

Coordination of Supply and Demand of Cultural Facilities in Guangzhou under the Background of Rapid Urbanization

Xiuyu Xu

Guangdong Polytechnic of Industry and Commerce, Guangzhou, China
Email: 450016102@qq.com

How to cite this paper: Xu, X.Y. (2025) Coordination of Supply and Demand of Cultural Facilities in Guangzhou under the Background of Rapid Urbanization. *Open Journal of Applied Sciences*, 15, 4134-4144. <https://doi.org/10.4236/ojapps.2025.1512267>

Received: October 21, 2025

Accepted: December 21, 2025

Published: December 24, 2025

Copyright © 2025 by author(s) and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

This article develops a framework for analyzing the coordination between supply and demand of cultural facilities. Using a comprehensive evaluation method, we assess the development levels of both supply and demand, and apply a coupling coordination model to examine the spatial evolution of their relationship. The findings reveal that: 1) Spatial Moran's Index values for the supply level, demand level, and supply-demand coupling coordination degree of cultural facilities in Guangzhou are positive. However, the spatial autocorrelation of demand weakens under rapid urbanization, reflecting an increasingly dispersed spatial pattern of demand as urbanization accelerates. 2) Against the backdrop of rapid urbanization, both the supply and demand levels of urban cultural facilities have improved. The proportion of areas experiencing severe supply-demand imbalance has decreased, and the highest level of coupling coordination has reached a moderate stage. 3) There is pronounced spatial heterogeneity in the coupling coordination of supply and demand. Under rapid urbanization, densely populated old urban districts, neighborhoods with high concentrations of elderly residents, and low-income communities on the peripheries of new urban areas persistently exhibit serious supply-demand mismatches, characterized by a typical pattern where supply falls short of demand.

Keywords

Cultural Facilities, Supply and Demand, Coupling Coordination Degree, Guangzhou City

1. Introduction

Against the backdrop of rapid urbanization in China, the focus of urban residents is shifting from basic material subsistence to higher-level spiritual and cultural

development, leading to growing demand for quality public cultural services and leisure experiences. Cultural facilities serve not only as essential infrastructure for fulfilling these aspirations but also as key elements in showcasing a city's cultural soft power and enhancing its overall attractiveness and competitiveness. However, the rapid pace of urbanization has commonly led to structural and spatial mismatches between the supply of and demand for such facilities. Therefore, studying the coupling coordination relationship between the supply and demand of cultural leisure facilities is of significant practical importance for optimizing their spatial distribution and better meeting residents' cultural and leisure needs.

Research on cultural facilities often employs quantitative metrics for evaluation, with efficiency and equity being two critical indicators reflecting how well supply matches demand. Advances in GIS technology have enabled widespread use of methods to accurately assess the spatial service efficiency and equity of facilities like libraries [1]-[3]. This has led to the development of four types of "place-based" and six types of "person-based" accessibility measures [4]. In particular, person-based approaches have evolved from initial assumptions of a homogeneous "economic man" toward a more nuanced focus on spatial equity for specific social groups—considering factors such as race, gender, education level, and household income [5] [6].

Although relevant studies have already explored this issue from the perspective of supply and demand balance [7], most existing studies tend to focus either on the supply capacity or the demand level of urban cultural facilities, with limited attention to the interactive coupling relationship between the two systems. Moreover, research is often conducted at macro scales [1]-[3] such as provinces, cities, or districts, while micro-scale analyses at the sub-district, town, or community level remain scarce. In particular, the construction of a comprehensive evaluation index system continues to pose challenges, and research on the coupling coordination of supply and demand—especially its dynamic evolution over time—is still underdeveloped.

2. Materials

2.1. Study Area

The study focuses on the central urban area of Guangzhou, with 2010 and 2020 selected as the observation years. To systematically analyze the evolution of the coupling coordination pattern between the supply and demand of cultural facilities, the central urban area is divided into three functional zones: the old city core, the new city center, and the new city edge [8].

Furthermore, drawing on existing research on the socio-spatial differentiation of Guangzhou, the social spatial structure in 2010 was categorized into several distinct types: densely populated old urban areas, middle-income zones, low-income clusters, urban population agglomerations, mixed areas of migrants and local residents, intellectual enclaves, and scattered agricultural populations [9]. By 2020, this structure had evolved into a "concentric circle and patchwork" pattern,

characterized by clusters such as elderly-dominated neighborhoods, elite enclaves, middle-income districts, low-to-middle-income areas, university precincts, high-to-middle-income zones, and low-income communities [10].

2.2. Data and Information

The selection of cultural facilities for this study focused on non-profit or preferentially priced public cultural venues that are managed by the government or provided through third-party entities. Given the broad public service mandate of such facilities, those catering to the general population were prioritized, including museums, public libraries, science and technology museums, memorial halls, art galleries, cultural activity centers (also known as cultural stations), cultural palaces, cultural centers, stadiums, and other designated cultural activity spaces.

Data for the year 2020 were compiled from 1241 Point of Interest (POI) records. For 2010, facility information was sourced from a combination of Guangzhou city maps, government open data portals, district government websites, district yearbooks, and the Guangzhou Yellow Pages, resulting in a total of 241 identified facilities.

To assess the service scale of cultural facilities at the sub-district level and above, the primary metric used was the total building area of such facilities within each administrative unit. Relevant data were obtained from district yearbooks of Guangzhou's central urban areas and through responses to government information disclosure requests. Population data were derived from the Sixth and Seventh National Population Censuses. Areal data for streets and towns were collected from district yearbooks and official government statistics, with reference to the end of 2020. The assessment of facility recreational function and service level was conducted through a scoring method based on established research [11].

3. Methodology

3.1. Indicators Selection

The Comprehensive Equity Index (IEI) is frequently employed to assess the level of public services [11]. In China, the composition of public service evaluation indicator systems tends to vary with the scale of analysis. At broader regional scales, such systems often emphasize the availability of basic public service facilities and the extent of government financial investment [12]. In contrast, evaluations conducted at the sub-district scale levels tend to focus on more localized metrics, such as facility coverage density, per capita availability, and facility quality [13]. Building on existing frameworks for assessing basic public services [14] and cultural facility provision [11] at the sub-district scale, this study develops an indicator system to measure the supply level of cultural facilities. This system encompasses five dimensions: the number of facilities, facility density, service capacity, leisure function diversity, and overall service quality (Table 1).

The demand for cultural facilities at the sub-district scale is primarily measured using demographic indicators, as different age groups exhibit varying needs for

such amenities. Drawing on relevant literature [11], demand is represented by a composite index that incorporates resident population density, the size and proportion of the population aged 5 and over, and the size and proportion of the population aged 15 and over (Table 1).

Table 1. An indicator system for measuring the coupling coordination between the supply and demand of cultural facilities services.

System	Primary Indicators	Secondary Indicators	Units
Culture Facilities Supply System	Number of Facilities	Number of Various Facilities	Unit
		Number of Facilities per Capita	Units per Thousand People
	Facility Density	Regional Facility Density	Units per km ²
	Service Scale	Scale of Various Facilities	m ² /hm ²
		Scale of Facilities per Capita	m ² per thousand people or hm ² per thousand people
	Leisure Function	Types of Various Facilities	Point
	Service Level	Levels of Various Facilities	Point
Culture Facilities Demand System	Population Density	Resident Population Density	10,000 people/m ²
	Population Size	The Size of the Population over 5 Years Old	Ten thousand people
		Population Size Aged 15 and above with Education	Ten thousand people
		Proportion of the Population over 5 Years Old	%
		Proportion of the Population over 15 Years Old with Education	%

3.2. Comprehensive Index Evaluation Method

The calculation of the supply and demand levels of cultural facilities adopts a relatively objective comprehensive index evaluation method, and the weight setting of the indicator system adopts the objective entropy weight method. The basic idea of entropy weight theory is that the higher the difference of the value among the evaluating objects on the same indicator, the more important the indicator is [15]. It can overcome the subjectivity of weights determined by human beings and the overlap of information among multiple indicator variables. On this basis, the supply level (L_s) and demand level (L_d) of cultural facilities are calculated, and the calculation method is as follows:

$$L_s = \sum_{i=1}^m w_s X'_{iz}, L_d = \sum_{i=1}^m w_d X'_{id} \quad (1)$$

where W_s and W_d are the indicator weights of each system.

3.3. Coupling Coordination Degree Model

Building upon the coupling coordination degree model from physics and guided by the principles of coupling coordination evaluation and prior research [16], we construct a coupling model to analyze the relationship between the supply level

(L_s) and demand level (L_d) of cultural facilities as follows:

$$C = 2 \left\{ \frac{(L_s \times L_d)}{(L_s + L_d)^2} \right\}^{\frac{1}{2}} \quad (2)$$

Here, L_s and L_d represent the points of the supply level and demand level. The coupling degree (C) ranges between 0 and 1. A value closer to 1 indicates stronger coupling, reflecting a more synergistic interaction between the subsystems and a movement toward ordered development. Conversely, a value closer to 0 suggests weaker coupling, characterized by disjointed relationships and a tendency toward disordered development.

It is important to note that the coupling degree (C) only reflects the intensity of interaction between the two subsystems and does not indicate their actual development performance. For instance, a system may exhibit high coupling even when both supply and demand are at low absolute levels. To more accurately assess the coordinated development state, the coupling coordination degree model is introduced. The model expression is:

$$D = \sqrt{C \times (\alpha L_s + \beta L_d)} \quad (3)$$

where $D \in [0, 1]$, D closer to 0 indicates a lower level of coordination between the systems, while D closer to 1 reflects a higher degree of coordination. The coefficients α and β represent the relative contributions of the supply and demand subsystems. In accordance with the coupling mechanism underlying the supply-demand system of cultural facilities and informed by expert consultation and existing literature [17], the coefficients were set as $\alpha = 0.5$ and $\beta = 0.5$. This assignment reflects the assumption that both subsystems contribute equally to the coordinated development of the system.

3.4. Coupling Coordination Degree Classification

Based on established research [18] and the specific context of the study area, a six-level classification scheme for coupling coordination degree is adopted as follows: severe imbalance (0 - 0.199), moderate imbalance (0.2 - 0.299), slight imbalance (0.3 - 0.399), primary coordination (0.4 - 0.499), moderate coordination (0.5 - 0.799), and high coordination (0.8 - 1). Furthermore, depending on the relative development levels of supply and demand at different stages, the coordination type is categorized into three classes: demand-lagged type ($L_s > L_d$), synchronous development type ($L_s = L_d$), and supply-lagged type (when $L_s < L_d$).

3.5. Spatial Autocorrelation Analysis

Global autocorrelation analysis [19] was used to explain the spatial correlation and differences in the supply and demand levels of cultural facilities in different sub-districts of Guangzhou. The global Moran's I index was used as the expression, and its calculation formula is as follows:

$$I = \frac{\sum_{i=1}^n \sum_{i \neq j}^n W_{ij} (X_i - \bar{X})(X_j - \bar{X})}{S^2 \sum_{i=1}^n \sum_{i=j}^n W_{ij}} \quad (4)$$

where n is the number of districts, x_i and x_j represent the scores of supply and demand levels for cultural facilities in districts. The value of Moran's I ranges from -1 to 1 . The magnitude of Moran's I reflects the strength of the spatial association.

4. Research Results

4.1. Characteristics of Supply for Cultural Facilities

Based on the calculation of Global Moran's I , the spatial autocorrelation indices for the supply level of cultural facilities in Guangzhou's central urban area were 0.074 in 2010 and 0.116 in 2020. The positive values indicate the presence of spatial clustering in the supply of cultural facilities, with a relatively stable spatial structure over the study period.

Analysis of supply level disparities at the sub-district scale reveals pronounced spatial heterogeneity in the distribution of cultural and leisure service facilities across Guangzhou. In 2010, the sub-district-level supply scores ranged from 0 to 0.392 , with a mean value of 0.037 . High-level supply areas were predominantly concentrated in several sub-districts of Yuexiu District, including Liurong, Datang, Beijing, and Dengfeng. A number of other sub-districts in Yuexiu—such as Zhuguang, Guangta, Huanghuagang, Dongshan, Renmin, and Baiyun—also exhibited relatively high supply levels. This clustering is supported by the presence of major high-standard cultural venues in Yuexiu, such as the Museum of the Western Han Dynasty Mausoleum of the Nanyue King, the Guangzhou Art Museum, the Guangdong Provincial Museum, the Guangdong Science Museum, the Sun Yat-sen Memorial Hall, and several key libraries and cultural palaces. Together, these form a high-level cultural and leisure cluster centered on the historic core of Yuexiu.

Additional high-supply areas were identified in sub-districts such as Shipai, Wushan, and Shahe in Tianhe District; Xinshi in Baiyun District; Pazhou in Haizhu District; and Luogang in the former Luogang District. These represent localized clusters of cultural facilities within their respective administrative areas. In contrast, northern sub-districts of Baiyun, northeastern Tianhe, eastern Huangpu, southern Haizhu, and southern Liwan were characterized as low to relatively low supply zones, reflecting a substantial shortage of cultural and leisure infrastructure.

By 2020, the supply score range had shifted to $0.011 - 0.605$, with the mean rising to 0.055 , indicating a general improvement across sub-districts. Spatially, the gap between high-level and relatively high-level areas became more pronounced, while differences among low-level areas remained modest. Yuexiu District continued to function as the primary cluster of high-level cultural facilities. However, with the development of new large-scale cultural venues in Tianhe and Haizhu Districts—such as the Guangdong Museum and Guangzhou Library in

Liede Sub-district, which opened in 2010 and 2012, respectively—the Zhujiang New Town area has emerged as a secondary cultural and leisure hub. Similarly, Pazhou Sub-district in Haizhu District strengthened its status as a high-level area with new facilities, including the Guangzhou Metro Museum, the Zhujiang InBev International Beer Museum, and the Guangzhou Water Expo Science Museum.

Compared to 2010, high-level cultural facilities in 2020 remained largely concentrated in the traditional core of Yuexiu. At the same time, citywide initiatives such as the “Guangzhou Plan for Building a Culturally Strong City and Cultivating a World-Class Cultural City (2011-2020)” promoted the development of basic cultural infrastructure, including sub-district cultural stations, community libraries, and cultural rooms. As a result, most sub-districts previously classified as low-level improved to relatively low or medium-level categories. However, due to constraints such as limited land availability, specific facility attributes, and development priorities, the construction of new large-scale public cultural facilities remained modest over the decade. This has contributed to a relatively low degree of spatial differentiation in cultural facility supply at the sub-district level.

4.2. Characteristics of Demand for Cultural Facilities

The global Moran's I for the demand level of cultural facilities at the sub-district scale in Guangzhou was 0.1 in 2010 and 0.001 in 2020. Although positive, indicating persistent spatial clustering of demand, the notable decline in the index reflects a weakening of spatial autocorrelation in cultural facility demand across sub-districts over the decade.

Significant spatial variation in demand levels was observed among sub-districts. In 2010, demand scores ranged from 0.069 to 0.988, with a mean of 0.367. High and relatively high-demand areas were mainly concentrated in densely populated historic urban neighborhoods—such as Donghu, Meihuacun, Dadong, Kuangquan, Dengfeng, and Huanghuagang Sub-districts—which also feature high proportions of residents aged 65 and above. Additional high-demand areas were identified in sub-districts with large migrant populations, located both within the central city and on the urban fringe, including Sanyuanli, Tongde, Songzhou, Huangshi, Yongping, Renhe Town, Junhe, Tangxia, and Shipai. Many of these areas are characterized by mixed communities of migrants and local residents, as well as scattered agricultural populations.

By 2020, the demand score range shifted to 0.077 - 0.961, with the mean rising to 0.389, indicating a moderate overall increase in demand. As urbanization advanced, population growth—particularly in the urban fringe—led to a rising share of school-age children (5 years and older) and a growing permanent resident base. This contributed to a clear spatial shift in demand toward emerging peripheral areas. Sub-districts such as Taihe Town, Shijing, Helong, Jingxi, and Tangjing in Baiyun District; Nanzhou, Fengyang, and Ruibao in Haizhu District; and Shipai, Tangxia, Chebei, Longdong, and others in Tianhe District all experienced marked increases in both permanent population and the proportion of children in educa-

tion compared to 2010. These areas, which coincide spatially with clusters of low-income residents, exhibited rapidly growing demand for cultural facilities over the study period.

4.3. Characteristics of Supply-Demand Coordination of Cultural Facilities

Based on the calculated coupling coordination degree between the supply and demand of cultural facilities in Guangzhou's sub-districts, it is evident that after a decade of optimized cultural facility allocation, most sub-districts have experienced significant improvement in supply-demand coordination.

In 2010, the coordination levels across sub-districts were classified into five categories: severe imbalance, moderate imbalance, mild imbalance, primary coordination, and moderate coordination—the highest level observed at that time. Among them, 100 sub-districts (86.2%) fell into the imbalanced categories, while only 16 sub-districts (13.8%) achieved coordinated development. By 2020, although the highest coordination level remained in the moderate coordination category, overall coordination continued to improve. Specifically, the number of sub-districts in severe imbalance decreased from 69 to 47, while those in moderate imbalance increased from 8 to 20. The number of mildly imbalanced sub-districts remained relatively stable, rising slightly from 23 to 26. Meanwhile, sub-districts with primary coordination increased from 10 to 17, and those with moderate coordination grew from 6 to 10.

Spatially, in 2010, only 16 sub-districts had reached basic or moderate coordination levels, while the rest exhibited varying degrees of imbalance. In districts such as Baiyun, Tianhe, and Huangpu, most sub-districts showed high or relatively high demand for cultural facilities, yet supply levels were low or relatively low. In contrast, most sub-districts in Yuexiu District had low demand but relatively high supply—reflecting the uneven distribution of cultural facilities across Guangzhou's central urban area. From a socioeconomic perspective, coordinated sub-districts were mainly concentrated in the historic urban cores of Yuexiu, Haizhu, Liwan, and Baiyun, which are typically densely populated old-city areas. In contrast, disadvantaged sub-districts were mostly located in transitional zones between the old city and newly developed urban areas. Most severely imbalanced sub-districts were situated on the urban periphery, often corresponding to residential clusters of middle- and low-income groups, agricultural populations, and mixed migrant-local communities. With the exception of Beijing Sub-district, the supply level of cultural facilities in all other imbalanced sub-districts fell below demand, indicating a general inadequacy in service provision.

By 2020, imbalanced sub-districts still accounted for the largest share (77.5%), primarily located in central and northern Baiyun, eastern Tianhe, the former Fangcun area of Liwan, southern Haizhu, and parts of the old urban core of Yuexiu. These areas continued to exhibit socio-spatial characteristics of low-income and elderly population concentration. Moderately imbalanced sub-districts were mainly distributed in central Baiyun, central Tianhe, the original Liwan area, and northern

Haizhu—mostly inhabited by low- to middle-income residents. On the other hand, the proportion of coordinated sub-districts rose to 22.5%, with primary and moderate coordination accounting for 14.2% and 8.33%, respectively. These were largely concentrated in northern Haizhu, the historic core of Yuexiu, and the central area of Tianhe. Benefiting from the city's historical development trajectory, the old urban core has long served as a cultural hub with a relatively high level of cultural facility supply. In Tianhe district, Liede sub-district has become a key location due to centralized urban cultural planning, hosting several major high-level facilities. Similarly, Dengfeng sub-district in Yuexiu benefits from its concentration of historical and cultural sites. Nevertheless, with the exception of Beijing, Datang, and Liede sub-districts, the supply of cultural facilities in other sub-districts still lagged behind demand, indicating a persistent gap in service provision.

5. Discussion

This study developed an evaluation framework for the coordinated development of urban cultural facilities from a supply-demand matching perspective. By systematically examining the coupling coordination relationship between supply and demand, this research offers a more objective and comprehensive approach compared to prior studies that relied solely on singular indicators of facility availability and resident population. Conducting a dynamic analysis of the coupling coordination of public leisure facilities at the sub-district level enables a more precise identification of supply-demand mismatches in the context of rapid urbanization. The findings help to locate areas with inadequate provision of cultural facilities and provide targeted insights for the planning and optimization of urban cultural and leisure services.

The supply-demand coupling system of urban cultural facilities constitutes a complex and dynamically interconnected system. Its coordinated evolution is shaped by both internal mechanisms and external driving forces. Future research should further explore and model these mechanisms to uncover the underlying principles governing the coordinated development of the urban cultural and leisure facility system.

This study has certain limitations, primarily related to data availability. The demand-side indicators were confined to potential demand measures, such as residential population density and the proportion of specific demographic groups. As the demographic data reflects potential demand rather than actual demand, it is necessary to add indicators representing real demand in the future, such as the demand differences of personalized groups and the intention of leisure activities, such as facility usage rate and travel intention, in order to more accurately assess the coordination between the supply and demand of urban cultural facilities.

Funding

This work was supported by the scientific research platform “Research Center for Integrated Cultural and Tourism Development” (NO.2025-PT-07) of Guangdong

Polytechnic of Industry and Commerce.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

References

- [1] Ma, W., Zhang, W., Chen, Q., Jiang, H., Zhao, K., Song, C., *et al.* (2025) Understanding the Regional Dynamics and Determinants of Urban Cultural Facilities in the Yangtze River Economic Belt, China. *Humanities and Social Sciences Communications*, **12**, 1-14. <https://doi.org/10.1057/s41599-025-04825-9>
- [2] Zhao, K., Cao, X., Wu, F. and Chen, C. (2023) Spatial Pattern and Drivers of China's Public Cultural Facilities between 2012 and 2020 Based on POI and Statistical Data. *ISPRS International Journal of Geo-Information*, **12**, Article 273. <https://doi.org/10.3390/ijgi12070273>
- [3] Zhang, S., Xu, S., Wan, D., Liu, H., Zhao, L., Guo, L., *et al.* (2023) Equalization Measurement and Optimization of the Public Cultural Facilities Distribution in Tianjin Central Area. *Sustainability*, **15**, Article 4856. <https://doi.org/10.3390/su15064856>
- [4] Neutens, T., Schwanen, T., Witlox, F. and De Maeyer, P. (2010) Equity of Urban Service Delivery: A Comparison of Different Accessibility Measures. *Environment and Planning A: Economy and Space*, **42**, 1613-1635. <https://doi.org/10.1068/a4230>
- [5] Brida, J.G., Meleddu, M. and Pulina, M. (2012) Factors Influencing the Intention to Revisit a Cultural Attraction: The Case Study of the Museum of Modern and Contemporary Art in Rovereto. *Journal of Cultural Heritage*, **13**, 167-174. <https://doi.org/10.1016/j.culher.2011.08.003>
- [6] Richards, G. and van der Ark, L.A. (2013) Dimensions of Cultural Consumption among Tourists: Multiple Correspondence Analysis. *Tourism Management*, **37**, 71-76. <https://doi.org/10.1016/j.tourman.2013.01.007>
- [7] Gu, X., Gu, B., Luo, X., Chen, H., Zhao, H., Fan, G., *et al.* (2025) Achieving a Balance between Supply and Demand for Urban Cultural Infrastructure: A Case Study of Nanjing, China. *Applied Geography*, **181**, Article 103693. <https://doi.org/10.1016/j.apgeog.2025.103693>
- [8] Zhou, C.S., Luo Y., Chen, S.S. (2004) Spatial Temporal Evolvement of Growth and Distribution of Population in Guangzhou in Recent Twenty Years. *Scientia Geographica Sinica*, **6**, 641-647.
- [9] Zhou, C.S., Hu, J.C., Tong, X.M., *et al.* (2016) The Socio-Spatial Structure of Guangzhou and Its Evolution. *Acta Geographica Sinica*, **71**, 1010-1024.
- [10] Wei, Z.C., Lan Z.Y., Tang Q.J., *et al.* (2024) Patterns and Improvement Strategies of Socio-Spatial Differentiation in Large Cities for Achieving High-Quality Development: The Case of Guangzhou. *China Ancient City*, **38**, 41-51.
- [11] He, D., Jin, F.J., Dai T.Q., *et al.* (2017) Spatial Patterns and Characteristics for Service Level of Urban Public Cultural Facilities in Central Beijing. *Progress in Geography*, **36**, 1128-1139.
- [12] Lyons, T. and Choi, D. (2021) Transit Economic Equity Index: Developing a Comprehensive Measure of Transit Service Equity. *Transportation Research Record: Journal of the Transportation Research Board*, **2675**, 288-300. <https://doi.org/10.1177/0361198120970529>
- [13] Li, T., Zhao, Y. and Kong, X. (2022) Spatio-Temporal Characteristics and Influencing

- Factors of Basic Public Service Levels in the Yangtze River Delta Region, China. *Land*, **11**, Article 1477. <https://doi.org/10.3390/land11091477>
- [14] Li, C.Y., Bi, H.N. and Bao, Y. (2014) Research on the Evaluation Method of Space Service Level of City Public Landscape Facilities. *Applied Mechanics and Materials*, **522**, 1612-1615. <https://doi.org/10.4028/www.scientific.net/amm.522-524.1612>
- [15] Wang, Q., Yuan, X., Zhang, J., Gao, Y., Hong, J., Zuo, J. and Liu, W. (2015) Assessment of the Sustainable Development Capacity with the Entropy Weight Coefficient Method. *Sustainability*, **7**, 13542-13563. <https://doi.org/10.3390/su71013542>
- [16] Liang, K., Zou, Y. and Li, G. (2024) Spatiotemporal Evaluation of the Coupling Relationship between Public Service Facilities and Population: A Case Study of Wuhan Metropolitan Area, Central China. *Sustainability*, **16**, Article 7698. <https://doi.org/10.3390/su16177698>
- [17] Zheng, Z., Zhang, Z. and Wang, S. (2023) Measurement and Development of Park Green Space Supply and Demand Based on Community Units: The Example of Beijing's Daxing New Town. *Land*, **12**, Article 943. <https://doi.org/10.3390/land12050943>
- [18] Zhang, Y., Yang, Q.Y. and Min, J. (2016) An Analysis of Coupling between the Bearing Capacity of the Ecological Environment and the Quality of New Urbanization in Chongqing. *Acta Geographica Sinica*, **71**, 817-828.
- [19] Tobler, W.R. (1970) A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography*, **46**, 234-240. <https://doi.org/10.2307/143141>