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Dataset Development on Urbanization Multidimensional Coordination Index at County-level on the Qinghai-Xizang Plateau

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Abstract: The authors constructed a multidimensional coordinated index of urbanization at the county level of Qinghai-Xizang Plateau from 156 counties based on 4 dimensions: economy, society, resources, and environment. The dataset includes the following data on the Qinghai-Xizang Plateau in 2000, 2010 and 2020: (1) indicator data at county-level; (2) urbanization multidimensional coordination index data at county-level; (3) independent variable data on the mechanisms influencing the urbanization multidimensional coordination index at county-level; (4) changes in the average urbanization rate of counties in different regions; (5) changes in the sub-indices and comprehensive index of county-level urbanization coordination; (6) changes in the percentages of secondary and tertiary industries in counties; (7) regional comparison of the percentage of local general budget revenue to public fiscal expenditure in counties. The dataset is archived in .xlsx format, and consists of one file with data size of 125 KB.

Keywords: urbanization; multidimensional coordination index; county; Qinghai-Xizang Plateau

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Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2024.11.06.V1.

1 Introduction

As the “Third Pole” of the Earth and a critical ecological barrier, the Qinghai-Xizang Plateau is undergoing a rapid urbanization, which significantly impacts regional sustainable development and aligns closely with national and global development goals[1]. Considering its fragile ecosystem and sensitivity to human activities, promoting high-quality urbanization is a key strategy for safeguarding the ecological environment. Urbanization entails the complex interaction of various elements, including population, land, economy, and the environment[2].

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Therefore, scientifically guided urban planning is essential for achieving regional coordinated development and improving livelihoods.

The core of high-quality urbanization lies in the coordination and dynamic balance of various elements[3]. Population urbanization, as a key factor, must align moderately with economic development and industrialization[4]. Excessively rapid migration may lead to inadequate employment opportunities and social challenges, while overly restricted migration may cause labor shortages, hindering economic growth[5]. The provision of social services plays a crucial role in enhancing urbanization quality, as the development of high-level public services can effectively stimulate urbanization[6]. In terms of resources and the environment, high-quality urbanization requires the rational allocation of both population and resources, avoiding both excessive resource consumption and insufficient environmental protection, to achieve harmonious development between humans and nature[7].

The quality of urbanization is typically assessed through the construction of multidimensional indicators and composite indices[8]. However, this approach has limitations in revealing the interrelationships among different indicator dimensions. To overcome this, coupling coordination analysis is often employed to evaluate the synergy between urbanization and the ecological environment[9], and it has also been applied to areas such as industry and public services[10]. Studies show that the coupling coordination between urbanization and the ecological environment in Qinghai-Xizang Plateau has improved in Qinghai[11], but remains relatively low in Xizang[12]. The relationship between urbanization, socio-economic development, and resource utilization is dynamic[13]. For example, its role in promoting economic growth, its connection to the Environmental Kuznets Curve[14], and its interaction with efficient land resource utilization[7] all demonstrate this dynamic pattern.

In the distinctive geographical and social context of the Qinghai-Xizang Plateau, counties enjoy a high degree of autonomy, making them pivotal units for advancing high-quality regional urbanization[15,16]. This study examines the urbanization process in Qinghai-Xizang Plateau, analyzing the dynamic coordination between urbanization and multidimensional factors. Using counties as the primary units, key indicators from different dimensions are selected to construct a multidimensional urbanization coordination index. Furthermore, the study investigates potential factors influencing coordinated urbanization development, offering insights to guide the promotion of high-quality urbanization on the plateau.

2 Metadata of the Dataset

Table 1 summarizes the metadata of the Dataset on urbanization multidimensional coordination index at county-level of Qinghai-Xizang Plateau[17], with the dataset full and short names, authors, year, temporal and spatial resolution, data format, data size, data files, data publisher, and data sharing policy included.

3 Methods

3.1 Data Sources

This study adopts the boundary definition of the Qinghai-Xizang Plateau proposed by Zhang, *et al*.[19,20], and selects the region within China's national borders as delineated by the standard map from the Standard Map Service of the Ministry of Natural Resources (No. GS (2022) 4306) as the study region. The study focuses on the years 2000, 2010, and 2020, covering 156 county-level units. The data used in this research covers the following aspects:

Table 1 Metadata summary of the Dataset on urbanization multidimensional coordination index at county-level of Qinghai-Xizang Plateau

Items	Description
Dataset full name	Dataset on urbanization multidimensional coordination index at county-level of Qinghai-Xizang Plateau
Dataset short name	CountyUrbanCoord-QXP-2000-2020
Authors	Tian, Y, C., School of Government, Beijing Normal University, 202131240006@mail.bnu.edu.cn Tian, M., School of Government, Beijing Normal University, tianm@bnu.edu.cn Zeng, D., School of Government, Beijing Normal University, 202121240021@mail.bnu.edu.cn
Geographical region	Qinghai-Xizang Plateau, China
Year	2000, 2010, 2020
Temporal resolution	Year
Spatial resolution	County-level administrative unit
Data format	.xlsx
Data size	125 KB
Data files	Raw indicator data for county-level urbanization multidimensional coordination; County-level urbanization multidimensional coordination index data, and the overall sub-indices and comprehensive index for Qinghai-Xizang Plateau; Independent variable data for the influencing mechanisms of county-level urbanization multidimensional coordination; Changes in the average urbanization rate of counties in different regions, etc.
Foundations	Ministry of Science and Technology of P. R. China (2019QZKK0406); National Natural Science Foundation of China (42371197)
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China
Data sharing policy	(1) *Data* are openly available and can be free downloaded via the Internet; (2) End users are encouraged to use *Data* subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute *Data* subject to written permission from the GCdataPR Editorial Office and the issuance of a *Data* redistribution license; and (4) If *Data* are used to compile new datasets, the "ten percent principal" should be followed such that *Data* records utilized should not surpass 10% of the new dataset contents, while sources should be clearly noted in suitable places in the new dataset[18]
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS, GEOSS, PubScholar, CKRSC

(1) Total population and urban-rural population structure data, obtained from county-level national population census data[1].

(2) Socio-economic data, including GDP, industrial structure, and fiscal revenue and expenditure, sourced from the China County Statistical Yearbook[21], supplemented by statistical yearbooks from specific prefectures and municipalities.

(3) Land use, land cover, and elevation data. Built-up land area for each year was calculated using ESRI's 10-m resolution land use data for 2020[2] and Liu, Yanxu's (2024) 30-m resolution land cover data for the Qinghai-Xizang Plateau at three time points[3]. County-level annual NDVI values were calculated using the cumulative method based on Xu, Xinliang's (2018) monthly NDVI dataset for China[4]. Additionally, average county-level elevation was derived from the SRTM 90-m resolution DEM dataset[5].

3.2 Selection of Indicators

In this study, the level of urbanization is represented by the proportion of the urban population within the total resident population. The multidimensional urbanization coordination index is constructed based on the following indicators: per capita GDP to represent regional economic

[1] National Bureau of Statistics. China Population Census Yearbook. https://www.stats.gov.cn/sj/pcsj/.

[2] ESRI. Esri 10-meter land cover. https://www.arcgis.com.

[3] Liu, Y. X., Zhang, R. The TPCover30 products with 30 m spatial resolution of the Qinghai-Tibet Plateau (2000–2020). https://doi.org/10.11888/Terre.tpdc.300886.

[4] Xu, X. L. China monthly NDVI, EVI 250 m dataset. https://www.resdc.cn/DOI/DOI.aspx?DOIID=50.

[5] USGS. https://dds.cr.usgs.gov/srtm/version2_1/SRTM3/Eurasia/.

development, the number of hospital beds per 1,000 people to reflect the level of social public services, the scale of built-up land per 10,000 people to indicate land use intensity, and the average county-level NDVI value to represent ecological environment quality.

3.3 Construction of the Multidimensional Urbanization Coordination Index

(1) Construction of Sub-Indices. A random-effects model is used to estimate the relationship between urbanization level and the economic, social, resource, and environmental variables separately. This allows for the calculation of the expected values of each indicator for each county across different years (Equation 1), representing the ideal state at each time point. The actual values of each indicator are then divided by the expected values to compute the sub-indices for each category (Equation 2):

$$y_{ij,t} = \beta_0 + \beta_1 urban_{i,t} + \alpha_{it} + \varepsilon_{it} \tag{1}$$

$$Y_{ij,t} = yr_{ij,t} / y_{ij,t} \tag{2}$$

where t represents the time period (t_1=2000; t_2 = 2010; t_3=2020). $y_{ij,t}$, $yr_{ij,t}$, and $Y_{ij,t}$ denote the expected value, actual value, and coordination index for the j-th item in the i-th county at time t (where j=1, 2, 3, 4), respectively. $urban_{i,t}$ represents the urbanization rate of county i in period t (%), β_0 represents the constant term, β_1 is the coefficient of urbanization rate, α_{it} denotes the individual effect residual, ε_{it} is the common effect residual. The coordination index is standardized using the following equations.

For positive indicators:

$$Y'_{ij} = \left(Y_{ij} - Y_{ij\,min}\right) \Big/ \left(Y_{ij\,max} - Y_{ij\,min}\right) \tag{3}$$

For negative indicators:

$$Y'_{ij} = \left(Y_{ij\,max} - Y_{ij}\right) \Big/ \left(Y_{ij\,max} - Y_{ij\,min}\right) \tag{4}$$

where the value of j can be 1, 2, or 3, representing the coordination degree between urbanization and the economy, society, and environment, respectively, in the i-th county. In Equation 4, j equals 1, representing the coordination degree between urbanization and resources in the i-th county.

(2) Construction of the Comprehensive Coordination Index. The combined weight calculation for each sub-index of the coordination index is as follows:

$$W_j = \frac{\sqrt{\frac{1}{m-1}\sum_{i=1}^{m}\left(Y'_{ij} - \bar{Y}'_j\right)^2}}{\sum_{j=1}^{n}\sqrt{\frac{1}{m-1}\sum_{i=1}^{m}\left(Y'_{ij} - \bar{Y}'_j\right)^2}} \tag{5}$$

where m represents the number of samples, and n represents the number of indices, where n = 4. The weights for the urbanization-economy, society, resources, and environment coordination indices are 0.241,9, 0.265,1, 0.187,6, and 0.305,4, respectively.

$$F_{ij} = y'_{ij} \times W_j \tag{6}$$

The comprehensive coordination index for each county is calculated as follows:

$$L_{ij} = \sum_{j=1}^{n} F_{ij} \times y_{ij} \tag{7}$$

3.4 Selection of Independent Variable Indicators for Mechanism Analysis

Urbanization coordination is influenced by several factors, including geographic location, population distribution, economic development, and government capacity. This paper selects variables from these four aspects as follows: the average altitude of the county and the distance from each county to the provincial capital to represent geographic location; county population density and the rank of central towns to represent population and urbanization

levels; per capita GDP, the value added of the primary industry, the proportion of secondary and tertiary industry structures, and the number of large-scale industrial enterprises to represent the level of economic development; local fiscal general budget revenue and public fiscal expenditure to represent government capacity.

4 Data Results

4.1 Dataset Composition

The dataset is archived in .xlsx format and consists of the following data for the Qinghai-Xizang Plateau in 2000, 2010, and 2020:

(1) Indicator data at county-level; (2) Urbanization multidimensional coordination index data at county-level; (3) Independent variable data on the mechanisms influencing the urbanization multidimensional coordination index at county-level; (4) Changes in the average urbanization rate of counties in different regions; (5) Changes in the sub-indices and comprehensive index of county-level urbanization coordination; (6) Changes in the percentages of secondary and tertiary industries in counties; (7) Regional comparison of the percentage of local general budget revenue to public fiscal expenditure in counties.

4.2 Data Products

(1) Urbanization level. From 2000 to 2020, urbanization in the counties of the Qinghai-Xizang Plateau exhibited slow growth. The region's overall urbanization level increased from 15% in 2000 to 33% in 2020, with an average annual growth rate of approximately 1%. In terms of regional differences, urbanization levels in the Qinghai and Gannan regions rose from 18% and 12% in 2000 to 34% and 28% in 2010, and further to 48% and 44% in 2020, reflecting a relatively stable growth rate. In contrast, urbanization in Xizang, western Yunnan, and western Sichuan grew slowly in the first decade, but accelerated in the second. For example, the urbanization rates in western Sichuan and western Yunnan increased significantly from 21% and 22% in 2010 to 33% and 37% in 2020 (Figure 1).

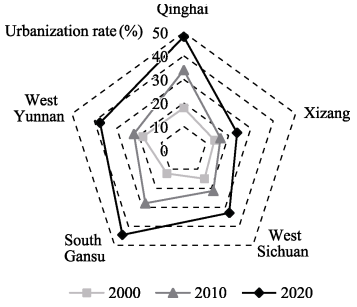

Figure 1 Urbanization rate changes in the counties of the Qinghai-Xizang Plateau

(2) Multidimensional urbanization coordination index. From 2000 to 2020, the urbanization coordination index of the Qinghai-Xizang Plateau exhibited notable variation (Figure 2). The overall coordination index increased from 0.43 in 2000 to 0.48 in 2020, showing steady growth. Specifically, the economic and social coordination indices demonstrated significant upward trends, with the coordination indices rising from 0.24 and 0.29 in 2000 to 0.39 and 0.44 in 2020, respectively. Economic coordination has been the lowest among all sub-indices, followed by social coordination and environmental coordination. Resource coordination has remained the highest, although it declined during the study period, particularly between 2010 and 2020. The environmental coordination index remained relatively stable and was the least variable among all indices.

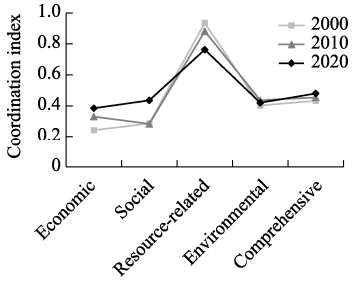

Figure 2 Urbanization coordination index changes of the counties on the Qinghai-Xizang Plateau

(3) Core indicators of the coordination mechanism. Industrial structure is a key economic factor influencing the coordination of urbanization. The industrial structure in the counties of the Qinghai-Xizang Plateau shifted from 48.16%, 19.03%, and 32.81% for the primary, secondary, and tertiary industries, respectively, in 2000, to 41.18%, 20.73%, and 38.09% in 2010, and further to 20.74%, 32.96%, and 46.3% in 2020. The percentage of the primary industry has steadily declined, the secondary industry experienced significant growth between 2010 and 2020, and the tertiary industry showed consistent growth (Figure 3). The industrial structure of the Qinghai-Xizang Plateau clearly reflects a shift toward service-oriented development, with the share of the tertiary industry surpassing that of the secondary industry. Currently, the Qinghai-Xizang Plateau remains in the early to mid-stage of industrialization, and increasing the proportion of the secondary industry will strengthen the overall coordination of industrialization and urbanization, providing a more solid economic foundation for urbanization in the region.

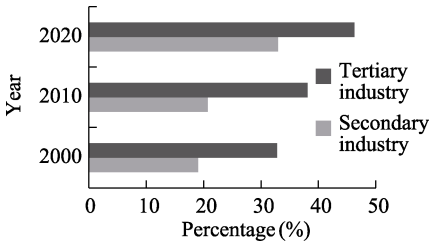

Figure 3 Changes of the percentage of Secondary and Tertiary Industries in the counties of Qinghai-Xizang Plateau

Government capacity is another key factor influencing urbanization coordination. As shown in Figure 4, the share of local fiscal revenue within public expenditure in the counties of the Qinghai-Xizang Plateau evolved from 2000 to 2020. Over this period, the proportion of local general budget revenue steadily declined, while the share of transfer payments from the central and provincial governments in public fiscal expenditure increased continuously, reaching nearly 90% by 2020. Although the impact of local fiscal revenue on urbanization coordination is constrained by its scale, increasing local fiscal revenue can significantly enhance the management and protection of the ecological environment, thereby promoting the coordinated development of urbanization and the environment.

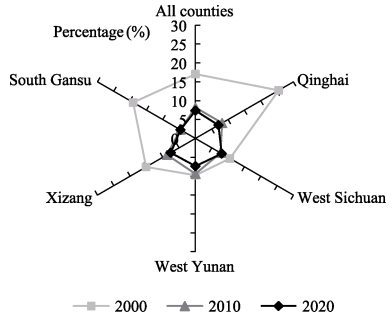

Figure 4 Percentage changes of local general budget revenue within public fiscal expenditure in counties of Qinghai-Xizang Plateau

5 Discussion and Conclusion

The high-quality development of urbanization is reflected in the coordination of various dimensions such as the economy, society, resources, and environment. Based on the analysis of the urbanization evolution characteristics in the counties of the Qinghai-Xizang Plateau, this study constructs a composite index to measure the multidimensional coordination index of urbanization. Specifically, the index includes the economic, social, resource, and environmental coordination, as well as the overall coordination of urbanization in the counties of the Qinghai-Xizang Plateau from 2000 to 2020. The study also explores the influencing factors and key variables driving multidimensional coordination at the county-level, providing insights into the evolution patterns and mechanisms of urbanization on the Qinghai-Xizang Plateau. This research offers valuable references for achieving high-quality urbanization development. However due to data availability constraints, this study uses straight-line distance to represent the impact of geographic distance on multidimensional coordination of urbanization. Should more accurate data become available, more precise time-distance variables should be incorporated. Additionally, the overall population and urban population scale of the counties on the Qinghai-Xizang Plateau are generally small, and when estimating the influencing mechanisms of multidimensional coordination, attention must be given to the potential errors caused by small sample sizes in

model estimation, to ensure the scientific reliability of the analysis results.

Author Contributions

Tian, M. was responsible for the overall design of the dataset, developing the models and algorithms, and performing data validation. Tian, Y. C. collected and processed the data and wrote the data paper.

Conflicts of Interest

The authors declare no conflicts of interest.

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