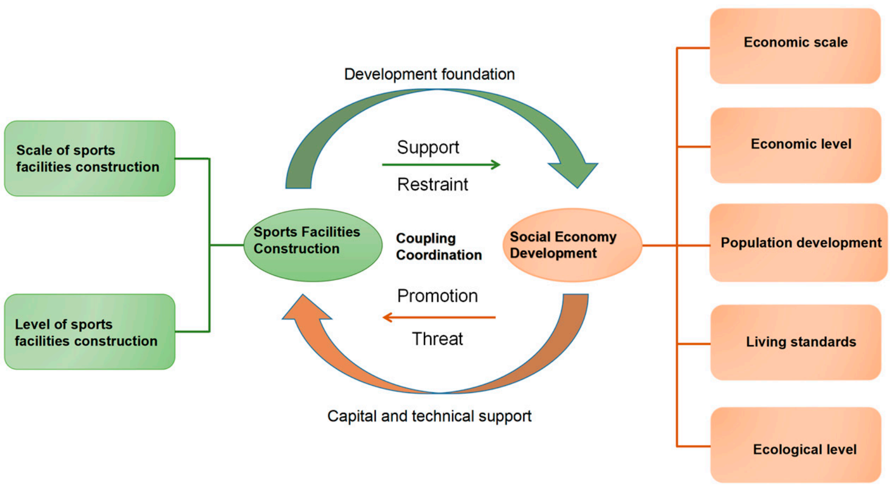

Figure 2. Framework of coupling coordination of the sports facilities' construction and social economy development.

In this paper, 23 individual indicators are selected in detail from six dimensions, including the scale of sports facilities, the number of sports facilities, investment in sports facilities, economic development, social security, and ecological environment to establish a coordinated evaluation index system of sports facilities construction and social economy development, in which urban population density, urban registered unemployment rate, sulfur dioxide emissions, and nitrogen oxides are inverse indicators and the rest are positive indicators (Table 2) [19,30–32].

Table 2. Evaluation index system for the coupling coordination of the sports facilities construction and social economy development.

System Layer	Dimension Layer	Indicator Layer	Nature of Indicator	Weights
Sports facilities construction	Scale of sports facilities construction	The total area of sports facilities	+	0.10
		The total area of sports facilities buildings	+	0.10
		Number of sports facilities	+	0.10
		Total investment in sports facilities	+	0.10
		Financial investment in sports facilities	+	0.10
		Social investment in sports facilities	+	0.10
	Level of sports facilities construction	Number of sports facilities per 10,000 people	+	0.10
		Area of sports facilities per capita	+	0.10
		Floor space of sports facilities per capita	+	0.10
		Investment in sports facilities per capita	+	0.10
Social economy development	Economic scale	GDP	+	0.05
		Total retail sales of social consumer goods	+	0.05
		Local fiscal revenue	+	0.06
		Local fiscal expenditure	+	0.06
	Economic level	GDP per capita	+	0.06
		Retail sales of consumer goods per capita	+	0.05
		Fiscal revenue per capita	+	0.06
		Fiscal expenditure per capita	+	0.06
	Population development	Resident population	+	0.06
		Urbanization level	+	0.06
		Number of primary and secondary school students per 10,000 population	+	0.06
	Living standards	Per capita disposable income of urban residents	+	0.06
		Per capita net income of rural residents	+	0.06
		Urban registered unemployment rate	-	0.06
	Ecological level	Forest coverage rate (%)	-	0.06
		Sulphur dioxide emissions	-	0.05
		Nitrogen oxide emissions	+	0.06
		Greening coverage of built-up areas	+	0.06

(Source: Fujian Statistical Yearbook-2020).

5. Empirical Analysis of the Coupling Coordination of Sports Facilities Construction and Social Economy Development in Fujian Province

5.1. Comprehensive Development Level of Sports Facilities Construction in Fujian Province

Figure 3 shows the development level of sports facilities construction in Fujian Province from 2016 to 2020 [19]. The overall development level of sports facilities construction in Fujian Province shows an upward trend, but there are large differences between regions. Using the average value of each year as the dividing line, there are some cities where the composite index is lower than the average value. The comprehensive level of sports facilities construction development in Longyan, Ningde, and Zhangzhou cities is significantly different from other provinces, and there is much room for improvement. It can be seen that there is an uneven polarization in the development of sports facilities construction in the province. As Ningde is in a special geographical location, there are more mountains and waters, and the construction of sports facilities is lacking. From 2018 onwards, Ningde vigorously promotes the development of sports, fitness, and leisure industries, cultivates several sports tourism projects, focuses on building several peoplefriendly fitness facilities, and promotes the construction of 15 min fitness circles in urban communities [32]. Since 2018, Ningde has vigorously developed its sports industry and has become the main base of China's electronic massager health care industry cluster, and the economy has grown considerably.

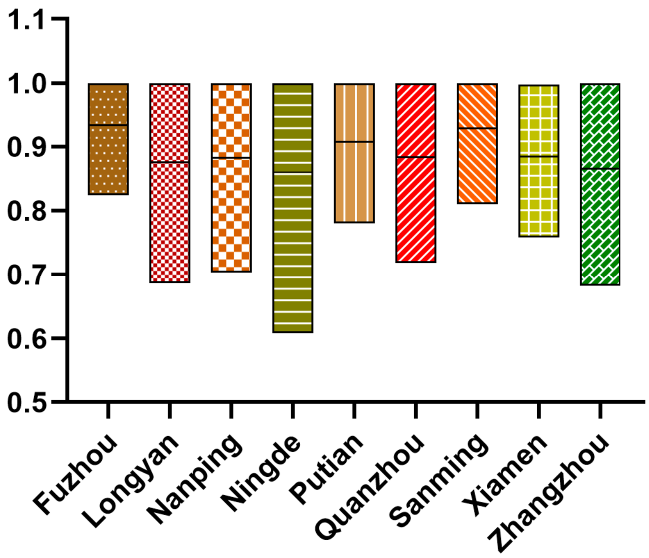

Figure 3. The comprehensive level of the sports facilities' construction from 2016 to 2020.

Figure 4 shows the comprehensive level of social economic development from 2016 to 2020. All cities in Fujian Province have shown steady growth each year. Among them, Fuzhou, Nanping, Sanming and Quanzhou have been leading the other municipalities by a clear margin. Longyan, Putian, and Zhangzhou are in the second tier of social economic development in the province. It is worth mentioning that Xiamen, a second-tier city, is in the third echelon of social economic development in the province.

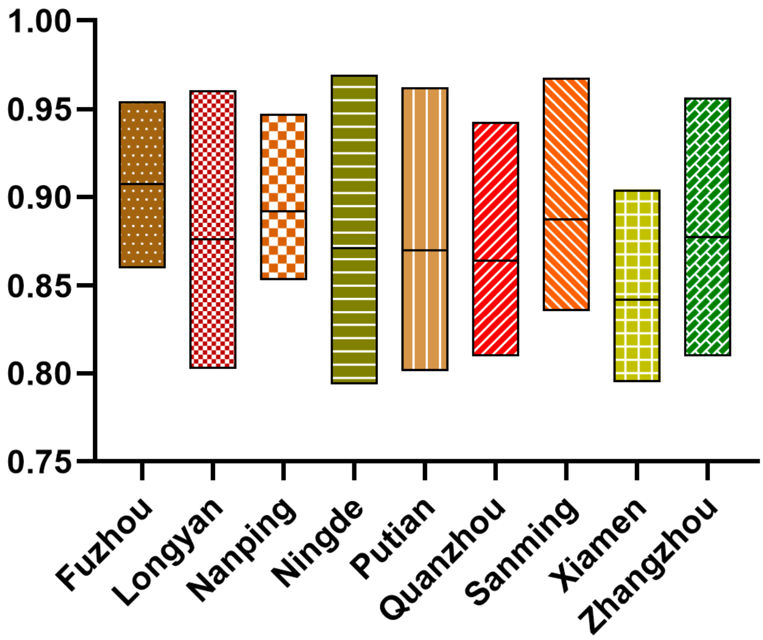

Figure 4. The comprehensive level of the social economic development from 2016 to 2020.

In examining whether the comprehensive level of sports facilities construction and social economic development is in synchronous, F and G represent the indicators of the comprehensive level of sports facilities and social economy development, respectively. When F = G, it means that the two systems are in synchronous development; when F > G, it means that the development of sports facilities construction outperforms social economy development and is a lag of social economy development; when F < G, it means that the development of sports facilities construction lags social economy development and is a lag of sports facilities construction. As can be seen from Figure 5, the lagging social economy development of the nine municipalities in Fujian Province from 2016 to 2020 is greater than the number of sports facilities built, which again indicates that the overall level of sports facilities construction in Fujian is better than the overall level of social economy development [33]. The comparative analysis of the nine municipalities shows that all nine municipalities in Fujian Province experienced lagging social economy development in 2018–2020, indicating that the level of development of sports facilities construction in the nine municipalities in Fujian Province is higher than social economic development. All nine cities in Fujian Province have lagging sports facilities construction. The situation of lagging sports facilities construction and lagging social economy development co-exists, indicating that the two systems are interacting with each other in the nine cities.

Figure 5. Relative development types of sports facilities and social economy development.

5.2. Analysis of the Coupling Coordination Degree between Sports Facilities Construction and Social Economy Development in Fujian Province

As shown in Figure 6, the degree of coupling coordination between sports facilities construction and social economy development in Fujian Province increases from 0.8754 in 2016 to 0.9870 in 2020. The level of coupling coordination gradually changes from good coordination to quality coordination, and the degree of coupling coordination between the two systems increases significantly, indicating that the interaction between the two systems continues to strengthen and the coupling coordination relationship are developing in a benign manner. In terms of averages, the coupling of these two systems over the last five years has been harmonized, with each municipality being at a high-quality level of coordination from 2018 onwards, due to China's efforts to develop mass sports and public sports facilities from the 13th Five-Year Plan onwards, in an effort to become a "strong sporting nation". As a developed coastal region, Fujian province is an important economic province in China and a global advanced sports goods manufacturing base [33]. Relying on its good location, Fujian province realizes that the two systems of sports facilities and social economy development promote each other and develop together, which has a positive impact on the coupling coordination of the two systems. Among them, the level of coupling coordination between the two systems in Fuzhou has reached a high-quality coordination level since 2016. The reason for this is that as the capital city of Fujian Province, it has been committed to promoting the co-construction of sports facilities, the sharing of sports resources, and the enhancement of sports services in the whole region. By the end of 2020, a five-level public sports facility system will have been built, with 108 km of leisure trails around the mountains, 475 km of riverfront greenways, 100% coverage of 15 min fitness circles in urban communities, the initial formation of a "10 min fitness circle" in the main urban areas, and a per capita area of 2.4 square meters for sports facilities. Fuzhou strives to be a "strong sports city", with the coordinated and healthy development of the social economy.

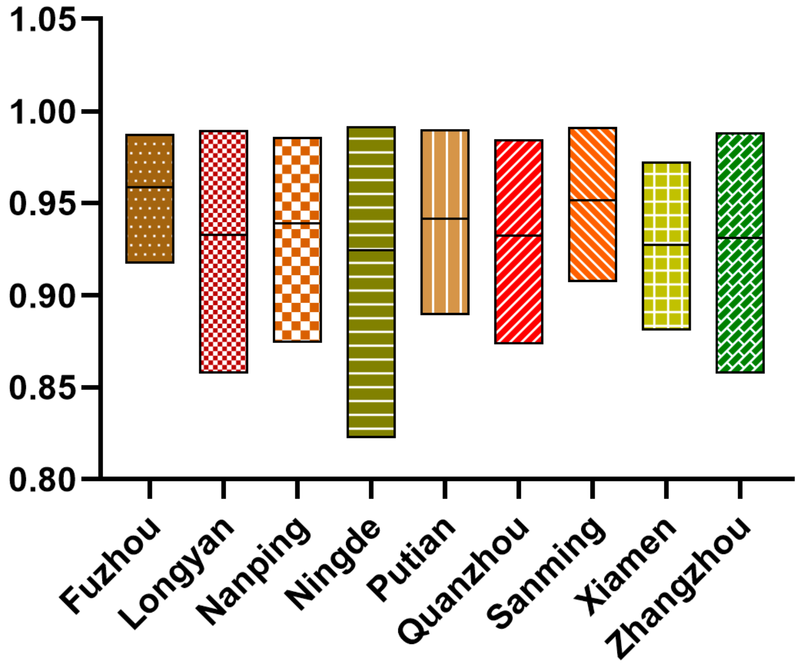

Figure 6. The degree of coupling coordination between the sports facilities and social economic development.

In order to visualize the coupling of sports facilities and social economic development in Fujian Province, this paper uses ArcGIS 10.2 software to visualize the spatial coordination of nine cities (Figure 7). The research shows that the various cities in Fujian Province have a large difference in spatial coordination between 2016 and 2018, with Fuzhou starting to develop more steadily and maturing in 2016, while the Ningde region changes from being more unstable to high-quality coordination [34,35].

In order to further explore the spatial correlation between the coupling coordination of sports facilities construction and social economy development of nine cities in Fujian Province, this study used ArcGIS10.2 software to calculate the Moran index of the coupling coordination of the two systems from 2016 to 2020, respectively. When greater than 0, a positive spatial correlation exists; when it is less than 0, a negative spatial correlation exists; when it is close to 0, a low spatial correlation or a random distribution exists. As can be seen in Figure 8, the Moran indices for 2016 to 2020 are −0.227068, −0.127627, 0.485396, 0.069730 and −0.006071, with z-values of −0.393212, −0.009962, 2.246874, 0.830907 and 0.597795, respectively, indicating that the model is mostly spatially randomly distributed from 2016 to 2020, with no spatial aggregation. The reason for the relative clustering in 2018, with less than a 5% chance of randomly generating this clustering pattern, is that 2018 was the year of national fitness development, with a wave of municipalities conducting practical work for the people, vigorously building public service facilities and vigorous construction and development of sports facilities. Overall, there are insufficient coupling and coordination spillovers from the two systems, and this will persist [36].

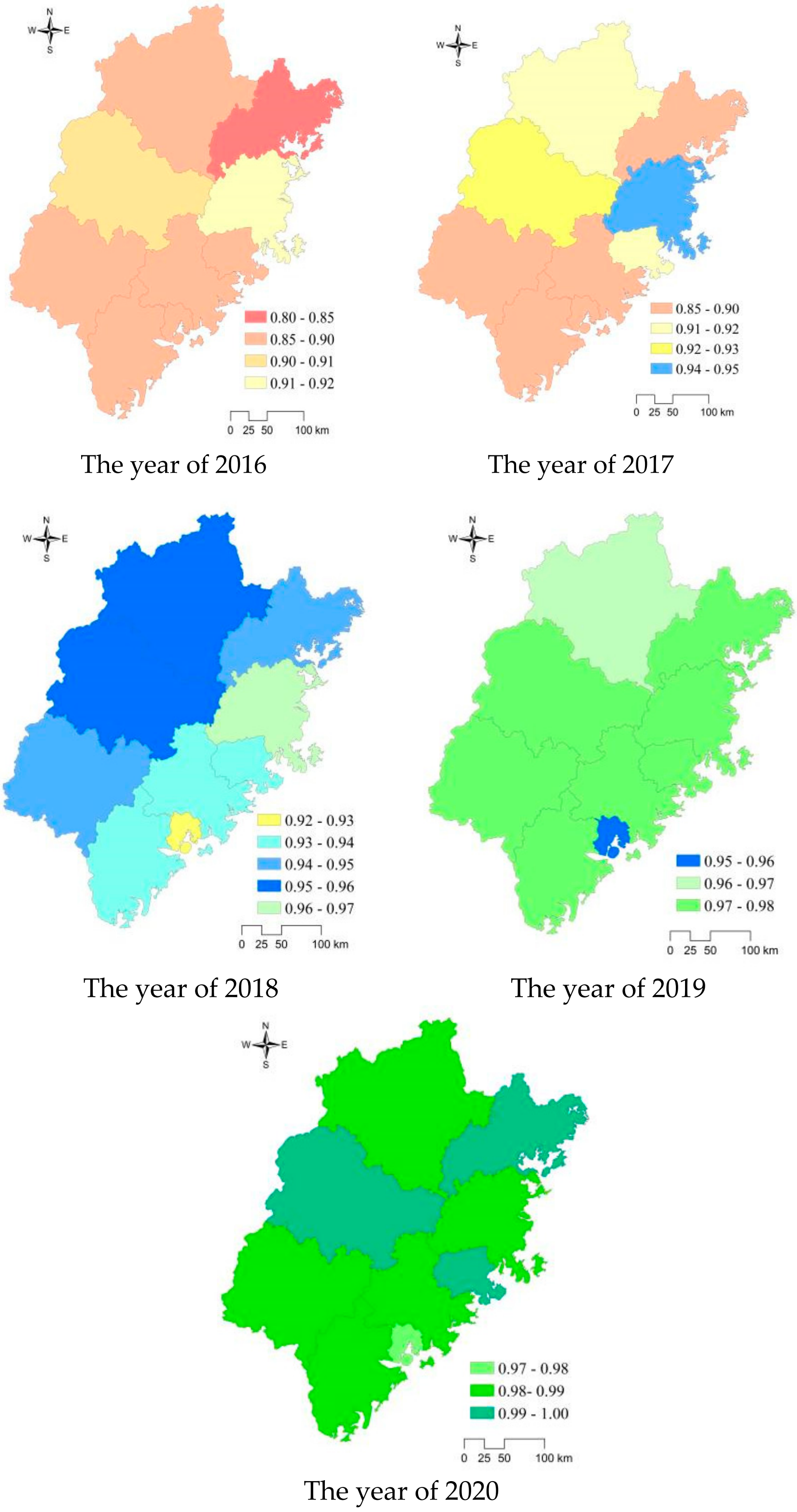

Figure 7. Spatial differences in the levels of coupling coordination between the two major systems of night cities in the Fujian Province from 2016 to 2020.

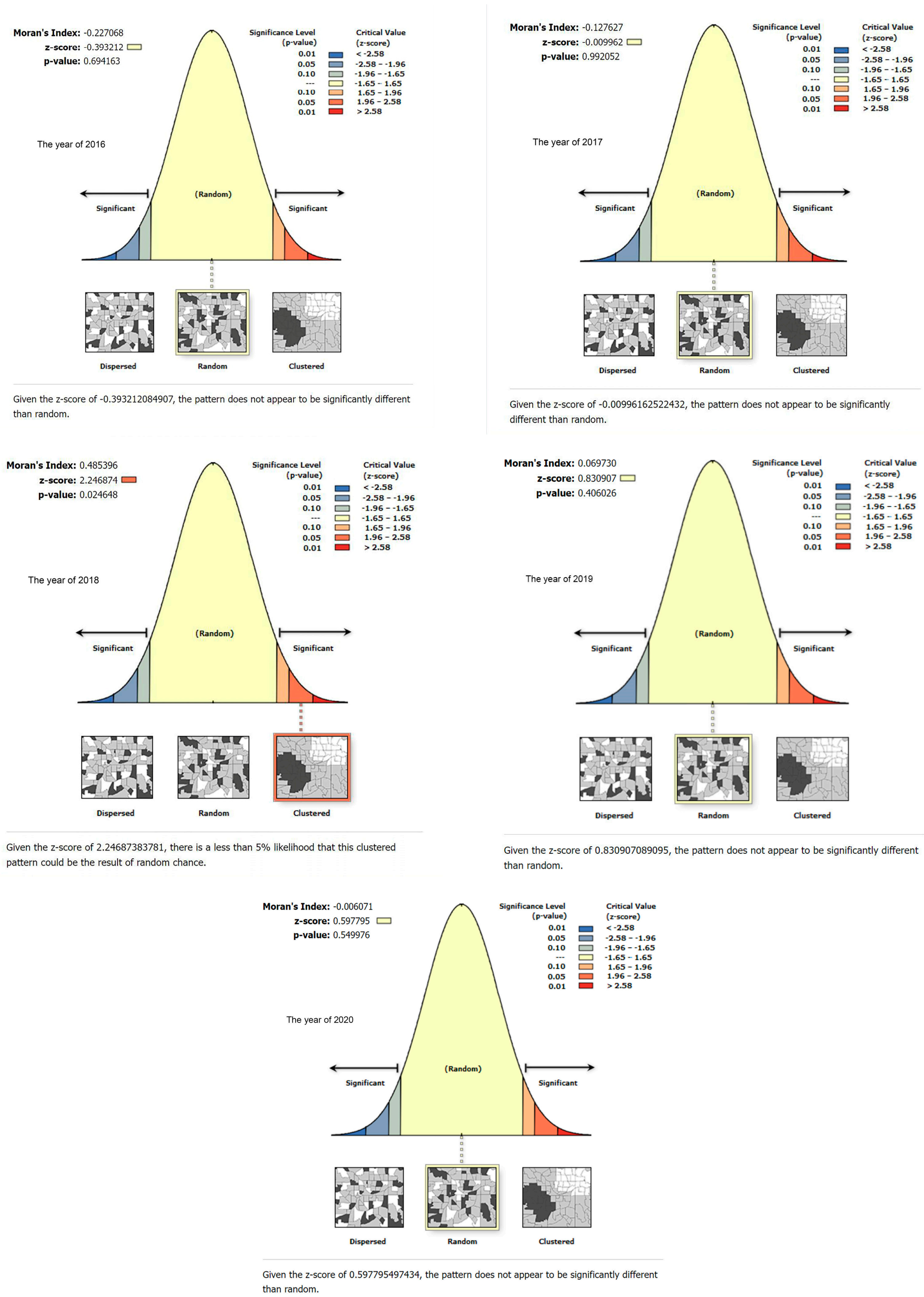

Figure 8. Spatial auto-correlation reports of the degree of coupling coordination between the two major systems of 9 cities in Fujian Province in 2016 to 2020.

Global spatial autocorrelation verifies the presence and type of spatial autocorrelation [37]. There are two cases of positive spatial autocorrelation: high-value clustering and low-value clustering, which needs to be investigated using Moran's I scatterplot. Moran's I scatterplot is in a standardized Cartesian coordinate system. The bottom scale reflects the local attributes. The vertical coordinates reflect the average of the attributes of neighboring areas [38–41]. There are four quadrants in Moran's I scatterplot. The first quadrant (HH) represents high-value clusters, also known as hot spots. The third quadrant (LL) represents low-value clusters, also known as cold spots. If the data has positive spatial autocorrelation, the type of aggregation can be further determined by the distribution in the first and third quadrants. Similarly, the second quadrant (LH) and the third quadrant (HL) can help determine the type of aggregation for negative spatial autocorrelation. As the time interval of the data is from 2016 to 2020, this study plots Moran's I scatterplot for these five years. As shown in Figure 9, the distribution of the coupling coordination degree of sports facilities and social economic development in various cities in Fujian Province is stable. Most of them are located in the second quadrant (LH) and the third quadrant (HL), and only one region is stable in the first quadrant (HH), which indicates the relatively stable development of the coupling coordination degree of the two systems of sports facilities construction and social economy development in Fujian Province.

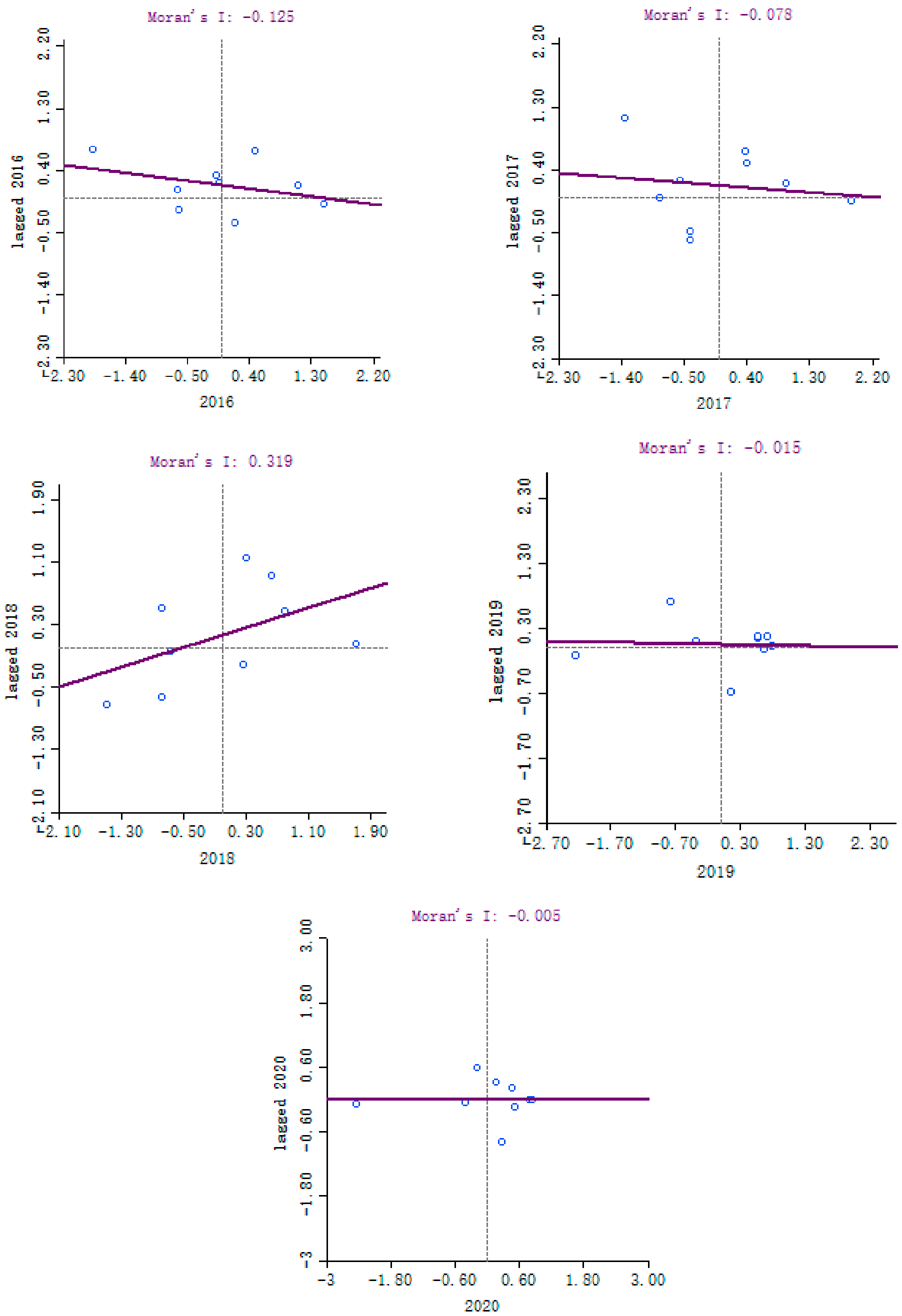

Figure 9. From 2016 to 2020: Moran scatter plot of the coupling coordination degree of the two systems.

6. Analysis of the Influence Factors of Coupling Coordination between Sports Facilities Construction and Social Economy Development—Based on the Panel Data Model

The coordination of sports facilities construction and social economic development is a systematic project. There are many factors affecting sustainable coupling coordination, and they are also complex. In this research, based on relevant research results, the degree of coupling coordination is chosen as the explanatory variable, fiscal expenditure, industrial development, urban development level, and environmental development are used as explanatory variables and quantitative analysis is conducted, as shown in Table 3. The raw data for all explanatory variables were obtained from the official statistical yearbooks published by the Fujian Province Bureau of Statistics [19,33].

Table 3. Coupling coordination dynamic factor index system.

	Variable Name	Variable Symbol	Variable Description	Data Sources
Explained variable	Coupling coordination Degree	D	Calculated by coupling coordination model	Calculated by the author
Explanatory variables	Financial Expenditures	X1	Sports Lottery Benefit Expenditure	Fujian Statistical Yearbook
	Industrial Development	X2	Tertiary industry output	Fujian Statistical Yearbook
	Level of urban development	X3	Urbanization rate	Fujian Statistical Yearbook
	Environmental Development	X4	Green space per capita	Fujian Statistical Yearbook

6.1. Stationary Test and Cointegration Unit Root Test

The regression analysis of panel data requires the data to be stationary. If non-stationary panel data is used for regression, false regression may occur, which may make the estimation results unreliable. Therefore, in order to avoid false regression and ensure the validity of the estimation results, this paper uses ADF tests to perform panel stationarity test before using panel data model for regression analysis. The Fisher-ADF test was mainly used to conduct the unit root test, it can be seen that the degree of coupling coordination [42–47]. Financial expenditures are shown as a stable sequence, and industrial development, level of urban development, and environmental development are shown as a first-order stable sequence (Table 4).

Table 4. The results of the unit root test of the variables.

Variable	Fisher-ADF	Stationary
D	−3.227 **	Stationary
X1	−6.658 ***	Stationary
X2	−0.191 −61.802 ***	First-order stationary
X3	0.835 −2.832 *	First-order stationary
X4	−1.996 −1.585 −8.070 ***	Second-order stationary

Note: ***, ** and * denote a significance of 1%, 5% and 10% respectively.

6.2. Panel Regression Analysis

In this study, panel models were constructed using X1, X2, X3, and X4 as explanatory variables and D as the explanatory variable. The panel model involves three models mixed POOL model, fixed effects (FE) model, and random effects (RE) model, and the model test is first conducted to facilitate the identification of the optimal model. From the Table above, the F-test showed significance at the 5% level of F(8,32) = 18.679, $p = 0.000 < 0.05$, implying that the FE model was superior to the POOL model. The BP-test did not show a significance chi(1) = 0.021, $p = 0.442 > 0.05$, implying that the POOL model was superior to the RE model. The Hausman test did not show significance chi(4) = −9.028, $p = 1.000 > 0.05$, implying that the RE model was superior to the FE model. Combining the above analyses, the FE model was ultimately used as the final result in this study [40,48,49].

Table 5 shows that X1 does not show significance (t = 1.142, $p = 0.262 > 0.05$), thus indicating that X1 does not have an effect on D. For X2, it is significant at the 0.05 level (t = 2.063, $p = 0.047 < 0.05$), indicating that X2 has a significant positive effect on D. For

X3, it is significant at the 0.01 level (t = 6.654, p = 0.000 < 0.01) and the regression coefficient is 0.015 > 0, indicating that X3 has a significant positive effect on D. For X4, it is significant at the 0.01 level (t = 6.654, p = 0.000 < 0.01) and the regression coefficient is 0.015 > 0, indicating that X3 has a significant positive effect on D. For X4, it showed a significant level of 0.05 (t = 2.658, p = 0.012 < 0.05) and a regression coefficient value of 0.012 > 0, indicating that X4 would have a significant positive influence relationship on D. It means that industrial development, level of urban development and environmental development have significant impacts on the coordination degree, some variable of them should be considered.

Table 5. The panel model results of the coupled and coordinated development dynamics factors.

Variables	POOL Model	FE Model	RE Model
Constant	0.799 ** (9.313)	−0.231 (−1.867)	0.743 ** (7.928)
X1	−0.000 (−0.075)	0.000 (1.142)	−0.000 (−0.007)
X2	0.000 (1.711)	0.000 * (2.063)	0.000 (1.764)
X3	−0.000 (−0.037)	0.015 ** (6.654)	0.000 (0.127)
X4	0.008 * (2.033)	0.012 * (2.658)	0.011 * (2.523)
R^2	0.166	−12.344	0.150
R^2 (within)	0.302	0.844	0.378
N	45	45	45
T	F(4,40) = 1.984, p = 0.116	F(4,32) = 43.217, p = 0.000	X2 (4) = 11.207, p = 0.038
Dependent variable: coordination degree (D)			

Note: ** and * denote a significance of 5% and 10%, respectively, T values are shown in parentheses.

7. Results

This paper first discusses the comprehensive level of sports facilities construction and social economy development in Fujian Province and the characteristics of the degree of coupling. The entropy method is used to construct a system of coupling indicators for sports facilities construction and social economy development, while a panel data regression model is used to analyze the dynamic factors affecting the degree of coupling coordination. The research indicates:

The overall development level of sports facilities construction in Fujian Province from 2016 to 2020 showed a steady growth trend, but there were large differences between cities.

(1) The level of coupling coordination between sports facilities construction and social economy development in Fujian Province has gradually changed from good coordination to quality coordination, and the degree of coupling coordination between the two systems has increased significantly, indicating that the interaction between the two systems has been strengthened and the coupling coordination relationship is developing in a benign manner.
(2) From the perspective of the spatial correlation effect, there was spatial aggregation in the coupling coordination of sports venue construction and social economy development in 2018, and there was no spatial agglomeration among cities in other years. The spatial spillover effect is insufficient, and there is a lack of mutual promotion between neighboring cities. At the same time, the degree of coupling coordination of the two systems of sports venue construction and social economy development in each city developed relatively steadily.
(3) In terms of influencing factors, industrial development, the level of urban development, and environmental development have a clear positive effect on the degree of coupling coordination.

8. Discussion

Under the background of "fitness for all" and "strong sports nation", the construction of sports facilities has been vigorously developed in China in recent years. Exploring the sustainable coupling coordination evaluation of sports facilities construction and social economy development can strengthen the understanding of regional governments of the importance of coordinated development of sports facilities resources and socio-economy, and actively explore and innovate new ways of coordinated development of sports facilities and social economy, so as to promote the resolution of the contradiction between the growing demand of the masses for sports and fitness and the lack of sports facilities resources construction, which is of great theoretical and practical significance in accelerating the construction of a strong sports nation. In this study, all nine cities in Fujian Province experienced lagging social economy development in 2018–2020, indicating that the level of development of sports facilities construction in nine cities in Fujian Province is higher than the level of social economic development. All nine cities in Fujian Province have lagging sports facilities construction. The situation of lagging sports facilities construction and lagging social economy development co-exists, indicating that the two systems in the nine cities are promoting each other's development. Secondly, Fuzhou as capital city of Fujian Province, has developed its infrastructure vigorously and has been at a quality and coordinated level since 2016, while all other cities have been at a quality and coordinated level since 2018, in line with the development concept of " Fitness for All " and the implementation of various policies. Thirdly, attention should be paid to the upgrading of industrial structures, urbanization, and environmental development in future development. At the same time, the government's financial support does not have a positive impact on the construction of sports facilities, but rather inhibits the development of sports venue construction to a certain extent, which has a certain negative impact on the sustainable coupling coordination.

Based on the above findings and results, we make the following recommendations:

Implementing the national strategy for national fitness and helping to build sports facilities. Strengthen the construction of urban greenways, fitness trails, bicycle paths, national fitness centers, sports and fitness parks, community cultural and sports squares, as well as football, ice and snow sports, and other facilities, combine them with the comprehensive development and renovation of residential, commercial, cultural and entertainment construction projects, and make reasonable use of vacant urban sites, underground spaces, park green spaces, building rooftops, and spaces attached to the properties of ownership units [50]. Encouraging social forces to build small sports facilities, improving the policy of opening public sports facilities free of charge or at low fees, and promoting the opening of various sports facilities and facilities to the community in an orderly manner. Closely combine the construction of livable villages and sports leisure towns to encourage the creation of leisure and fitness areas, functional areas, and idyllic scenic spots. Exploring the development of rural fitness and leisure industries and the construction of sports leisure villages with special characteristics.

The municipalities can use the hosting of various events as an opportunity to improve the utilization and operational efficiency of sports facilities. It is recommended that the government actively host events, with a focus on the competition and performance industry, and vigorously develop multi-level and diversified sports events of all kinds to enrich sports activities and improve the utilization rate of sports facilities. Strengthening exchanges and cooperation with domestic and international sports organizations and other professional bodies, actively introducing high-quality events, promoting the development of professional events, and creating a number of attractive international and regional brand events [51]. Promoting the opening of various types of public sports facilities for free or at low fees, and speeding up the opening of sports facilities in institutions, schools, and enterprises to the public.

Broadening investment and financing channels for the construction of sports facilities. National and local government investment in the construction of sports facilities is limited. Social funds should be actively guided and encouraged to invest in the construction of sports facilities. Supporting eligible sports enterprises to issue special bonds for the social sector industry gradually changing the situation of a single source of sports funding structure, relying mainly on state funding to build public sports facilities, and establishing a new situation of diversified investment and open operation with multiple inputs from the government, society, collectives, individuals and foreign investment [52].

Optimizing the layout of industries and promoting the coordinated development of municipalities. Strengthening the driving effect of sports venue construction on related industries especially the tertiary industry [53]. It is necessary to carry out reasonable planning and design around the construction and operation of sports facilities and form industrial chains with tourism, finance, culture, and other related industries. Encouraging the construction of sports leisure tourism bases such as sports leisure, recreation, and sports holidays in various places, and promoting the mutual drive and common development of the constituent industries in the industrial chain [54].

9. Limitations and Future Research

This research measures the coupling synergy between sports facilities construction and social economy development in Fujian's municipalities by using coupling coordination models, and testing influencing factors by spatial panel regression models. However, this research still has some limitations. First, social economy development involves a wide range of contents and the two are interlinked in so many ways that the social economy indicators available are somewhat limited and may not be perfect due to the caliber of statistics and the time series of statistical data, and the selection of indicators is not comprehensive and systematic. Secondly, sports facilities and social economic development are a dynamic evolutionary process. This study has obtained a large amount of statistical data through various statistical yearbooks and government gazettes, and the research spans a long period of time, covers a wide range of areas, is comprehensive, and has a large amount of data processing work. This study also lacks in-depth elaboration on the relationship between sports facilities and sustainable coordination of social economy development. In addition, other researchers who are interested in a particular area can try to analyze it from perspective of other evaluation index system.

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