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Evaluation and System Coupling of Beautiful Qinghai–Tibet Plateau Construction Based on Point of Interest Data

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Abstract: The unique high-frigid environment and poor natural conditions of Qinghai–Tibet Plateau (QTP) have limited sustainable economic and social development. The construction of the beautiful QTP is a concrete implementation of the United Nations Sustainable Development Goals. However, identifying the progress and system coupling relationships of beautiful QTP construction entails some barriers due to data and methodological issues. To evaluate beautiful QTP construction and achieve a coordinated development regime, this paper employs an analytic hierarchy process and coupling model to quantify the comprehensive index and the coupling relationships of five subsystems (i.e., ecological environment, cultural inheritance, social harmony, industrial development, and institutional perfection) based on point of interest (POI) data, which are highly accurate, containing quantity and location information. Meanwhile, spatial autocorrelation analysis is conducted on the comprehensive index and coupling coordination degree for identifying the spatial clustering characteristics of the two. Results show that the progress of the beautiful QTP construction in most counties are under a very low or low level. For the system coupling perspective, 86% of counties are under the coupling stage indicating a strong interaction among the subsystems. However, coordination is out of harmony in most counties. For the spatial clustering characteristics, the comprehensive index and the system coupling relationships of beautiful QTP construction show a positive spatial correlation, indicating an aggregation effect. The aggregation is mostly "low–low" and "high–high" aggregation indicating the spatial differences and regional imbalances. The government should adopt measures to make the five subsystems of beautiful QTP construction more synergistic to achieve the sustainable development of the QTP. Our study formed a sample case of special areas where statistical data are scarce while constructing a technical framework of Beautiful China construction that is applicable to these areas. The findings of this study can serve as a reference for improving the beautiful QTP or other similar areas of construction.

Keywords: beautiful Qinghai–Tibet Plateau; point of interest data; index system; coupling coordination degree; spatial autocorrelation analysis

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1. Introduction

After the reform and opening up, China has experienced rapid economic growth [1,2]. However, environmental protection and rational use of resources have been neglected in development, resulting in resource waste, environmental pollution, and major ecosystem degradation, which severely limit the attainment of sustainable development goals [3,4]. Faced with increasing resource constraints, severe environmental pollution, and a deteriorating ecosystem, the Chinese government must raise ecological awareness of the need to respect, accommodate and protect nature. In light of this event, China has proposed the ecological civilization, which is of vital importance to the people's well-being and

China's future [5–7]. China has put forward a series of new concepts, new ideas, and new strategies for the development of ecological civilization, for example, the concept of "Beautiful China" was proposed [8–10]. The construction of Beautiful China implies the natural, social, economic, political, and cultural aspects of the region, including the natural ecological beauty of the land and rivers in the regional space and the coordination and harmony of the nation, society, and organization [11]. Beautiful China is a comprehensive beauty of ecological, economic, social, and cultural beauty, coordinated and unified [12,13]. The government has taken the lead to build a "Beautiful China" as an important means to promote the harmonious development between humans and nature [11,12,14]. In 2015, the 2030 Agenda for Sustainable Development was adopted at the United Nations Conference on Sustainable Development. The "2030 Agenda for Sustainable Development" consisted of 17 sustainable development goals (SDGs) that aimed to reshape the global governance system for sustainable development, eradicate poverty, and promote equitable and inclusive development [15]. Beautiful China and SDGs have the same connotation and development direction, covering economic, social, ecological, and other dimensions [16–18]. Building Beautiful China is a Chinese practice and national model for implementing the United Nations 2030 Sustainable Development Goals, a strategic initiative for reform and innovation of China's ecological civilization system, a test of the results of high-quality green development, and an important means to promote the harmonious development of humans and nature [16–18]. Since the introduction of the Beautiful China concept, relevant departments and scholars have conducted a substantial amount of research on theories [10–13], case practices [18–20], and institutional norms [21,22]. The construction of Beautiful China has become the focus of social and academic fields. International scholars have carried out less research on Beautiful China, which was mostly focused on the analysis of the sustainable development dimension [23]. For example, the transformation, development, and path of a green economy have gained wide attention in the lagging countries or European Union countries [24–27], which may have an impact on the life quality. For Beautiful China construction, some scholars (Table 1) have studied the construction of Beautiful China index system [11,14,16,20,23,28–33]. Xie et al. [28] constructed an evaluation system of Beautiful China based on the environmental performance index, human development index, and political culture index. Shi et al. [29] and Xiong et al. [30] studied the progress of Beautiful China based on ecology, production, and living spaces. Shen et al. [31] studied the evaluation system of "Strong Economy, Rich People, Beautiful Environment and High Degree of Social Civilization" in Jiangsu Province based on the entropy method. Xie et al. [32] constructed an index system with three dimensions, namely, economic development, social culture, and ecological environment. Fang et al. [33] created a construction evaluation system with five dimensions, namely, ecological environment, green development, social harmony, institutional perfection, and cultural heritage, and 31 specific indexes. Ma et al. [16] constructed an evaluation system of social, economic, and environmental aspects of the typical regions of Beautiful China based on remote sensing observation data. Analytic hierarchy process (AHP) [20], 3D vertical model [32], entropy model [31], and other methods have been used to evaluate the construction progress of Beautiful China. These studies can provide not only a reference index system for the construction of an evaluation index system and a model method but also a comparable basis for the stage evaluation of the construction of Beautiful China in each region. Although these evaluation systems can provide a more comprehensive view of the progress of Beautiful China, the relationship between the subsystems is ignored. In reality, mutual interaction and coupling occur between the five subsystems: social, economic, political, ecological, and cultural subsystems. The concept of coupling comes from physics, which is defined as the phenomenon of the influence caused by the interaction between systems or the interconnection between factors within the system [34]. Quantifying the system coupling relationships is conducive to identifying the strength of the interaction and the degree of benign coordination between systems or between factors within the system. If the coupling relationships are in a state of incoordination, control measures could be timely taken. The

coupling model is suitable for the target system with multilevel evaluation indexes, and it can better reflect the structure and function of complex systems [35,36]. Many aspects are involved in the construction of Beautiful China, which is not a system with a single level and dimension, but a relatively complex system. The coupling coordination model has great application potential in identifying the coupling coordination relationship in assessing Beautiful China's progress and regulating regional coupling and coordination.

Table 1. The literature review of Beautiful China construction evaluation.

References	Evaluation Systems	Evaluation Methods	Data Resource	Geographical Areas	Journal
[11,33]	Ecological environment, green development, social harmony, institutions, and cultural heritage	Entropy	Statistical data, remote sensing data, and others	China	Journal of Geographical Sciences and Acta Geographica Sinica
[14]	Resource load, economy develop, organism's habits environment protects, and society progress	Entropy TOPSIS	Statistical yearbook and bulletins	Yunnan–Guizhou region	Land
[16]	Fresh air, clean water, soil safety, good ecology, and clean living environment	Model simulation	Big earth data and remote sensing data	Songhua River Basin, Heihe Basin, etcetera	Remote Sensing Technology and Application
[20]	Ecological environment, industrial development, social harmony, institutional perfection, and cultural heritage	Analytic hierarchy process	Amap	Inner Mongolia Autonomous Region	ISPRS International Journal of Geo-Information
[23]	Social development, green environment, economic growth, cultural inheritance, and institutional system	Entropy TOPSIS	Statistical yearbook and bulletins	China	Acta Ecological Sinica
[28]	Environmental performance, human development, and political culture	3D vertical model	Statistical yearbook	China	Economic Geography
[29]	Ecological, production, and living spaces	Entropy	Statistical yearbook and bulletins	Yangtze River Economic Belt	Resource Development and Market
[30]	Ecological environment, economic development, social culture	Principal component analysis	Statistical yearbook and bulletins	Yangtze River Economic Belt	East China Economic Management
[31]	Strong economy, rich people, beautiful environment and high degree of social civilization	Entropy	Statistical yearbook	Jiangsu Province	East China Economic Management
[32]	Ecological environment, economic development, social culture	Entropy and coupling model	Statistical yearbook and remote sensing data	China	Economic Geography

Majority of the currently proposed evaluation systems for Beautiful China's progress are based on traditional indexes and data obtained from statistical sources [37,38] (Table 1), the reliability of which is questioned because the authenticity and accuracy of the statistical data are affected by the interference of local governments. Statistics are more difficult to be obtained in some areas, such as the Qinghai–Tibet Plateau (QTP), due to a weak spatial representation, poor assessment resolution, and non-intuitive and non-concrete indexes. Geographic big data, which are rich in types and fast in updates, are a kind of multi-source data that integrates many aspects [39]. The point of interest (POI) data are highly accurate, diverse in types, rich in attributes, and updated in real time, making them ideal for spatial analysis [40–42]. The POI data can be used for urban spatial structure analysis [43–45], urban centers [46,47] and functional area identification [48–50], land use mapping [51,52], poverty evaluation [53], spatial hotspot analysis of retail [54,55], and population spatialization [56–59]. Moreover, the POI data are real-time, representative, and comprehensive. The POI data also contain various pieces of information, such as POI name, longitude, latitude, address, spatial information, type category, and quantity [60]. Therefore, the indexes of POI data can help in conducting a standardized, comprehensive, rapid, and

specific analysis in research on Beautiful China construction and in the evaluation of its progress.

Within the previous literature on the evaluation of Beautiful China construction, there are gaps in the following two aspects. (i) The research on the coupling relationship among the subsystems of Beautiful China construction remains insufficient. The existing research focuses on the concept connotation [8–13] and evaluation systems [11,16,20,28–33] of Beautiful China. Few studies consider the interaction among the subsystems and its spatial clustering characteristics from an integration perspective. To close the gap, there is a great need for research that employs the coupling model and spatial autocorrelation analysis to assess the subsystems of Beautiful China construction. (ii) The data resources of Beautiful China construction evaluation are mainly statistical data (Table 1), which could not be obtained in some special area. With unique high/cold environments and poor natural conditions, the QTP is unattractive for human beings and is relatively backward. Statistical data are scarce in the QTP. Therefore, other sources data (e.g., POI data) are urgently needed in resolving the gap, which appears in the process of Beautiful China construction evaluation.

Since the 21st century, human beings have confronted resource and environmental problems, such as climate change, environmental pollution, and resource depletion, and socioeconomic problems, such as population migration, rapid urbanization, and urban–rural gap [18]. In the face of such a serious and complex problem, building a "beautiful home" has become a common vision for all Chinese people, which not only means an inevitable requirement for transforming the mode of economic development, improving national and social development goals, and achieving comprehensive modernization but also an objective need for maintaining global ecological security, sustaining the foundation of human existence, and building a community of shared future for mankind. With a vast territory, the QTP, also known as the "roof of the world," is the birthplace of many rivers in Asia and its ecological environment is fragile [61,62]. Its existence is of great significance to neighboring regions and the world. Since the 21st century, the infrastructure construction represented by the QTP Railway and Sichuan–Tibet Railway has become a "booster" for the development of the QTP, providing the region with new economic opportunities. However, for a long time, the QTP has shown particularities and difficulties related to human–land relationships, topographic features, resource endowment, and regional development that differ from those of other regions. Its unique high-frigid and natural conditions have limited population distribution and social and economic development [63–65]. Against this background, this paper explores the following questions: (1) how to construct and evaluate the system of beautiful QTP construction based on POI data; (2) are the system coupling relationships of beautiful QTP construction balanced in each county; (3) and how to identify the spatial clustering characteristics of beautiful QTP construction level and the system coupling relationships. To answer the questions, the POI big data will be used to divide the socio-economic complex system in the QTP, establish an evaluation index system for the progress of beautiful QTP construction, and evaluate the progress at county scale. The coupling model is employed to quantify the coupling degree and the coupling coordination degree of the system of beautiful construction QTP. The synergistic development of each subsystem can be understood through the coupled model and the coupling analysis of the relationship of the subsystems. The spatial autocorrelation analysis is used to identify the clustering characteristics of beautiful QTP construction level and the system coupling relationships. Our study can propose feasible suggestions for improving the progress of beautiful QTP construction and provide reference for the progress of Beautiful China in other regions.

2. Materials and Methods

2.1. The Study Area

The QTP is located in the southwest of China at latitude 26–39° N and longitude 73–104° E, west to the Pamir Plateau, east to the Hengduan Mountains, north to the Kunlun Mountains, Arjinshan, and Qilian Mountains, and south to the Himalayas (Figure 1). The

plateau has a total length of 2800 km from east to west and a width of 300–1500 km from north to south, covering an area of 2.5 million km^2. The QTP is the largest and highest plateau in the world, known as the "roof of the world" and the "third pole", and it serves as a key area for the ecological civilization in China. The ecological civilization in the QTP is of great significance in promoting the plateau's sustainable development and ecological and environmental protection in China and throughout the world and has an important impact on the progress of Beautiful China. The boundary of the QTP has constantly changed in recent years. Thus, this utilized the administrative scope defined by the national QTP Scientific Data Center, which includes 26 county-level units in Gansu, 41 county-level units in Qinghai, 46 counties in Sichuan, 78 counties in Tibet, 14 counties in Xinjiang, and 9 counties in Yunnan, totaling 214 county-level units.

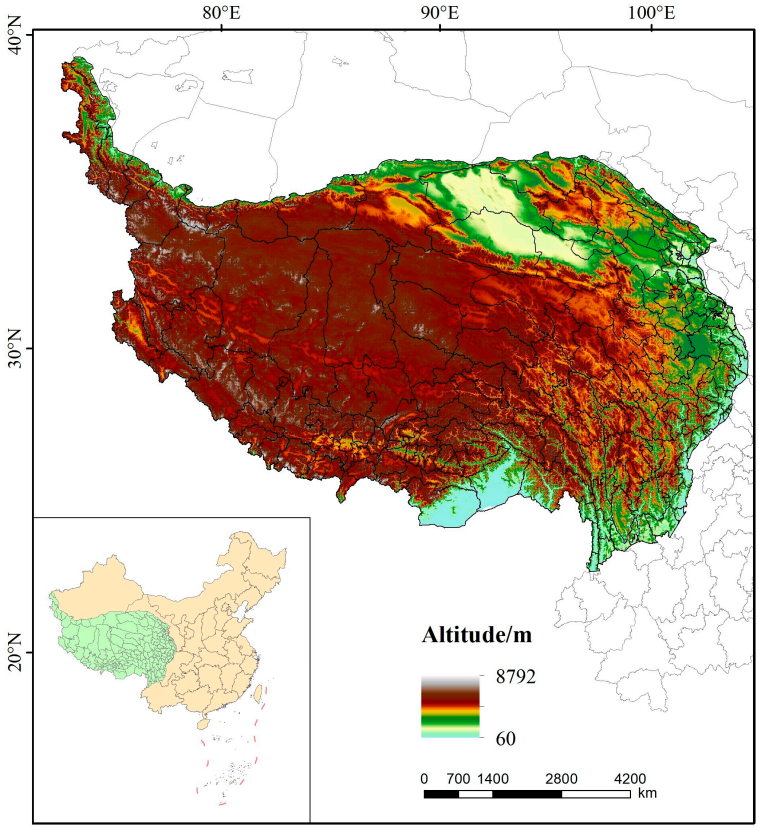

Figure 1. County distribution map of the QTP.

2.2. Data Sources

The POI data used in this research were obtained from the Resource and Environment Science and Data Center of the Chinese Academy of Science. The Python programming language was used to call out the POI data about tourist attractions, medical care, living services, transportation facilities, education and training, shopping and finance, companies and enterprises, gourmet hotels and government agencies, etc. The obtained data were screened to obtain the POI data relevant to this study, and the data that might have an influence on the experimental results, such as meaningful duplicate points, were removed. Finally, the POI data of the QTP were obtained (Figure 2). The data were collected in 2020, and the dense distribution of POI points of the QTP is shown in Figure 2. The number of households in each county of the QTP in 2020 used in this work was obtained from the China County Statistical Yearbook 2021. Meanwhile, the number of households in the QTP at the end of 2020 was as high as 27,074,700.

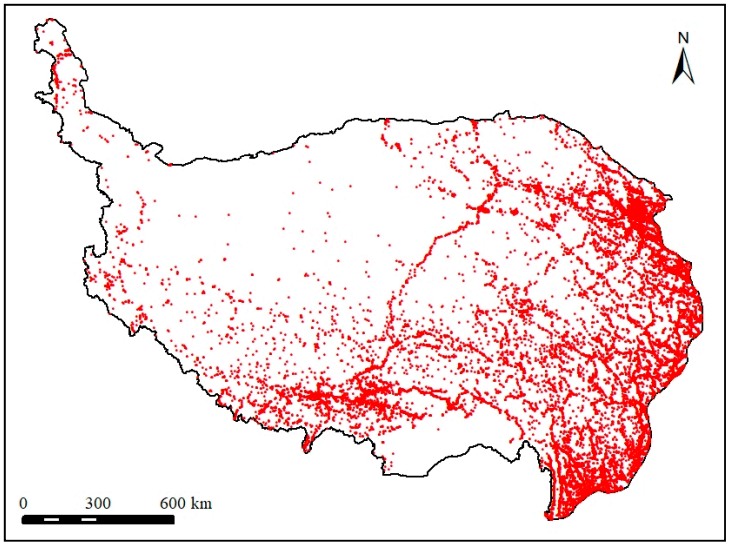

Figure 2. POI distribution in 2020 on the QTP.

2.3. Research Route

To achieve a sustainable and coordinated development regime of the QTP, we presented a research route (Figure 3) for identifying the system coupling relationships and spatial patterns of beautiful QTP construction. Firstly, the evaluation system of beautiful QTP construction was constructed from five aspects (subsystems), namely, ecological environment, social harmony, industrial development, cultural heritage, and institutional perfection. Secondly, the AHP was applied to allot the weight of each evaluation index and evaluate the subsystem level and comprehensive level of beautiful QTP construction of each county. Thirdly, the coupling model was employed to quantify the coupling degree and the coupling coordination degree among the five subsystems of beautiful QTP construction. Fourthly, spatial autocorrelation was used to analyze the spatial clustering characteristics of beautiful QTP construction level and the coupling coordination degree among the five subsystems in the counties. Finally, the related policy recommendations are proposed for supporting the beautiful QTP construction.

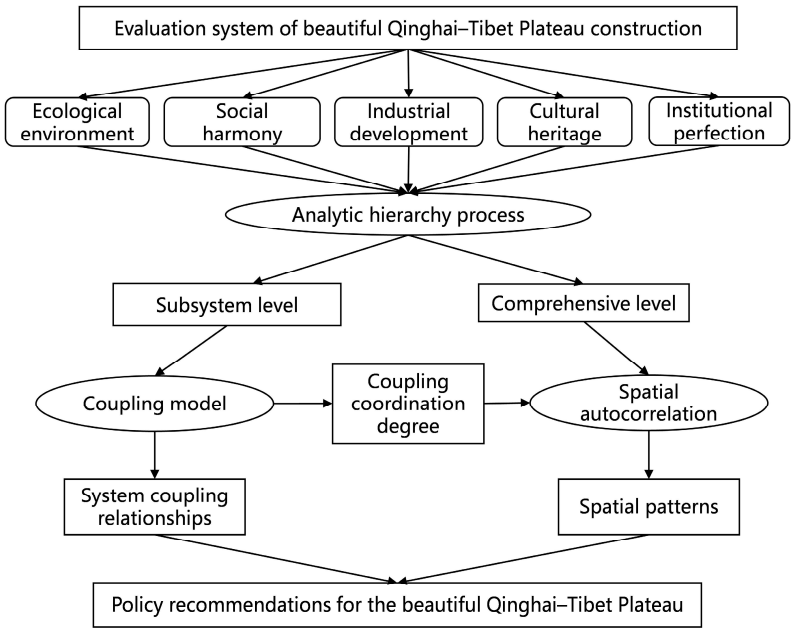

Figure 3. Research technology road map.

2.4. Establishment of Evaluation Index System

The construction of Beautiful China implies a comprehensive beauty of ecological, economic, social, political, and cultural beauty of the region, and the five aspects are coordinated and unified [11–13]. Drawing lessons from previous research results on Beautiful China [20,28–33] and following the principles of scientificity, standardization, and accessibility of data, we constructed the evaluation index system of beautiful QTP, which includes five dimensions, namely, ecological environment, industrial development, social harmony, institutional perfection, and cultural heritage, and 31 specific indexes. Considering the plateau characteristics, the beautiful QTP construction evaluation index system based on POI with 5 subsystems and 25 indicators was constructed.

The evaluation index system of beautiful QTP construction involves 25 sub-categories of POI, such as leisure places, tourist attractions, medical services, living services, transportation hubs, public facilities, schools, companies, government agencies, and social organizations (Figure 4). Park squares, leisure places, and tourist attractions are selected as tertiary indicators based on the green and friendly principle for the ecological environmental system. Sports stadiums, schools, public culture, literature and art landscape, religious and cultural landscapes, and media institutions are selected as representations from the perspective of education and culture for the cultural heritage system. Transportation hubs, medical services, living services, large shopping malls and supermarkets, and public toilets are mainly chosen for the social harmony system. Companies, factories, road facilities, scientific research institutions, industrial parks, agriculture, forestry, and fishery bases are mainly selected to reveal the construction of primary, secondary, and tertiary industries in the region for the industrial development system. Social organizations, government agencies, public prosecution, and law enforcement agencies, and industrial and commercial taxation agencies are regarded as tertiary indicators because they take into account additional factors, such as legal protection, public social security, and equal services, with banks and insurance companies for the institutional perfection system.

2.5. Evaluation of Beautiful Qinghai–Tibet Plateau Construction

The calculation of a beautiful QTP construction level includes three steps. First, the raw data are collected to carry out the standardized treatment. Second, AHP is used to obtain the weights for each index and the subsystem. Last, the indicators are aggregated to calculate the subsystem level and comprehensive level of beautiful QTP construction. In the calculation process at comprehensive level, the five subsystems are equally important and the weight is the same.

2.5.1. Data Standardization

Given that the POI quantities varied by orders of magnitude among regions and types, the POI quantities need to be standardized first to eliminate the effects of order-of-magnitude differences on the study. The utilization of POI total for direct data processing is not feasible because the QTP is vast and sparsely populated. Accordingly, the POI per capita is used for data processing in this study to eliminate the influence of the QTP's own characteristics on the study. The number of POI in each county was first divided by the corresponding number of people (10,000 persons) to obtain the number of POI per capita, which was then normalized. The standardized calculation formula is as follows:

$$Z_{\mathrm{i}} = \frac{X_i - \min X_i}{\max X_i - \min X_i} \tag{1}$$

where X_i represents the number of POIs per capita of a certain type of the ith (i = 1, 2, 3, . . . , 214) county or city; and Z_i, $\max X_i$, and $\min X_i$ represent the standard, maximum, and minimum values of the occurrence times of POI per capita in this category. The value can be standardized between zero and one by this formula. The more the number of POIs is, the higher the progress of the beautiful QTP construction will be.

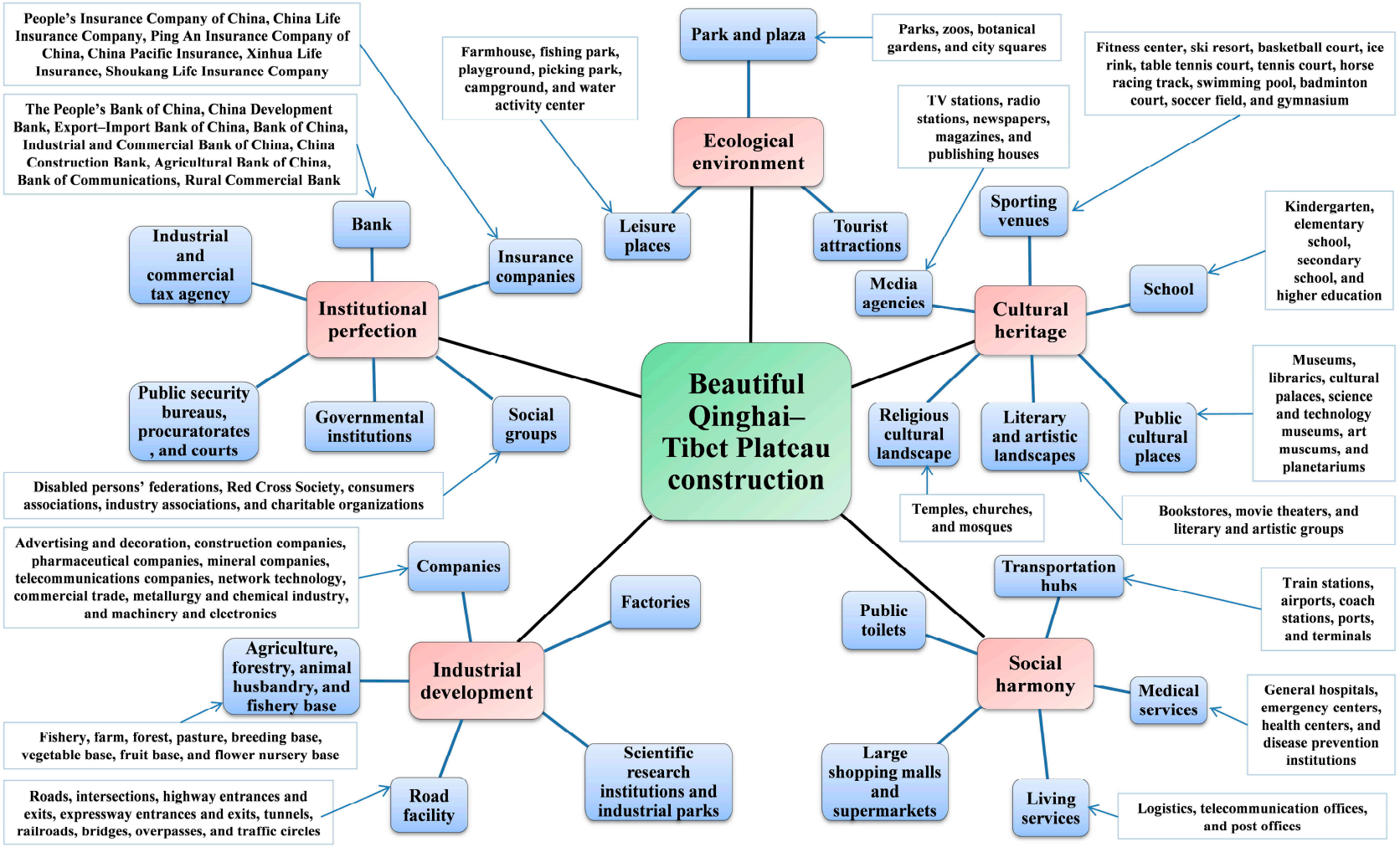

Figure 4. Beautiful Qinghai–Tibet Plateau construction evaluation index system.

2.5.2. Allocation of Evaluation Index Weights

Weights must be assigned to every index in the system to calculate the coupling between the evaluation indexes and the system, which can be carried out via the entropy value assignment method [66] and AHP. AHP is a multi-objective decision analysis method which combines qualitative and quantitative analysis methods. AHP transforms the decision-making problem of multi-objective which is difficult to be quantified into a multi-level single-objective problem and is suitable for the target system with hierarchical evaluation indexes (e.g., beautiful QTP construction system). The calculation of AHP is simple, and the results are also clear and easy for decision-makers to understand. The AHP can complete the weight distribution through a hierarchical structure model, a judgment matrix, an expert score, and other methods [67]. This mechanism is applied when performing "bottom-up integration" of 25 evaluation indicators into five subsystem-level indicators. The combined weight value of each index in the evaluation index layer is obtained by constructing the judgment matrix → hierarchical single ranking → hierarchical total ranking. The Yaahp10.1 software is used to obtain the weight of evaluation index layer (Table 2). The weight distribution of the indicators is achieved "from top to bottom", and the size of the weight represents the importance of each index. Accordingly, the weight distribution results of the evaluation index system for the construction of the beautiful QTP can be obtained (Table 2). According to the overall plan for promoting economic, political, cultural, social, and ecological civilization, the five subsystems of ecological environment, cultural inheritance, social harmony, industrial development, and institutional perfection are equally important, that is, the weights of five indicators at the subsystem level are set as 0.2.

Table 2. Index weights of the beautiful QTP construction evaluation.

Target Layer	Sub-System Layer	Weight	Evaluation Index Layer	Weight
Beautiful QTP construction	Ecological environment	0.2000	Park and plaza	0.0521
			Leisure places	0.0212
			Tourist attractions	0.1267
	Social harmony	0.2000	Transportation hubs	0.0832
			Medical services	0.0197
			Living services	0.0322
			Large shopping malls and supermarkets	0.0524
			Public toilets	0.0125
	Industrial development	0.2000	Companies	0.0240
			Factories	0.0240
			Road facility	0.0695
			Scientific research institutions and industrial parks	0.0130
			Agriculture, forestry, animal husbandry, and fishery base	0.0695
	Cultural heritage	0.2000	Sporting venues	0.0223
			School	0.0819
			Public cultural places	0.0401
			Literary and artistic landscapes	0.0401
			Religious cultural landscape	0.0078
			Media agencies	0.0078
	Institutional perfection	0.2000	Bank	0.0111
			Insurance companies	0.0111
			Social groups	0.0111
			Governmental institutions	0.0556
			Public security bureaus, procuratorates, and courts	0.0556
			Industrial and commercial tax agency	0.0556

2.5.3. Calculation of the Evaluation Index

After the data standardization, weight assignment, and integration of the evaluation index layer indexes to target layer indicators from the bottom to the top, each beauty evaluation index I_k and comprehensive evaluation index I are calculated with the following formula:

$$I = \sum_{i=1}^{n} W_i Z_{\mathrm{i}} \tag{2}$$

$$I_k = \sum W_i Z_i / \sum W_i \tag{3}$$

where W_i is the weight value of the ith (i = 1, 2, . . . , 25) evaluation index, Z_i represents the standard values of the occurrence times of POI per capita in this category, and k (k = 1, 2, 3, 4, 5) represents the indicator dimension of the subsystem layer. With the help of the visualization function of ArcGIS10.7 software, the natural discontinuous point rating method (Jenks) was adopted to divide the evaluation results of beautiful QTP construction into six levels, including the five subsystems evaluation results and the comprehensive evaluation results.

2.6. Coupling Model

In this paper, coupling is defined as the state of the interconnection between factors within the beautiful QTP construction system. The coupling degree and coupling coordination degree both can quantify the coupling relationships among the five subsystems of beautiful QTP construction. The coupling degree is an indicator of the strength of the influence among the five subsystems. Although the coupling degree can represent the mutual influence of the five subsystems, it is not a good measure of the coordinated development among the five subsystems. The coupling coordination degree is an indicator of the degree of benign coordination among the five subsystems and aims to quantitatively reflect whether the five subsystems are in a state of imbalance or coordination. If the five subsystems are in a state of incoordination, control measures could be timely taken to provide a theoretical basis for beautiful QTP construction. Although the coupling degree and coupling coordination degree are closely related in the calculation process, their conceptual connotations have different meanings. The degree of coupling reflects the degree of interaction among the five subsystems, and the coupling coordination degree reflects whether the whole system has a good level.

2.6.1. Calculation of the Coupling Degree

In this work, the model of capacity coupling in physics is applied to calculate the coupling degree among the five subsystems. The coupling degree function is shown below:

$$C_{\mathrm{n}} = \left[\prod_{\mathrm{i}=1}^{n} U_i \Big/ \left(\frac{\sum_{i=1}^{n} U_i}{n} \right)^n \right]^{\frac{1}{n}} \tag{4}$$

where C_n represents the degree of coupling; and U_i represents the comprehensive development score of a system, reflecting the subsystem's influence on the beautiful QTP construction evaluation.

Five subsystems are involved in the beautiful QTP construction evaluation. The coupling degree formula of the five subsystems can be obtained according to the coupling degree formula:

$$C_5 = \left[\frac{U_1 U_2 U_3 U_4 U_5}{\left(\frac{U_1+U_2+U_3+U_4+U_5}{5} \right)} \right]^{\frac{1}{5}} \tag{5}$$

where C_5 indicates the coupling degrees of the five subsystems; U_1, U_2, U_3, U_4, and U_5 are the comprehensive development scores of ecological environment, cultural heritage, social harmony, industrial development, and institutional perfection, respectively, that is,

the evaluation index of each corresponding subsystem I_k (Formula (3)). The larger coupling value indicates the better coupling action of the five systems. Based on the research results of other scholars [68], the stages of coupling degrees among the five subsystems within each county of the QTP are divided, and the specific criteria are shown in Table 3. The visualization of the coupling degree of the five subsystems is accomplished in the ArcGIS10.7 software.

Table 3. Criteria for the coupling stage of the five subsystems in the beautiful QTP construction evaluation.

Coupling Degree	Stage of the System
0.8–1.0	Coupling stage
0.6–0.8	Grinding-in stage
0.3–0.6	Antagonistic phase
0–0.3	Separation phase

2.6.2. Calculation of the Coupling Coordination Degree

The strength of the interaction between the systems can be reflected by the coupling degree. Meanwhile, the overall coordination of the system needs to be measured and assessed by the coupling coordination degree. The coupling coordination degree model used in this work is as follows:

$$D = \sqrt{C_5 T} \tag{6}$$

where D represents the degree of coupling coordination; T represents the development score of the overall system, that is, the comprehensive evaluation index I in this work (Formula (2)). Based on the research results of other scholars [69], the grades of coupling coordination degrees to each county of the QTP are divided, and the specific criteria are shown in Table 4. The visualization of the coupling coordination degree of the five subsystems is accomplished in the ArcGIS10.7 software, which is manufactured by Environmental Systems Research Institute.

Table 4. Criteria for the coupling coordination degree of the five subsystems in the beautiful QTP construction evaluation.

Coupling Coordination Degree	Coupling Coordination Grades	Coupling Coordination Degree	Coupling Coordination Grades
0.89–1.00	Excellent coordination	0.39–0.49	Adjutant to incoordination
0.79–0.89	Good coordination	0.29–0.39	Slight incoordination
0.69–0.79	Moderate coordination	0.19–0.29	Moderate incoordination
0.59–0.69	Primary coordination	0.09–0.19	Severe incoordination
0.49–0.59	Barely coordination	0.00–0.09	Extreme incoordination

2.7. Spatial Autocorrelation Analysis

Spatial autocorrelation is a mathematical representation of the spatial dependence that describes the correlation between a variable at a location in space and the same variable at its neighboring location [70,71]. The purpose of spatial autocorrelation analysis is to determine whether a variable is spatially correlated and to what extent. Moreover, spatial autocorrelation includes global and local spatial autocorrelation. Spatial autocorrelation coefficient is often used to quantitatively describe the spatial dependence of things. Moran's I index is adopted in this work. The global Moran's I index is used to assess whether the spatial element distribution is in an aggregated, a discrete, or a random pattern. This index can be calculated by using the spatial autocorrelation tool in the ArcGIS10.7 software. The local Moran's I index can be used to analyze the correlation between local elements and adjacent units, and the local indicators of spatial association (LISA) cluster map can be obtained through the clustering and outlier analysis tools in the ArcGIS10.7 software. The

LISA map can reflect the "high–high", "high–low", "low–high", and "low–low" aggregation in local areas and the insignificant situations. The global and local autocorrelation coefficients can be formulated as:

$$I = \frac{\left[n \sum_{i=1}^{n} \sum_{j-1}^{n} W_{ij}(y_i^m - y_m)(y_j^z - y_z) \right]}{(\sum_{i=1}^{n} \sum_{j-1}^{n} W_{ij} \sum_{i=1}^{n})(y_i^m - y_m)(y_j^z - y_z)} \quad (7)$$

$$I_{ij} = Q_i^m \sum_{j=1}^{n} (W_{ij} Q_j^z); Q_i^m = \frac{y_i^m - y_m}{\sigma_m}; Q_j^z = \frac{y_j^m - y_z}{\sigma_z} \quad (8)$$

where I represents the global spatial autocorrelation coefficient and a greater than zero, I index indicates a positive spatial autocorrelation, while a less than zero denotes a negative spatial autocorrelation. When I index tends to zero, it indicates no spatial autocorrelation (i.e., completely spatial random process); n represents the number of grid cells; W_{ij} represents the spatial weight; y_i^m and y_j^z represent the m and z attribute values of the i and j grid cells, respectively; y_m and y_z represent the average values of attributes m and z, respectively; I_{ij} represents the local spatial autocorrelation coefficient and the I_{ij} value was calculated by using the Geoda software to obtain the LISA map; σ_m and σ_z represent the variances of attributes m and z, respectively.

3. Results

The results of beautiful QTP construction evaluation are presented in four steps. Firstly, the level of five subsystems and their spatial distribution are analyzed, including ecological environmental, cultural heritage, social harmony, industrial development, and institutional perfection. Secondly, we analyze the comprehensive level of beautiful QTP construction from the perspective of statistical characteristics and spatial distribution. Thirdly, the coupling relationships of the five subsystems are analyzed by the coupling degree and coupling coordination degree. Lastly, the calculation values of global and local spatial autocorrelation were analyzed to identify the spatial aggregation patterns of beautiful QTP construction level and five subsystems' coupling relationships.

3.1. Subsystem Level of the Beautiful Qinghai–Tibet Plateau Construction

3.1.1. Ecological Environment

The total number of related POI in the ecological environment subsystem is 4276 (including 897 park squares, 720 leisure places, and 2662 tourist attractions) in the QTP. On average, there are three ecological environment POI points per 20,000 people, and each county has 20 POI points. The standard deviation of ecological environment index is 0.09. The mean value is 0.0676, the maximum value is 0.8683, and the variation coefficient is 133.20%. In 214 counties, the ecological environment indexes of 18 counties are higher than 0.15. The ecological environment indexes of Pulan County, Aksai Kazak Autonomous County, Haixi Mongolian and Tibetan Autonomous Prefecture, and Chengxi District are all higher than 0.3. The area with the highest ecological environment index is directly under the jurisdiction of the Haixi Mongolian and Tibetan Autonomous Prefecture. Approximately 75 areas have an ecological environment index lower than 0.03, and 63 areas have an evaluation index ranging from 0.03 to 0.06 (Figure 5A), which is due to the insufficient number of park squares, leisure places, and tourist attractions.

3.1.2. Cultural Heritage

The total number of related POI in the cultural heritage subsystem is 15,902 (including 1935 sports venues, 9036 schools, 937 public culture, 1238 literary and artistic landscapes, 1925 religious and cultural landscapes, and 831 media organizations). On average, there are six cultural heritage POI points per 10,000 people, and each county has 74 POI points.

The standard deviation of the QTP cultural heritage index is 0.0888. The mean value is 0.0743, the maximum value is 0.9566, and the variation coefficient is 119.45%. The cultural heritage indexes of 13 counties in the whole region are higher than 0.15. Meanwhile, the cultural heritage indexes of the five areas of Haixi Mongolian and Tibetan Autonomous Prefecture, Chengbei District, Chengdong District, Chengzhong District, and Chengxi District are higher than 0.3. Chengxi District has the highest ecological environment index. The cultural inheritance indexes of 39 regions are lower than 0.03, and the evaluation indexes of 71 regions are within the range of 0.03–0.06 (Figure 5B). This situation is due to the lack of sports venues, public culture, literature and art landscapes, religious and cultural landscapes, and media organizations.

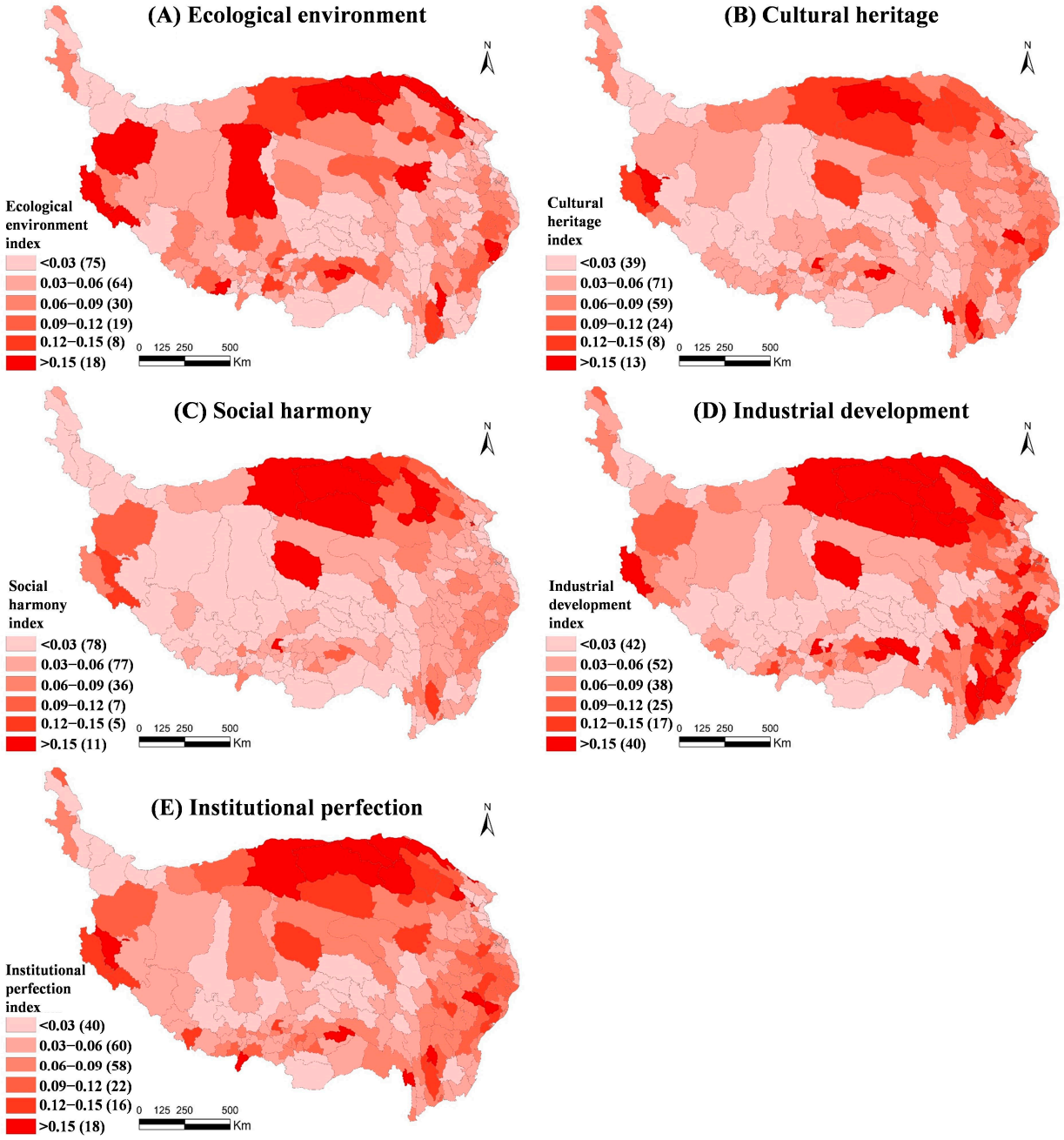

Figure 5. Spatial distribution of five subsystems level of the beautiful QTP construction, including (**A**) ecological environment, (**B**) cultural heritage, (**C**) social harmony, (**D**) industrial development, and (**E**) institutional perfection.

3.1.3. Social Harmony

The total number of related POI in the social harmony subsystem is 48,645 (including 913 transportation hubs, 15,841 medical services, 11,452 living services, 11,563 large shopping malls and supermarkets, and 8876 public toilets). On average, there are 18 cultural heritage POI points per 10,000 people, and each county has 227 POI points. The standard deviation of the QTP social harmony index is 0.0852. The mean value is 0.0573, the maximum value is 0.8591, and the variation coefficient is 148.66%. The social harmony index of 11 counties in the whole region is higher than 0.15. The social harmony indexes of Duilong Deqing District, Haixi Mongolian and Tibetan Autonomous Prefecture, Chengbei District, Chengdong District, Chengzhong District, and Chengxi District are higher than 0.3. The area with the highest social harmony index is directly under the direct jurisdiction of the Haixi Mongolian and Tibetan Autonomous Prefecture. Meanwhile, the social harmony index of 78 areas is lower than 0.03, and the evaluation index of 77 areas is within the range of 0.03–0.06 (Figure 5C), which is due to the lack of transportation hubs, large shopping malls, supermarkets, and public toilets.

3.1.4. Industrial Development

The total number of related POI in the industrial development subsystem is 88,318 (including 39,389 companies, 2135 factories, 42,590 road facilities, 2882 scientific research institutions and industrial parks, and 1322 agricultural, forestry, animal husbandry, and fishery bases). On average, there are 33 cultural heritage POI points per 10,000 people, and each county has 413 POI points. The standard deviation of the QTP industrial development index is 0.0939. The mean value is 0.0971, the maximum value is 0.61, and the variation coefficient is 96.71%. The industrial development index of 40 counties in the whole region is higher than 0.15. Specifically, the industrial development index of Daocheng County, Duilong Deqing District, Bayi District, Bomi County, Aksai Kazak Autonomous County, Gangcha County, Haixi Mongolian, and Tibetan Autonomous Prefecture, Chengbei District, Chengzhong District, and Chengxi District is higher than 0.3, and the area with the highest industrial development index is directly under the jurisdiction of the Haixi Mongolian and Tibetan Autonomous Prefecture. Meanwhile, the industrial development index of 42 areas is lower than 0.03, and the evaluation index of 52 areas is within the range of 0.03–0.06 (Figure 5D), which is caused by the lack of factories, scientific research institutions, industrial parks, and agricultural, forestry, animal husbandry, and fishery bases.

3.1.5. Institutional Perfection

The total number of related POI in the institutional perfection subsystem is 45,286 (including 4329 banks, 1404 insurance companies, 1910 social groups, 30,414 government agencies, 6217 public security agencies, and 1012 industrial and commercial tax agencies). On average, there are 17 cultural heritage POI points per 10,000 people, and each county has 212 POI points. The standard deviation of the QTP institutional perfection index is 0.0916. The mean value is 0.0816, the maximum value is 0.9469, and the variation coefficient is 112.32%. The institutional perfection index of 18 counties in the whole region is higher than 0.15. Specifically, the institutional perfection index of the four areas of Haiyan County, Haixi Mongolian and Tibetan Autonomous Prefecture, Chengzhong District, and Chengxi District is higher than 0.3. Chengxi District has the highest institutional perfection index. The institutional perfection index of 409 regions is lower than 0.03, and the evaluation index of 60 regions is within the range of 0.03–0.06 (Figure 5E). This phenomenon is due to the lack of banks, insurance companies, social groups, industrial, and commercial tax agencies.

3.2. Comprehensive Level of the Beautiful Qinghai–Tibet Plateau Construction

The standard deviation of the comprehensive evaluation index of the beautiful QTP is 0.0794, the average value is 0.0752, the highest value is 0.7382, and the coefficient of variation is 105.56%. In the whole region, the comprehensive evaluation index of 17 counties is higher than 0.15. The comprehensive evaluation index of the three cities directly under the jurisdiction of Haixi Mongolian and Tibetan Autonomous Prefecture, Chengzhong District, and Chengxi District are all higher than 0.3. Meanwhile, the area with the highest comprehensive evaluation index is directly under the direct jurisdiction of Haixi Mongolian and Tibetan Autonomous Prefecture. However, the comprehensive evaluation index of 43 areas is lower than 0.03, and the evaluation index of 68 areas is within the range of 0.03–0.06 (Figure 6). These areas have obvious deficiencies in ecological environment, cultural heritage, and social harmony.

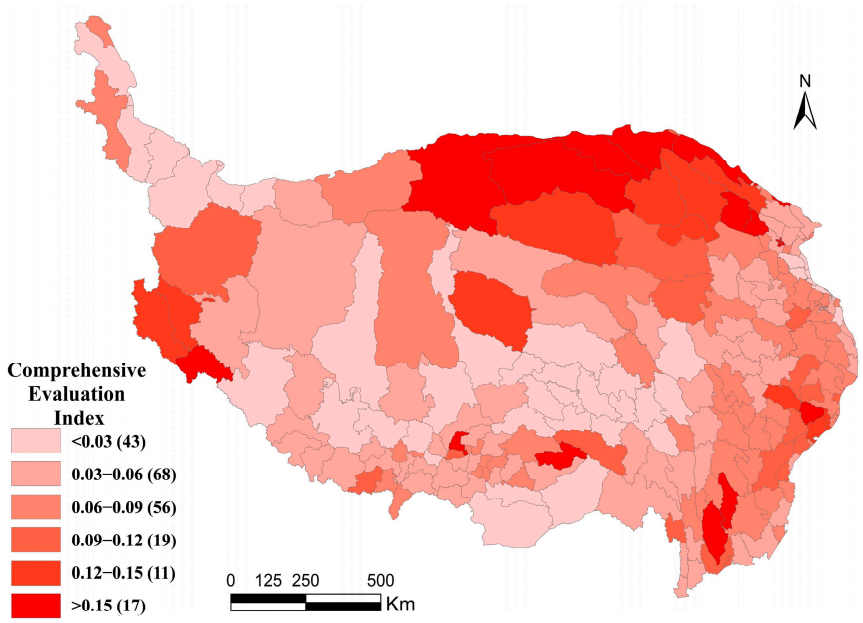

Figure 6. Spatial distribution of the beautiful QTP construction level.

3.3. Coupling Relationships of the Beautiful Qinghai–Tibet Plateau Construction System

The coupling degree of four counties in the QTP is less than 0.3. The regional coupling degree of two counties is located within the range of 0.3–0.6, and that of 24 counties is approximately 0.6–0.8. Meanwhile, the areas whose index is greater than 0.8 are as high as 184 (Figure 7). Specifically, Luolong, Medog, Cuona, and Longzi counties are in the separation stage, indicating that the interaction between the five subsystems is weak, without mutual influences and independent development. The subsystems of Muli Tibetan Autonomous County and Gongjue County are in an antagonistic stage during the construction of beautiful QTP: twenty-four counties, such as Luhuo, Xiangcheng, Fugong, Bianba, Zuogong, Dazi, Chayu, and Bomi, are in the grinding-in stage, indicating that the subsystems check and balance each other and continuously cooperate. The other 184 counties are in the coupling stage, where the degree of interaction is strong. The coupling degree can only reflect the strength of the interaction between the subsystems, but not the development level of the whole system, the efficacy, and the system coordination. These 184 counties have a high coupling degree, but this notion does not mean that these 184 areas are experiencing high and good development of Beautiful China construction. Five sub-systems are all backward in development and uncoordinated with each other. Nevertheless, a high coupling degree can be found in some counties.

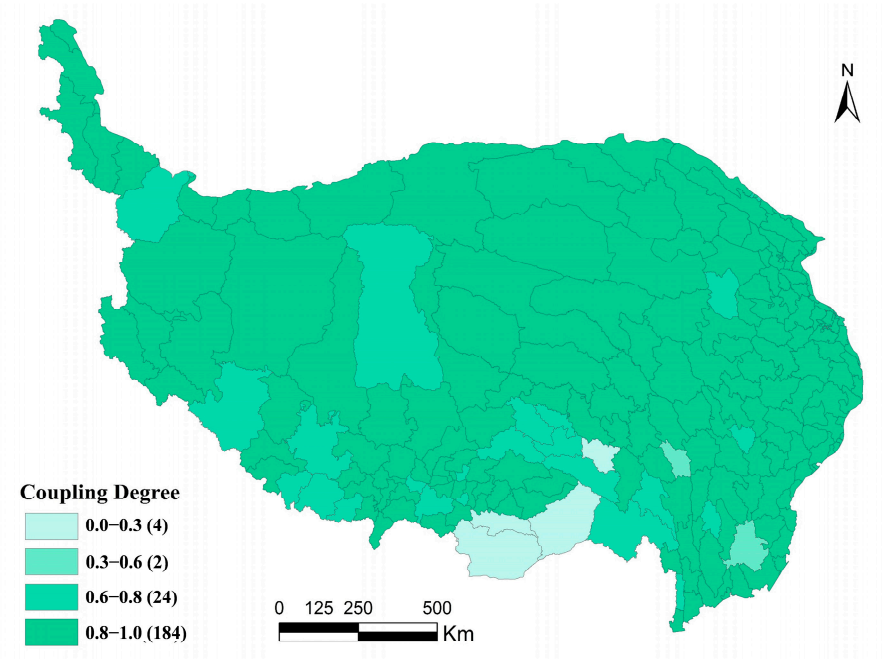

Figure 7. Spatial distribution of coupling degree of the beautiful QTP construction system.

In all the counties of the QTP, the average coupling coordination degree is 0.24, and most of them are concentrated below 0.39 (Figure 8). The values of six counties are less than 0.09. Specifically, the coupling coordination level of Luolong, Murdoch, Jiali, Shona, Lhunzi, and Mohu counties is extremely uncoordinated. The values of 64 counties are between 0.09 and 0.19, and their overall coupling coordination is seriously incoordinated. Meanwhile, the coupling coordination of 96 counties is within the interval of 0.19–0.29, and the overall coupling coordination is moderately incoordinated. The values of 35 counties are within the interval of 0.29–0.39, and the overall level of coupling coordination is slightly incoordinated. Although the coupling values among counties on the QTP are high, the overall coupling coordination is mostly concentrated in the stage of moderate incoordination and below. This notion indicates that the overall progress of the beautiful QTP construction is backward, and the development is extremely weak. Among the remaining counties, nine counties/districts, such as Shangri-La City, Dulongdeqing District, Bayi District, Aksai Kazakh Autonomous County, Subei Mongol Autonomous County, Sunan Yugur Autonomous County, Haiyan County, Chengdong District, and Ruoqiang County, are on the verge of incoordination concerning their coupling coordination. The stage of Chengbei District is barely coordinated, and Chengzhong District is primitively coordinated. Chengxi District experiences a moderate level of coupling coordination, while Haixi Mongolian–Tibetan Autonomous Prefecture under the direct administration shows good coordination.

According to the analysis of the evaluation index, coupling degree, and coupling coordination degree of 184 areas under the coupling stage, the coupling coordination of 52 areas is seriously uncoordinated. Meanwhile, the coupling coordination of 84 areas is moderately incoordinated. This phenomenon is due to the weak ecological environment, cultural heritage, social harmony, industrial development, and institutional perfection, and low construction level of the beautiful QTP. The slight incoordination of 35 areas concerning the coupling and coordination is due to the slow development of social harmony and the ecological environment. The development between the subsystems is not coordinated because the industrial development, cultural heritage, and institutional perfection development are slightly faster than the former. Nine areas whose coupling coordination is on the verge of incoordination are under the coupling stage because their evaluation indices are moderately low, even though the subsystems are coupled. Consequently, the overall development is at a low level. Only the Haixi Mongolian and Tibetan Autonomous

Prefecture are under the coupling stage and are well coordinated. The evaluation index of each subsystem is relatively high, the development is relatively coordinated, and the interaction effects are relatively high. Meanwhile, the development of Moyu County is extremely incoordinated, and the development situation is grim with the urgent need to promote the development of construction. The reluctant coordination in the Chengbei district, the primary coordination in the Chengzhong district, and the moderate coordination in the Chengxi district are coupled. The overall construction and development of the former two are at a low level, while the latter is at a medium level. The coupling coordination levels of those regions under the abrasion, antagonism, and separation stages are all incoordinated, or even seriously incoordinated mostly. The development among the subsystems is imbalanced, and the beautiful QTP is at an extremely low construction level.

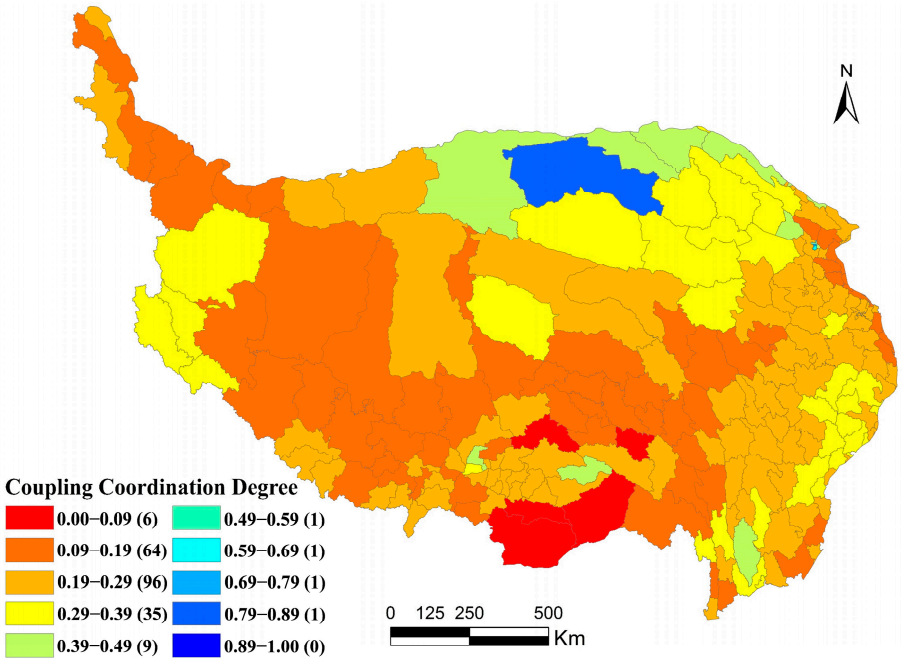

Figure 8. Spatial distribution of coupling coordination degree of the beautiful QTP construction system.

3.4. Spatial Autocorrelation of Comprehensive Index and Coupling Coordination Degree

3.4.1. Global Spatial Autocorrelation

The Moran's I value for the comprehensive index and coupling coordination of the beautiful QTP construction are greater than zero, showing positive spatial autocorrelation (Table 5). The same variables at neighboring locations indicate a high degree of similarity, showing a clustering effect. Moreover, the *p*-values of the composite index and the coupling coordination are small, with both Z scores greater than 2.58. Therefore, the observed aggregation patterns cannot be the result of a random process, or the probability of this clustering pattern produced randomly is less than 1%.

Table 5. Moran's I value for the comprehensive index and coupling coordination degree.

Value	Comprehensive Index	Coupling Coordination Degrees
Moran's I	0.371	0.458
Expected index	−0.005	−0.005
Variance	0.002	0.002
Z score	9.248	10.657
p-value	0.000	0.000

3.4.2. Local Spatial Autocorrelation

The "low–low" and "high–high" aggregations are the main aggregation patterns of the comprehensive index and coupling coordination of the beautiful QTP construction system, with obvious development differences in the study area.

The areas with a higher comprehensive level of beautiful QTP construction are mostly concentrated in the Haixi Mongolian and Tibetan Autonomous Prefecture, namely, Aksai Kazak Autonomous County, Delingha City, Chengbei District, Chengzhong District, Chengdong District, Chengxi District, Dulan County, Golmud City, Haixi Mongolian and Tibetan Autonomous Prefecture, Ruoqiang County, Suzhou District, and Tianjun County (Figure 9). The comprehensive index of such 13 counties (cities/districts) is "high–high". Angren County, Basu County, Baqing County, Ru County, Bianba County, Cele County, Cuomei County, Coqin County, Cuona County, Dingqing County, and Gongjue County, have a lower comprehensive index. Thirty counties (cities/districts) are regarded as "low–low" aggregation. Meanwhile, "high–low" aggregation in Ritu County and Sangzhuzi District and "low–high" aggregation in Huangzhong County also exist.

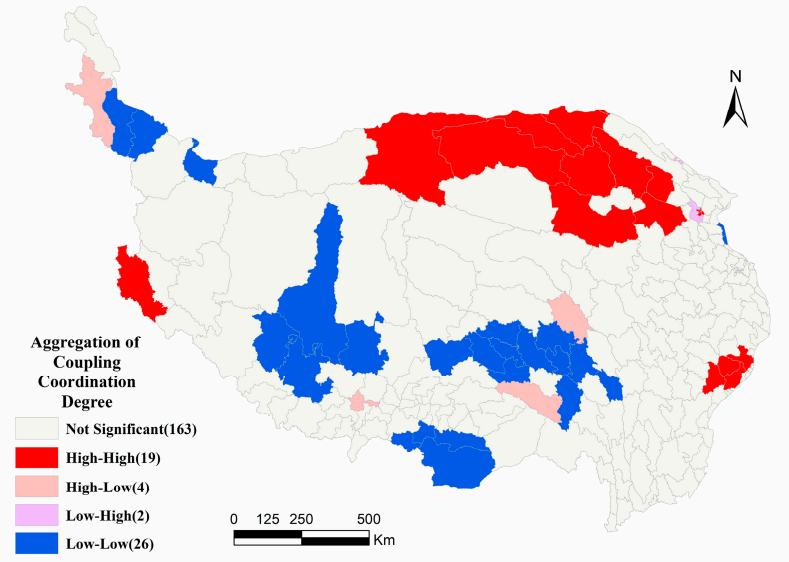

Figure 9. Aggregation pattern of the comprehensive level of the beautiful QTP construction system.

The areas with a higher coupling coordination degree of the beautiful QTP construction system are mostly concentrated in the Haixi Mongolian and Tibetan Autonomous Prefecture, southwestern Ali area, and other areas, including Aksai Kazak Autonomous County, Chengbei District, Chengdong District, Chengxi District, Chengzhong District, Delingha City, Dulan County, Gangcha County, Gonghe County West Mongolian and Tibetan Autonomous Prefecture Zhi, Li County, Mao County, Ruoqiang County, Subei Mongolian Autonomous County, Tianjun County, Wenchuan County, Xiaojin County, Yumen City, and Zanda County (Figure 10). The coupling coordination of such 19 counties (cities/district) is "high–high" aggregation. Those areas with lower coupling coordination are mostly concentrated in Kashgar, Nagqu City, Shigatse City, Shannan City, and other regions, including Karuo District, Leiwuqi County, Longzi County, Luopu County, Luopu County, and Luoyang County. Zha County, Minhe Hui, and Tu Autonomous County, Moyu County, Nagqu County, Nangqian County, Nima County, Pishan County, and Shenza County. The coupling coordination of such 26 counties (cities/district) is "low–low" agglomeration. "High–low" and "low–high" aggregation can be found in the coupling coordination degree. For example, Bomi county and Yushu city have "high–low agglomeration", and Huanzhong and Minle counties have "low–high" agglomeration.

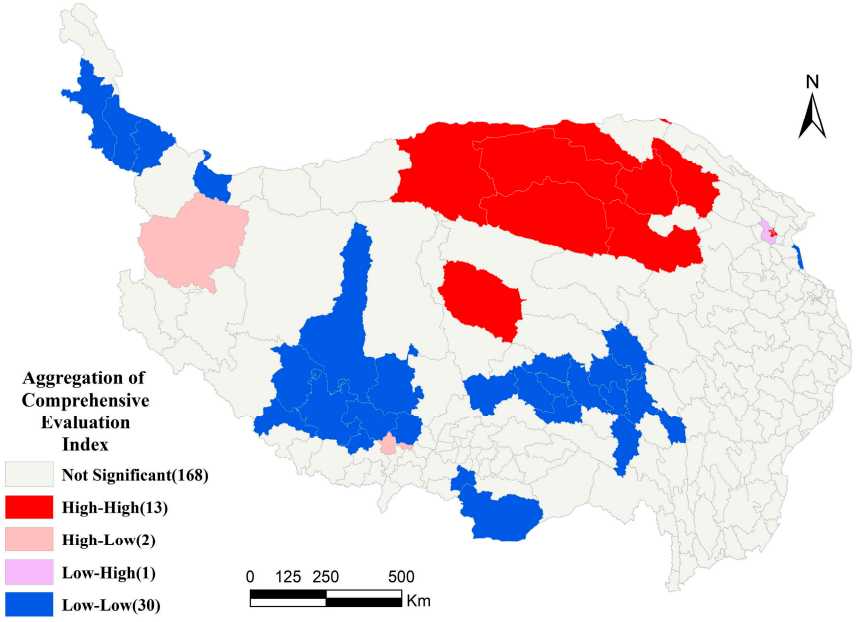

Figure 10. Aggregation pattern of the coupling coordination degree of the beautiful QTP construction system.

4. Discussion

4.1. Methodological Advantages and Concerns

Identifying the progress and system coupling relationships of Beautiful China construction was conducive to achieving region sustainability. The existing research focused more on the concept connotation [8–13] and evaluation systems [11,16,20,28–33] of Beautiful China. The interaction (i.e., coupling degree and coupling coordinate degree) of the subsystems failed to be identified from an integration perspective. Existing research mainly applied statistical data to quantify the level of Beautiful China construction [14,23,28–31]. However, the method is not suitable for the QTP because statistical data are scarce. The construction evaluation index system could come from various sources, such as remote sensing image data, statistical yearbooks, research reports, government bulletins, social statistics, and field actual measurement data. The POI data are social perception data and have low acquisition cost, fast update, and rich attributes. Thus, the POI data are used as the basis for this research. Our research sheds light on the progress and system coupling relationships of beautiful QTP construction by using AHP and coupling models on the county scale. The study had two major findings that could be important for further exploration of the Beautiful China construction in other areas as follows: (i) five subsystems division of Beautiful China construction was conducive to identifying system coupling relationships; (ii) the coupling coordination degree of five subsystems showed more revealing results than the coupling degree of five subsystems in the county scale.

Previously, the evaluation system of Beautiful China is mainly studied based on three dimensions, such as environment, society, and economy [28,32] or ecology, production, and living spaces [29,30], four dimensions, such as environment, society, culture, and economy [31], and five dimensions, such as environment, society, culture, economy, and institution [23]. Five dimensions are adopted in this work according to the sustainable development theory and a five-sphere integrated plan [13,23,72]. Five dimensions are comprehensive in all aspects of Beautiful China. The evaluation index system and coupling coordination model for the construction of the beautiful QTP based on the POI data are constructed to analyze the coupling coordination status of the five subsystems. The POI data are highly accurate in terms of assessment and can be implemented in various locations in different regions. The number of POI can be visually reflected in the study of the construction progress, which is more relevant to the research with relatively small

errors and high credibility. The POI data are highly real-time and quickly updated in assessment, which can effectively avoid mismatches between data time and study time. The research method combines the comprehensive index with the coupled coordination model, which can more comprehensively analyze not only the development progress of each subsystem in each county but also the overall coordination degree and construction level. The analysis results are more practical and closer to the public. Each POI is real and accessible for everyone, which can directly reflect the living, working, and learning statuses of the public.

Meanwhile, the evaluation scheme of the beautiful QTP construction based on POI still has certain defects and uncertainties due to the characteristics of the POI data itself. Specifically, the POI data only contain the corresponding information at a certain point of time and cannot reflect the dynamic changes over a period of time. POI is only an abstract description, indicating only the number and location information of features. Characteristics, such as size, texture, form, height, and mass, are ignored. The population is not taken into consideration in the POI data, which makes it easy to pose influences on a sparsely populated and vast region such as the QTP, resulting in findings that are inconsistent with reality. The per capita POI data can be selected as the study data according to the regional population characteristics. Establishing a scientific and accurate construction evaluation index system and assessment model to solve the existing problems and shortcomings is the focus of further research in the future.

The credibility of evaluation results of beautiful QTP construction should be compared and evaluated. Our results have shown that the average level of beautiful QTP construction is 0.0752, which is lower than that in Inner Mongolia Autonomous Region (0.22) [20], China (0.28) [11], Yangtze River Economic Belt (0.11) [29] and Jiangsu Province (0.44) [31]. In the spatial distribution, the comprehensive evaluation index of 111 counties is less than 0.06. Moreover, the comprehensive evaluation index of 68% of the counties is less than 0.09 in the QTP. These reflected there was an urgent need to raise the level of beautiful QTP construction. Moreover, given that the progress of the beautiful QTP is related to the level of economic development, the correlation analysis is performed between the assessment results and the GDP per capita to evaluate the rationality of the research results. Correlation analysis of the GDP per capita and the composite evaluation index is performed to make their scatter plots (Figure 11). The figure demonstrates that $R^2 = 0.3826$, indicating that the degree of the linear fitting is general, and the per capita GDP and the comprehensive evaluation index are positively correlated. $p < 0.01$ indicates that the correlation is significant. The scatter plot demonstrates that most of the points fall in the lower left corner (i.e., regions with low overall evaluation index and low GDP per capita). The two variables show a significant correlation and a strong relationship. Therefore, the comprehensive evaluation index calculated based on the POI data is closely related to the GDP per capita of each region. The POI data are reliable, and the research results are consistent with reality, and the operation is robust. The result also provides a certain reference value for the research in related research fields.

4.2. Policy Recommendations

The variation coefficients of ecological environment, cultural heritage, social harmony, industrial development, and institutional perfection are calculated as 130.90%, 119.45%, 148.66%, 96.71%, and 112.32%, respectively. The variation coefficient of comprehensive evaluation is 105.56%. All the variation coefficients are particularly huge, indicating that the development of QTP is lacking in all dimensions, and the development of the construction region is not balanced. Moreover, spatial clustering characteristics of beautiful QTP construction also showed the obvious spatial differences and regional imbalances. The variation coefficient of ecological environment and social harmony is the highest among the five systems, and the construction of the beautiful QTP is lagged in terms of ecological environment and social harmony. Therefore, the QTP should give full play to its own advantages. In terms of the ecological environment, the institutions and system of

ecological civilization should be established and improved, the ecological protection red line should be strictly adhered, environmental protection and restoration projects should be scientifically implemented, and ecological priority and green development should be emphasized. In terms of social harmony, the people-oriented concept should be given priority. The construction of public service facilities in areas with a low social harmony index should be strengthened, additional transportation hub stations, logistics express stations, and medical service areas should be set up, and the development of the public service industry should be vigorously promoted to promote social harmony.

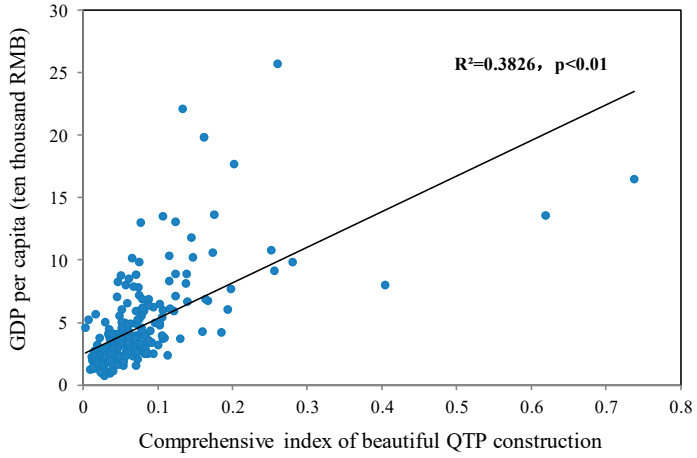

Figure 11. Scatterplot between comprehensive index of beautiful QTP construction and GDP per capita.

Moreover, our result showed the five subsystems of beautiful QTP construction of 184 counties have a high coupling degree, which conformed to the strong interaction among the five subsystems. However, the coupling coordination of 136 counties is incoordinated. Thus, the government should make the five subsystems of beautiful QTP construction more synergistic to achieve the sustainable development of the QTP. The relatively good industrial development can drive the economic development of the surrounding areas through industrial transfer, increased capital investment, and the flow of production factors, which can play a role in promoting the construction and development of other dimensions, thus promoting the synergistic development of counties on the QTP. Furthermore, the cooperation with the government should be strengthened, and a green economy, ecological economy, and circular economy should be vigorously developed to promote economic leapfrog development, drive the construction of public services, such as culture, education, entertainment, and medical care, and achieve a win–win situation for the environment, economy, society, and culture. In summary, the construction of ecological civilization must be strengthened to vigorously carry out the construction of the beautiful QTP. Ecological civilization should be fully implemented, and the construction of ecological civilization should be integrated into all aspects of the construction and development of the beautiful QTP to promote the coordinated development of each county on the QTP.

5. Conclusions

Since World War II, the worldwide perspective of development has undergone several major changes, from "growth theory" to "development theory" and then to "sustainable development" theory. This work constructs the evaluation index system of the beautiful QTP according to the sustainable development theory by combining five dimensions: ecological environment, cultural inheritance, social harmony, industrial development, and institutional perfection. Research on the beautiful evaluation index based on POI is conducted, and the coupling coordination analysis of the beautiful QTP construction subsystems is analyzed to explore the development status and progress of the beautiful QTP construction. The beautiful index, coupling degree, and coupling coordination degree

of the QTP in 2020 calculated based on the POI data are analyzed by using the coupling coordination model. Spatial autocorrelation analysis is also conducted. The following conclusions are drawn.

The progress of the beautiful QTP construction in most counties is at a very low or low level. Only Chengbei District and Haixi Mongolian and Tibetan Autonomous Prefecture are at a medium and high level, respectively.

From the perspective of coupling degree, 86% of counties are under the coupling stage. However, the coupling coordination degree of these countries is extremely weak even though they are coupled, and their development in terms of ecological environment, cultural heritage, social improvement, industrial development, and institutional improvement needs to be urgently promoted.

The comprehensive index and the coupling coordination degree of the beautiful QTP construction show positive spatial autocorrelation, indicating an aggregation effect. However, the aggregation patterns are mainly "low–low" and "high–high", indicating a huge difference within the study area and an uneven development.

Based on POI data, we identified the progress and system coupling relationships of beautiful QTP construction by the AHP method and coupling model. Our study formed a sample case of special areas where statistical data are scarce while constructing a technical framework of Beautiful China construction that is applicable to these areas. The findings of this study can serve as a reference for improving the beautiful QTP or other similar areas of construction.

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