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# Spatiotemporal evolution of the coupling coordination between inheritance of local culture and new-style urbanization in China

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## Abstract

The rapid new-style urbanization process in China has had a significant impact on the inheritance and protection of local culture. This paper quantitatively analyzes the spatiotemporal difference regarding the coupling coordination between the inheritance of local culture and the new-style urbanization process in China. It is found that during the period between 1991 and 2017, the coexistence of inheritance of local culture and new-style urbanization in China has successively undergone three stages, and at present, the coupling coordination between these two processes is still at a relatively low level, featuring significant differences across various regions and a progressive decrease in the degree of coupling coordination from east to west in China. However, the economically underdeveloped regions, especially ethnic minority regions, are under far greater pressure in terms of coordinated coexistence of both the inheritance of local culture and new-style urbanization.

**Keywords:** Local culture, Cultural inheritance, New-style urbanization, Coupling, Coordination

## Introduction

Cultural heritage means the joint property that has been produced, used and accumulated in people's life from the past and is still in current use, which includes material cultural heritage and intangible cultural heritage. The material cultural heritage refers to the heritage that has been preserved with specific physical forms and can reflect culture related things, such as the Terracotta Army in China and the Pyramid in Egypt, which is visible and touchable. The intangible cultural heritage refers to the various social practices, concepts, mediums, knowledge, skills and related tools, material objects, handicrafts as well as cultural sites which are regarded as a part of the cultural heritage by different communities, groups and individuals, such as Beijing opera, Japanese sumo wrestling and so on. The local culture talked in this

paper not only includes material cultural heritage, but also includes intangible cultural heritage. The cultural heritage is the crystal of human beings and the important collection of human civilization. The local culture can show the thinking ways of the local. To inherit cultural heritage is not only to preserve the historical memory of human civilization, but also to preserve the common material and cultural foundation for sustainable development. What's more, the cultural inheritance is the basis of normal behaviors and mental disorder [1]. The world is a multi-cultural world where everything here is different, so as people. People growing up in different areas, environment, social habits and historical tradition will have completely different values, thoughts and habits, which can be explained by the law of diversified. The cultural diversity, that is, will help flourish and develop the nations and culture all around the world.

Under the global view, countries(areas) which better inherits the culture mainly includes China, Japan and South Korea. In terms of modern history, China, Japan and South Korea have similar development background,

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and have very similar culture. Confucianism and Taoism have influenced them a lot, therefore, we can compare them while talking about the cultural inheritance. In Japan, both the material cultural heritage such as Miyake and intangible cultural heritage such as food, Japanese tea and sumo are retained well [2–4]. In South Korea, both material cultural heritage such as Gyeongbok Palace and Changgyeong Palace and intangible cultural heritage such as Changwang Culture, Hot Spring Culture are also retained well in the urbanization development. Compared with them, in China, there are more abundant material cultural heritage and intangible cultural heritage, so Chinese culture is under a bigger inheritance pressure in the urbanization development.

While Chinese economy is on a rapid way, the urbanization development in rural China also develops rapidly. Because of the large-scale demolition and construction, many ancient buildings, old streets and aged trees are on the way disappearing. What's more, some traditional culture and art is also out of the spotlight. Hence, the original social structure, cultural relics, urban styles and local customs all fade away, which means that there is not historical context anymore. In the process of human civilization evolution, the chain of cultural inheritance can't be broken, or the characteristics of cities or nations will die away. The inheritance of local culture not only includes the protection of ecological environment, spatial environment, cultural environment and visual environment, but also includes the development of soft environment such as the social network structure in neighborhood, mental set, emotional attachment and so on, which is an effective method to achieve sustainable urban development and solve the comprehensive problems existed in urban development. Under this background, Chinese government has put forward the new-style urbanization policy. The new-style urbanization policy means that when the rural are transforming into the urban and the rural infrastructure is developing, we need to more focus on the development of population quality, the inheritance of traditional culture, the improvement of social relations and the promotion of ecological environment in order to achieve the sustainable development of human society. However, as the process of urbanization developing, the local culture represented by farming culture is fading away. Therefore, how to better achieve the coupling and coordinated development between the local culture and new-style urbanization is an important topic.

The local culture is the oldest and most fundamental form of culture as the result of the agricultural development, featuring the weak nature of the agricultural industry, plain and yet mellow nostalgia as well as affinity for the homeland. In recent years, however, the local culture represented by traditional farming culture has been

gradually fading out of the public attention, and it is crucial to preserve all forms of invaluable culture that retain the authenticity of localness and make people feel “a wisp of homesickness”.

At present, fruitful results have been achieved by the academic community in unilateral research and studies on the new-style urbanization and the inheritance of local culture, but there is a paucity of literature on the study of the coexistence of these two processes. The only literature available is mainly based on the case analysis of specific cultural symbols, Hu Xinggong found the inheritance and protection of “Liuzuo Wind-Blowing and Percussion Music in Nanjing City” [5], Ding Zhicai found “Incense Dragon Dance in Gangwayao Village in Nanning City” [6], and Yang Jiliang found “Renowned Historical Villages and Towns at Minjiang Estuary” under the impact of the new-style urbanization. Some scholars have also expanded their scope of studies to include the inheritance of ethnic minority culture, with a focus on specific regions and natural attributes. However, Qiao Guiping reveals that all such studies reflect one common issue: under the impact of new-style urbanization, the local culture in China is facing a variety of challenges, including discontinuation in cultural inheritance, cultural deficiency, and weakening of awareness [7]. Li Yanping points out that while the new-style urbanization process has injected vitality into the inheritance of local culture, it has also destroyed some of the stable attributes of their cultural forms [8]. Guan Ning holds that the key prerequisite for overcoming such obstacle is clarifying the connotations of cultural inheritance in the context of new-style urbanization [9]. Guan Ning argues that the inheritance of historical culture during the process of new-style urbanization should feature a three-pronged vision and reflect the dynamic integration of traditional and contemporary elements as well as the dynamic integration of man and nature. Liang Xinhua has proposed the establishment of five cultural dimensions from the perspective of cultural creativity [10]. Only a deeper and better understanding of the nature of such issue can help resolve the above issue more effectively.

Existing studies are all falling into the category of normative analysis, and their discussions of cultural protection and inheritance under the impact of new-style urbanization are merely based on perceptual knowledge but lack the quantitative research methodology. Some academics have also pointed out the importance of coordinated coexistence of urbanization and cultural inheritance and proposed a strategy for coordinated development [11], but their studies still fell into the category of theoretical analysis and failed to directly reflect the degree of coordination between these two processes. For the first time, this paper quantifies the progress of

new-style urbanization process and the inheritance of local culture as well as the degree of coupling coordination between these two processes from an empirical perspective and evaluates the status quo of the inheritance and protection of local culture more objectively in the context of rapid new-style urbanization.

### Research methodology and data sources

#### Research methodology

##### Coefficient of variation

Coefficient of variation is commonly used to determine the index weight. The calculation of the evaluation index through the coefficient of variation mainly involves the following three steps:

Step one: nondimensionalization. In consideration of the need for index weighting, as well as the variety of units of measurement for, and the large difference in values of various indexes, the range method is applied in this paper to nondimensionalize all the relevant data. The index matrix is expressed as  $X = (X_{ij})_{s \times n}$ , with  $\max_{1 \leq i \leq s} X_{ij}$  and  $\min_{1 \leq i \leq s} X_{ij}$  representing the maximum and minimum values of the index sequence  $j$ , and the positive index (a larger value indicates a better outcome) shall be standardized using the following formula:

$$x_{ij} = \frac{X_{ij} - \min_{1 \leq i \leq s} X_{ij}}{\max_{1 \leq i \leq s} X_{ij} - \min_{1 \leq i \leq s} X_{ij}} \quad (1 \leq i \leq s, 1 \leq j \leq n)$$

The reverse index (a smaller value indicates a better outcome) shall be standardized using the following formula:

$$x_{ij} = \frac{\max_{1 \leq i \leq s} X_{ij} - X_{ij}}{\max_{1 \leq i \leq s} X_{ij} - \min_{1 \leq i \leq s} X_{ij}} \quad (1 \leq i \leq s, 1 \leq j \leq n)$$

Step two: calculate the index weight. First, compute the coefficient of variation of the  $j$ -th index using the following formula:

$$V_j = \frac{\sigma_j}{\bar{X}_j}$$

where in  $\sigma_j$  and  $\bar{X}_j$  represent the standard deviation and average value of the index sequence  $j$  respectively. Then calculate the weight of the  $j$ -th index using the formula below:

$$W_j = \frac{V_j}{\sum_{j=1}^n V_j} \quad (1)$$

Step three: calculate the composite index  $F_i$  using the formula below:

$$F_i = \sum_{j=1}^n W_j \times x_{ij} \quad (2)$$

#### Coupling coordination degree model

(1) Theory of the coupling coordination degree model. The degree of coupling is originally a circuit-related concept in physics, indicating the degree of interdependence between two subsystems. Mu Jing, Tan Baihong & Ren Lishang regard that the higher the coupling degree is, the more closely connected the two subsystems are, and vice versa [12]. In this paper, the composite indices for the inheritance of local culture and the new-style urbanization in the  $i$ -th year are represented as  $X_i$  and  $Y_i$  respectively, and the coupling degree of these two indices is expressed as follows:

$$C_i = \frac{\sqrt{X_i \times Y_i}}{X_i + Y_i} \quad (1 \leq i \leq s) \quad (3)$$

The larger the value of  $C_i$  is, the closer connection between the inheritance of local culture and the new-style urbanization is, and the greater the interdependence between these two factors is. However, the degree of coupling can only reflect the static coordination between two or more subsystems, and the degree of coupling may appear to be “falsely” high, in which case the degree of coordination between the subsystems cannot be accurately reflected. Therefore, Wang Tianjiao believe it is necessary to establish a coupling coordination degree model based on the coupling degree model in order compute the value of  $D_i$ , i.e., the coupling coordination degree of the inheritance of local culture and the new-style urbanization process [13].  $D_i$  can reflect not only the static coordination between the inheritance of local culture and the new-style urbanization, but also the degree of dynamic coordination between these two processes. The specific formula for calculating  $C_i$  is expressed as follows:

$$D_i = \sqrt{C_i \times (\alpha * X_i + \beta * Y_i)} \quad (4)$$

What are shown in the above formula (4),  $\alpha$  and  $\beta$  represents the weights of the inheritance of local culture and new-style urbanization respectively. This study assumes that these two factors are of equal significance, each being assigned a weight of 0.5.

(2) Criteria for the categorization of coupling coordination degrees. Based on the specific criteria by Zhang Chunyan and other scholars for categorizing the coupling coordination degrees [14], the degrees of coupling coordination between the inheritance of local culture and the new-style urbanization in this paper are categorized into ten levels, as what is shown in Table 1, wherein the

**Table 1** Criteria for categorization of coupling coordination degrees

Range of coupling coordination degrees	Degree of coordination	Range of coupling coordination degrees	Degree of coordination
(0,0.1]	Extremely Imbalanced	(0.5,0.6]	Barely coordinated
(0.1,0.2]	Highly Imbalanced	(0.6,0.7]	Slightly coordinated
(0.2,0.3]	Moderately Imbalanced	(0.7,0.8]	Moderately coordinated
(0.3,0.4]	Slightly Imbalanced	(0.8,0.9]	Highly coordinated
(0.4,0.5]	Nearly Imbalanced	(0.9,1)	Extremely coordinated

coupling coordination degree being 0 means “completely imbalanced”, while such degree being 1 means “completely coordinated”.

#### Data sources

This paper features time series data of 27 year from 31 provinces (municipalities and regions) in mainland China from 1991 to 2017 for further analysis. In particular, the data on the evaluation indexes for inheritance of local culture comes from the *Statistical Yearbooks of Chinese Cultural Relics* of 1992–2017 and the *2018 Bulletin on Statistics of Cultural Development* of the Ministry of Culture of the People’s Republic of China, among which the data on the financial allocations to mass cultural institutions in 2017 is estimated based on the data of the past five years from 2012 to 2016, and the value of this index in 2017 is represented by the estimated value of 2017 approximated using the average growth rate from 2012 to 2016. The data on the evaluation indexes for new-style urbanization comes from the *China Statistical Yearbooks* of 1992–2018, among which the data on the area of urban green spaces from 1991 to 1994 is estimated based on the data of 1990 and 1995 respectively, with the data on such index for 1991–1994 being approximated using the average annual growth deducted from data of 1995 data minus that of 1990.

Furthermore, due to the large number of provinces and cities involved during the calculation of the coupling coordination degree to signify the spatial difference, as well as the apparent challenge in querying and collecting some related data, some indexes have either been replaced by others or not been included in this study, as illustrated later in the related table. The rest of the data comes from the *2018 China Statistical Yearbook*, the statistical yearbooks of various provinces, municipalities and regions, and the database on “Three Rural Issues” in the EPS China Statistics. The data of Japan and South Korea are from Japan Statistics Bureau (<https://www.stat.go.jp/>) and South Korea National Bureau of Statistics (<https://kostat.go.kr/portal/SouthKorea/index.action>) respectively. In this paper, the local culture inheritance is made up by 2 primary indexes and 13 secondary indexes,

while the new-style urbanization development is made up by 4 primary indexes and 15 secondary indexes. The data of 28 index in mainland China can be got from above channels and the statistics are consistent and effective. Although the data of 28 indexes in Japan and South Korea can also be found in official channels, the number of public cultural institutions is little different from the statistics in mainland China. The main reason of it is that the three countries have a different definition on “public cultural institutions”. Japan and South Korea have a wider definition on “public cultural institutions” than China. Through collecting the statistics from non-government organizations in Japan and South Korea and removing some of them, this paper ensures the maximum consistency of statistics. After preparing the data, this paper makes the unit root test for all the 28 secondary indexes, and all the result can pass the ADF test, which means these data can be measured with coupling and coupling coordination calculation.

## Analysis of results

### Establishment of evaluation index systems

#### Evaluation index system for inheritance of local culture

There are 13 indexes from two aspects in total—the basis and practice for the inheritance of local culture including the number of mass cultural institutions have been selected to establish the whole set of evaluation index system for the inheritance of local culture, wherein the basis for such cultural inheritance incorporates manpower, material resources and human resources, while the practice for such cultural inheritance mainly refers to the popularization of various forms of local culture and the cultivation of cultural inheritors among the public through various forms of activities organized by mass cultural institutions, Xue Ke et al. found it should including exhibitions, training courses and cultural performances (see Table 2 for specific indexes) [15].

#### Evaluation index system for new-style urbanization

There have been many sophisticated studies on the evaluation of urbanization or new-style urbanization. Nie Su et al. first categorized the standards of rural urbanization

**Table 2** Evaluation index system for inheritance of local culture and new-style urbanization

Level of objective	Primary index	Secondary index	Unit	Direction of index
Inheritance of local culture (X)	Basis for inheritance	Financial allocations to mass cultural institutions	CNY Ten Thousand	+
		Total expenditure of mass cultural institutions	CNY Ten Thousand	+
		Actual floor space of building for use	Ten Thousand m <sup>2</sup>	+
		Number of mass cultural institutions	One	+
		Number of employees in mass cultural institutions	Person	+
		Number of material cultural heritage and intangible cultural heritage	Sum	+
		Number of government cultural and tourism administration	One	+
	Practice of inheritance	Number of extreme climate and geological disasters	Times	-
		Number of exhibitions held by mass cultural institutions	One	+
		Number of cultural activities organized by mass cultural institutions	One	+
		Number of training courses organized by mass cultural institutions	One	+
		Number of cultural heritage restoration	Piece	+
		Number of protection policies issued by the government	Sum	+
New-style urbanization (Y)	Population urbanization	Urbanization rate of resident population	%	+
		Urbanization rate of household registered population	%	+
		Per capita years of education	Year	+
	Economic urbanization	Per capita net income of farmers	CNY	+
		Per capita disposable income of urban residents	CNY	+
		Proportion of output value of primary industry	%	-
		Engel's coefficient for urban residents	%	-
		Engel's coefficient for rural residents	%	-
	Social urbanization	Number of beds in medical and health institutions	Ten Thousand	+
		Number of participants of basic pension insurance Program at the end of the year	Ten Thousand Persons	+
		Average number of students in higher education per 100,000 population	Person	+
		Registered urban unemployment rate	%	-
	Eco-friendly urbanization	PM2.5 index	µg/m <sup>3</sup>	-
		Area of urban green spaces	Ten Thousand ha	+
		Forest coverage	%	+

The direction symbols "+" and "-" indicate that the index is either a positive or a negative index respectively

and proposed a preliminary concept of an evaluation system for urbanization from four aspects—population structure, economic development, development of small towns and quality of life in small towns. Immediately afterwards [16], Cui XG et al. [17], focused on the connotation of (new-style) urbanization and incorporated multiple indexes to establish an evaluation system for (new-style) urbanization from the perspectives of population growth, economic development, environmental protection, lifestyle, and social civility [18]. Based on the existing study results of Zhong Lina et al. [19], this paper features a selection of 15 secondary indexes

from four aspects—population urbanization, economic urbanization, social urbanization, and eco-friendly urbanization (see Table 2 for specific indexes) to further establish an evaluation index system for China's new-style urbanization.

**Explanation of evaluating index system**

In this paper, the inheritance of local culture is made up by 2 primary indexes and 13 secondary indexes, while the new-style urbanization development is made up by 4 primary indexes and 15 secondary indexes. All the 28



secondary indexes have passed the ADF test. Here is an explanation of following indexes.

(1) 8 secondary indexes including financial allocations to mass cultural institutions, total expenditure of mass cultural institutions, actual floor space of building for use, number of mass cultural institutions, number of employees in mass cultural institutions, number of material cultural heritage and intangible cultural heritage, number of government cultural and tourism administration and number of extreme climate and geological disasters will directly influence the basis for inheritance, in which only the “number of extreme climate and geological disasters” is negatively correlated with the “basis for inheritance”, while the other 7 secondary indexes are positively correlated with the index “basis for inheritance”.

(2) The 5 secondary indexes including number of exhibitions held by mass cultural institutions, number of cultural activities organized by mass cultural institutions, number of training courses organized by mass cultural institutions, number of cultural heritage restoration and number of protection policies issued by the government are directly correlated with the first-level index “practice of inheritance” and are positively correlated with it.

(3) The 3 secondary indexes including Urbanization rate of resident population, per capita years of education and per capita net income of farmers are directly correlated with the primary index “Population Urbanization” and are positively correlated with it.

(4) The 4 secondary indexes including per capita disposable income of urban residents, proportion of output value of primary industry, Engel’s coefficient for urban residents, and Engel’s coefficient for rural residents are directly correlated with the primary index “economic urbanization”, in which the per capita disposable income of urban residents is positively correlated with the it, while the proportion of output value of primary industry, Engel’s coefficient for urban residents and Engel’s coefficient for rural residents are negatively correlated with it.

(5) The 4 secondary indexes including number of beds in medical and health institutions, number of participants of basic pension insurance program at the end of the year, average number of students in higher education per 100,000 population and registered urban unemployment rate are directly correlated with the primary “social urbanization”, in which the registered urban unemployment rate is negatively correlated with it, while the other 3 are positively correlated with it.

(6) The 3 secondary indexes including PM2.5 index, area of urban green spaces and forest coverage are directly correlated with the primary index “eco-friendly urbanization”, in which the PM2.5 index is negatively correlated with it, while the area of urban green spaces and forest coverage are positively correlated with it.

(7) The “financial allocations to mass cultural institutions” refers to that the central finance allocates money based on the resource situation of local culture in different places, therefore, the local economy doesn’t matter the amount a lot, and the index is independent. This money will be mainly used to protect the local cultural heritage. 8. The cultural institutions mainly include the institutions which are engaging in art, library, archives, mass culture, cultural relics protection, art education, art study, culture and entertainment, press and publication and other activities.

### **Temporal evolution of the coupling coordination between inheritance of local culture and new-style urbanization**

As shown in Table 3, the co-existence of the inheritance of local culture and the new-style urbanization have gone through three different stages, i.e., the stages of imbalance, transition, and coordination.

The period of imbalance (1991–2003). In the early 1990s, there was a highly imbalanced coexistence between the inheritance of the local culture and the new-style urbanization process. At this time, the index of inheritance of local culture and the index of new-style urbanization were either less than or close to 0.3, and the coupling coordination degree was only 0.4, signaling a low level of coordination between the two processes which were otherwise relatively isolated from each other. Later, there was a continuing increase in the degree of imbalance between these two processes, which lasted for 5 years and resulted in a moderate-degree imbalance between the two processes. Compared with 1991, the index of inheritance of local culture declined in 1992 and 1993, and the degree of coupling also decreased slightly. On the other hand, there was a continuing slow increase in the coupling coordination degree, as well as a transition of coupling coordination degree from “moderately coordinated” to “slightly coordinated”. The year 1996 saw a significant surge in the index of inheritance of local culture, as well as a slightly coordinated coexistence of the two processes, which further lasted for 8 years. During this period, the index of inheritance of local culture only changed by 0.0496 units, signifying slow development in contrast to a relatively rapid acceleration of new-style urbanization process.

The period of transition (2004–2013). The coexistence between these two factors in this period features a combination of both imbalance and coordination. This transition period lasted for up to 10 years, of which 6 years saw “nearly imbalanced” coexistence while the remaining 4 years saw “barely coordinated” coexistence. A transition of the coexistence between the inheritance of local culture and the new-style urbanization from imbalance

**Table 3** Degree of coupling coordination between inheritance of local culture and new-style urbanization

Year	Index of inheritance of local culture	Index of new-style urbanization	Degree of coupling	Degree of coupling coordination	Type of coupling coordination
1991	0.0657	0.1042	0.4870	0.2034	Moderately imbalanced
1992	0.0613	0.1022	0.4841	0.1989	Moderately imbalanced
1993	0.0608	0.1108	0.4783	0.2026	Moderately imbalanced
1994	0.0723	0.1664	0.4595	0.2342	Moderately imbalanced
1995	0.0857	0.1731	0.4706	0.2468	Moderately imbalanced
1996	0.2652	0.1821	0.4913	0.3315	Slightly imbalanced
1997	0.2772	0.1803	0.4887	0.3343	Slightly imbalanced
1998	0.2822	0.2159	0.4956	0.3513	Slightly imbalanced
1999	0.2874	0.2432	0.4983	0.3636	Slightly imbalanced
2000	0.2893	0.2761	0.4999	0.3759	Slightly imbalanced
2001	0.2834	0.2813	0.5000	0.3757	Slightly imbalanced
2002	0.2881	0.2982	0.4999	0.3828	Slightly imbalanced
2003	0.3121	0.3211	0.4999	0.3978	Slightly imbalanced
2004	0.3367	0.3342	0.5000	0.4095	Nearly imbalanced
2005	0.3513	0.3712	0.4998	0.4249	Nearly imbalanced
2006	0.3767	0.4103	0.4995	0.4434	Nearly imbalanced
2007	0.3851	0.4511	0.4984	0.4565	Nearly imbalanced
2008	0.4203	0.4834	0.4988	0.4747	Nearly imbalanced
2009	0.4723	0.5421	0.4988	0.5030	Nearly imbalanced
2010	0.5209	0.5904	0.4990	0.5266	Barely coordinated
2011	0.5809	0.6321	0.4996	0.5504	Barely coordinated
2012	0.6311	0.6676	0.4998	0.5697	Barely coordinated
2013	0.691	0.7154	0.4999	0.5929	Barely coordinated
2014	0.7551	0.7582	0.5000	0.6151	Slightly coordinated
2015	0.8132	0.8113	0.5000	0.6373	Slightly coordinated
2016	0.8901	0.8711	0.5000	0.6635	Slightly coordinated
2017	0.9423	0.9325	0.5000	0.6846	Slightly coordinated

to coordination was underway, with the coupling coordination degree being between 0.4–0.6, further signifying a remarkable turning point for the coexistence between the inheritance of local culture and the new-style urbanization. The year 2010 also saw a beginning of a period of “barely coordinated” coexistence between these two processes. During this time, the coupling coordination degree began to be gradually exceeded the degree of coupling with a relatively higher growth rate, and the coordinated coexistence of inheritance of local culture and new-style urbanization managed to move onto the fast track. The period of “barely coordinated” coexistence lasted for only 4 years, a decrease of 4 years and 2 years compared with the periods of “slightly imbalanced” and “nearly imbalanced” coexistence respectively.

The period of coordination (2014–present). This period saw a “slightly coordinated” coexistence between the inheritance of local culture and the new-style urbanization process. In 2014, the indices of inheritance of local culture and new-style urbanization were relatively large,

reaching 0.7551 and 0.7582 respectively. By 2017, the coupling coordination degree reached 0.6846, close to 0.7, signifying an incoming stage of “moderately coordinated” coexistence and sound momentum for further development. However, since 1999, and especially since the beginning of the transition period, the coupling degree between the two processes has remained at approximately 0.50, while the degree of coupling between the two processes has always been in a somewhat antagonistic state, signaling weak coupling effect. The advancement of coupling coordination mainly stems from the acceleration of the relatively isolated development of these two processes. This further hinders the improvement of the coupling coordination between the inheritance of local culture and the new-style urbanization process, is not conducive to the inheritance and protection of the local culture in the context of new-style urbanization and the improvement of the intrinsic quality of new-style urbanization, and thus further exacerbating the discontinuation in the inheritance of local culture.

### **Spatial characteristics of the coupling coordination between inheritance of local culture and new-style urbanization**

Due to the inevitable differences in levels of regional economic development, natural conditions and cultural heritage, there are spatial differences in the coupling coordination between the inheritance of local culture and the new-style urbanization process. Because there are provincial data lacking in some years, this paper chooses the related data from 31 Chinese provinces (cities and districts) of 2017 and made heteroscedasticity significance suggestion on them. All the result can pass the test.

This paper analyzes the spatial differences in the degree of coupling coordination between the inheritance of local culture and the new-style urbanization based on the data of 31 provinces (municipalities and regions) in mainland China in total in 2017 (considering the challenges in more accurate data acquisition, Hong Kong, Macao and Taiwan are excluded from the analysis in this study) which were obtained using the ArcGIS.

In terms of index choosing, because some indexes are lacking, this paper properly adjust the data built in 2.1, in which 14 indexes in local culture heritage are selected including financial allocations to mass cultural institutions, total expenditure of mass cultural institutions, total revenue of mass cultural institutions, actual floor space of building for use, number of mass cultural institutions, number of employees in mass cultural institutions, number of material cultural heritage and intangible cultural heritage, number of government cultural and tourism administration, number of extreme climate and geological disasters, number of exhibitions held by mass cultural institutions, number of cultural activities organized by mass cultural institutions, number of training courses organized by mass cultural institutions, number of cultural heritage restoration and number of inheritance and number of protection policies issued by the government. 15 indexes in new-style urbanization are selected including urbanization rate of resident population, urbanization rate of household registered population, per capita years of education, per capita net income of farmers, per capita disposable income of urban residents, proportion of output value of primary industry, Engel's coefficient for urban residents, Engel's coefficient for rural residents, number of beds in medical and health institutions, number of participants of basic pension insurance program at the end of the year, average number of students in higher education per 100,000 population, registered urban unemployment rate, PM2.5 index, area of urban green spaces and forest coverage. The values of various indices, including the index of inheritance of local culture, index of new-style urbanization, degree of coupling and degree of coupling coordination (see Table 4), are all calculated

based on the method of coefficient of variation and the coupling coordination degree model, further signifying the obvious differences across various regions.

### ***Spatial difference in the index of the inheritance of local culture***

The index of inheritance of local culture in China reflects the considerable differences in cultural inheritance and development among various regions. The indices of inheritance of local culture for coastal regions in eastern and southeastern China are relatively higher due to their obvious regional advantages in economic development, remaining mostly at above 0.5. Through calculating the data in 31 provinces (cities and districts), it is found that the difference of cultural inheritance index is relatively huge. The index for Zhejiang being is the highest that is 0.7911, and the index for Hainan is the lowest that 0.0687. The major reason for such significant difference is that there is a huge gap between these two provinces regarding the financial input and output of mass cultural institutions, resulting in a significant difference in the inheritance of the local culture between the two regions. The financial allocations to mass cultural institutions and total income of mass cultural institutions in Zhejiang province in 2017 totaled CNY 8.405 billion and CNY 2.316 billion respectively, 4.37 times and 18.35 times those of Hainan province in the same year in respective terms, whereas the values of these two indexes for Hainan province in the same year only reached CNY 1.925 billion and CNY 180 million respectively. In addition, there is a significant difference in the numbers of exhibitions held by mass cultural institutions, of cultural activities organized by mass cultural institutions, and of training courses organized by mass cultural institutions between the two provinces, with the values of these three indexes for Zhejiang being 29.5 times, 30.42 times and 34.44 times those for Hainan.

In addition, the distribution of indices of inheritance of the local culture for various provinces (municipalities and regions) in China generally follows the typical pattern of economic development in China. Since the eastern China is better economically developed than the central China, and the central China is likewise better economically developed than the western China, there is a gradual decrease in the index of inheritance of the local culture from east to west, and the provinces with the highest index values are Zhejiang, Guangdong, Sichuan, Jiangsu and Shandong in a descending order. There are two major reasons for such high index values for these five provinces: first, the Wuyue culture of Zhejiang and Jiangsu, the Lingnan culture of Guangdong, the Bashu culture of Sichuan, and the Qilu culture of Shandong which is blended with traditional



**Table 4** Degree of Coupling Coordination Between Inheritance of Local Culture and New-Style Urbanization Regarding 31 Provinces, Municipalities and Regions of China in 2017

Province (Municipality and Region)	Index of inheritance of local culture	Index of new-style urbanization	Degree of coupling	Degree of coupling coordination	Type of coupling coordination
Beijing	0.3152	0.6675	0.4668	0.4789	Nearly imbalanced
Tianjin	0.1165	0.3764	0.4248	0.3236	Slightly imbalanced
Hebei	0.3565	0.3178	0.4992	0.4102	Near imbalance
Shanxi	0.262	0.2612	0.5000	0.3617	Low-degree imbalance
Inner Mongolia	0.2312	0.2711	0.4984	0.3538	Low-degree imbalance
Liaoning	0.2931	0.3723	0.4964	0.4064	Near imbalance
Jilin	0.1798	0.2743	0.4891	0.3332	Near imbalance
Heilongjiang	0.2538	0.2474	0.5000	0.3540	Low-degree imbalance
Shanghai	0.4733	0.5612	0.4982	0.5076	Marginal coordination
Jiangsu	0.6102	0.5717	0.4997	0.5434	Marginal coordination
Zhejiang	0.7911	0.6134	0.4960	0.5902	Marginal coordination
Anhui	0.3433	0.3223	0.4998	0.4078	Near imbalance
Fujian	0.2715	0.381	0.4929	0.4010	Low-degree imbalance
Jiangxi	0.2843	0.3532	0.4971	0.3980	Low-degree imbalance
Shandong	0.6172	0.4774	0.4959	0.5210	Marginal coordination
Henan	0.4978	0.3765	0.4952	0.4653	Near imbalance
Hubei	0.3614	0.3912	0.4996	0.4336	Near imbalance
Hunan	0.3922	0.3572	0.4995	0.4326	Near imbalance
Guangdong	0.7824	0.6618	0.4983	0.5998	Marginal coordination
Guangxi	0.2336	0.3421	0.4910	0.3760	Low-degree imbalance
Hainan	0.0687	0.2423	0.4149	0.2540	Moderate-degree imbalance
Chongqing	0.3102	0.3167	0.5000	0.3959	Low-degree imbalance
Sichuan	0.7154	0.3485	0.4693	0.4997	Near imbalance
Guizhou	0.2562	0.2365	0.4996	0.3508	Low-degree imbalance
Yunnan	0.3204	0.2532	0.4966	0.3774	Low-degree imbalance
Tibet	0.1374	0.1353	0.5000	0.2611	Moderate-degree imbalance
Shaanxi	0.3474	0.3356	0.4999	0.4132	Near imbalance
Gansu	0.2551	0.1885	0.4943	0.3311	Low-degree imbalance
Qinghai	0.0731	0.1462	0.4714	0.2274	Moderate-degree imbalance
Ningxia	0.0754	0.1784	0.4570	0.2408	Moderate-degree imbalance
Xinjiang	0.3186	0.2254	0.4926	0.3660	Low-degree imbalance

Confucianism, are all deemed typical paradigms of folk culture, and profound cultural heritage in these regions has undoubtedly laid the foundation for better practice of inheritance of the local culture; second, sufficient financial resources, material resources, and manpower have further heightened practicality of the inheritance of the local culture. The total sum of the financial allocations to, the total actual floor space of building used by, and the total number of employees in the mass cultural institutions in these five provinces in 2017 totaled CNY 37.609 billion, 17.1196 million square meters and 46,476 in respective terms, up to 29.37, 41.69 and 25.69% of the national total respectively.

There are 11 provinces in total, which are mainly located in the west, north and northeast China, with an index of inheritance of the local culture of less than 0.255. They are located on the periphery of China's territory, mostly populated with ethnic minorities and relatively economically underdeveloped. All these 11 provinces except Tianjin, a municipality directly under the control of Central Government with no population of ethnic minorities, are somewhat populated with ethnic minorities, among which Inner Mongolia, Tibet, Guangxi, and Ningxia are among the six provinces (autonomous regions) with the largest minority populations in China. The total sum of financial allocations to the mass cultural

institutions in these 11 provinces (municipalities and regions) combined, which account for 35% of the 31 provinces (municipalities and regions) in China, only accounted for 18.54% of the national total, and the total number of cultural activities organized by mass cultural institutions in these provinces accounted for less than 15% of the national total. Meanwhile, their total annual GDP only totaled CNY 11.69 trillion, up to 14.24% of the national total, or even as low as 11.98% when excluding Tianjin from their total sum. Therefore, the local culture is not only impacted by modern culture, but also affected by other factors such as the conflict between the ethnic minority culture and the Han Chinese culture, which have further impeded the inheritance of the local culture and resulted in significant regional differences.

#### ***Spatial differences in the index of new-style urbanization***

The regional differences in the indices of new-style urbanization in China are more significant than those of the inheritance of the local culture. There is a gradual decrease in the index of new-style urbanization from the coastal regions in the east and southeast to the inland regions in the west and northwest of China. Among the selected 31 provinces (municipalities and regions) in China in 2017, Beijing had the highest index value of new-style urbanization of 0.6675, while Tibet had the lowest index value of 0.1353, signifying a significant gap between the two regions, as well as a considerable imbalance in the urbanization process. In terms of population urbanization, the urbanization rate of resident population in Beijing in 2017 reached 86.5%, 2.8 times that of Tibet; regarding economic urbanization, the per capita disposable income of urban and rural residents in Beijing in 2017 was CNY 24240.5 and CNY 62406.3, 71.5 and 80.5% higher than the national average level respectively, while such income of urban and rural residents in Tibet in the same year was 15.7 and 23.1% lower than the national average level respectively; the gap between the two regions regarding social urbanization is even more obvious, and the number of participants of basic pension insurance program at the end of 2017 in Beijing, for example, was 37.43 times that of Tibet; likewise, there is a relatively huge difference in the ecological urbanization, and the area of urban green spaces in Beijing was significantly larger, nearly 16 times that in Tibet.

In addition, the top five provinces (municipalities and regions) with the highest indices of new-style urbanization are Beijing, Guangdong, Zhejiang, Jiangsu and Shanghai. There are several main reasons for the exceptionally high index values for this five provinces (municipalities): firstly, these five regions are either the state capital, financial metropolises or developed coastal regions, ranking among the highest nationwide regarding their high levels

of income for urban and rural residents, thus widening the gap in the economic urbanization between themselves and other regions; secondly, these five regions have considerable economic strength to outperform other provinces (cities, districts) in China, each with substantial investment in urban construction, high urban green space coverage, and an advantageous position in the ecological urbanization process; thirdly, these five provinces (municipalities) have well-equipped social services and infrastructure, and boast higher quality in medical, health, education and employment services than other regions, and meanwhile, successful social urbanization has also contributed remarkably to their higher indices of new-style urbanization; fourth, in terms of population, the urbanization rate of the resident population in these five regions is remarkably higher than in other regions, which serves as an important index in the comprehensive evaluation of new-style urbanization and is of somewhat unignorable significance to the urbanization process. The average per capita disposable income of urban and rural residents in these five provinces (municipalities) in 2017 reached CNY 52,171 and CNY 22,391, both being 1.5 times the national average level; the total number of participants of basic pension insurance program at the end of 2017 as well as the total area of urban green spaces of these five regions accounted for 35.21 and 38.37% of the national total.

The index of new-style urbanization in seven provinces is less than 0.245, i.e. Tibet, Qinghai, Ningxia, Gansu, Xinjiang, Guizhou and Hainan, all of which are located in the western and southwestern regions in China, and are all frontier provinces and also ethnic minority-inhabited provinces in China. All seven provinces except Hainan fall into the scope of the Western Development Strategy. With the implementation of relevant policies, these six provinces have seen effective improvement of their local economy. However, the urbanization process in these regions remains somehow stagnant and lags behind other advanced regions, and has been affected by various factors, such as the relatively low level of economic development and the underdeveloped urban infrastructure and social services. Therefore, successful new-style urbanization requires considerable improvement in not only the rate of population urbanization and the level of economic development, but also the quality of social services and ecological environment in the region. These are the important factors causing the significant regional differences in the index of new-style urbanization.

#### ***Spatial differences in the coupling coordination between inheritance of local culture and new-style urbanization***

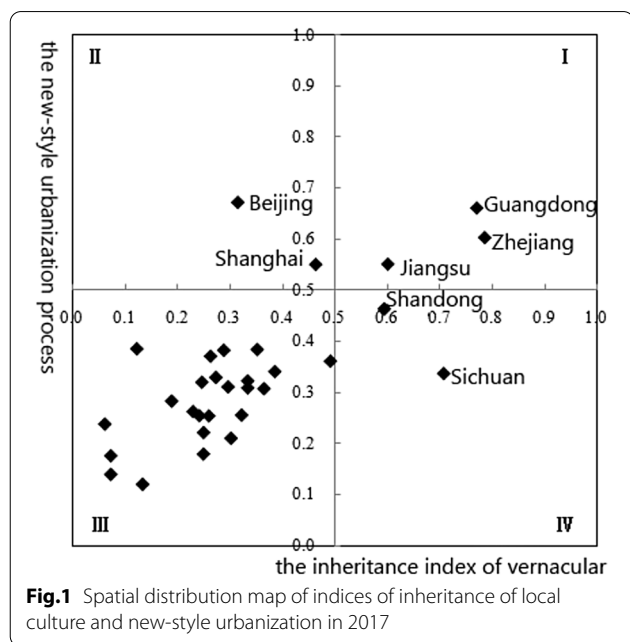
All 31 provinces (municipalities and regions) in this study can be further divided into four categories, based on the

value of their indices of inheritance of the local culture and new-style urbanization as well as the degree of coexistence of these two processes, as shown in Fig. 1 below: type I regions—double excellence type (well-performed cultural inheritance and new-style urbanization type), type II regions—new-style urbanization dominant type, type III regions—double weakness type (weakly-performed coordination cultural inheritance and new-style urbanization type) and type IV regions—cultural inheritance dominant type. See in Fig. 1.

Among the above categories, type-I regions—double excellence type (well-performed cultural inheritance and new-style urbanization type) refers to regions with both their indices of inheritance of the local culture and new-style urbanization being greater than 0.5. The provinces (municipalities and regions) that meet the criteria for Type-I regions are Guangdong, Zhejiang and Jiangsu. These regions not only boast superior economic advantages and high degree of urbanization but also focus on the exploration and maximization of the value of the local culture, thus being able to achieve a perfect combination of promotion of urbanization and cultural inheritance, and successfully integrating Lingnan folk culture and Wuyue culture into the urbanization process to inject more cultural appeal to the urbanization process. Type-II regions—new-style urbanization dominant type refers to regions with their index of new-style urbanization being higher than 0.5 and their index of inheritance of the local culture being lower than 0.5. Typical provinces (municipalities and regions) falling into this category are Beijing, the capital of China, and Shanghai, an open

international financial center serving as China’s window to the world. Both two cities are highly urbanized international metropolises, and their progress in urbanization is far ahead of most other regions in China, making them more susceptible to the influence and impact of modern culture and foreign culture, and thus bringing more challenges in the inheritance and promotion of the local culture. However, their indisputable economic strengths and status can also help provide sufficient material and financial resources for cultural inheritance. Type IV regions—cultural inheritance dominant type refers to regions with their index of inheritance of the local culture being higher than 0.5 and their index of new-style urbanization being lower than 0.5. Regions meeting the criteria for type-IV regions include Sichuan and Shandong, featuring greater degree of exploration and maximization of the value of the local culture. For example, the Sichuan Provincial Association for Promotion of Local Culture and Art was established in July 2016 in Sichuan, and has since been dedicated to actively promoting relevant national policies and guidelines on promoting local culture and art, discovering and training professionals specializing in folk art, conducting friendly at and cultural exchanges and academic exchanges with other folk art communities, and organizing various distinctive local folk art activities, thus successfully creating a local culture industry chain. Type-III regions—double weakness type (weakly-performed coordination cultural inheritance and new-style urbanization type) refers to regions with both their indices of inheritance of the local culture and new-style urbanization being lower than 0.5. Excluding the above mentioned 7 provinces (municipalities and regions) of the above three types, all other 24 provinces (municipalities and regions) are all classified as Type-III regions. Regions with such features like incomprehensive preservation and inheritance of the local culture as well as relatively slow new-style urbanization process, are reflecting major flaws in their efforts. On the other hand, such regions have great potential for future development, and can expect their transition to the type-II (new-style urbanization dominant type) and type-IV (cultural inheritance dominant type) regions, or even further to type-III (weakly-performed coordination cultural inheritance and new-style urbanization type) regions.

In terms of the indices of inheritance of the local culture and the new-style urbanization alone, there are existing regional differences in China. While the coastal regions in the east generally have significant advantages for coordination between the two processes, the coupling coordination degree between the two process remains relatively stable at around 0.5, signifying a relatively low degree of coupling. In 2017, the degrees of coupling coordination between the inheritance of the



local culture and the new-style urbanization in 31 provinces (municipalities and regions) across China range between “moderately imbalanced”, “slightly imbalanced”, “nearly imbalanced” and “barely coordinated”. There is a significant regional difference in the coupling coordinating degree, with the coupling coordination degree for Guangdong being the highest, at 0.5998, indicating a “barely coordinated” coexistence, and such degree for Qinghai being the lowest, at 0.2274, indicating a “moderately imbalanced” coexistence. In addition, the distribution of the degrees of coupling coordination between the inheritance of the local culture and the new-style urbanization in China generally follows the typical pattern of economic development. Since the eastern China is better economically developed than the central China, and the central China is likewise better economically developed than the western China, there is a gradual decrease in such degree of coupling coordination from east to west. There are 5 provinces (municipalities) in a “barely coordinated” stage of such development—i.e. Guangdong, Zhejiang, Jiangsu, Shandong and Shanghai, all of which are all located in the coastal regions in the eastern part of China, while there are 13 and 9 provinces respectively in a “slightly imbalanced” and “nearly imbalanced” stage of such development in total. While most of the provinces with a coupling coordinating degree of “nearly imbalanced” are located in the central part of China, Fujian in the southeast and Liaoning in the northeast are also in a “nearly imbalanced” stage. Provinces with a coupling coordinating degree of “slightly imbalanced” and “moderately imbalanced” are mainly located in the peripheral regions in the west, north and northeast of China. It is also worth noting that among the aforementioned 7 provinces (municipalities) that meet the criteria of type-I (well-performed cultural inheritance and new-style urbanization type), type-II (new-style urbanization dominant type) and type-IV (cultural inheritance dominant type) regions, 5 provinces (municipalities) are in a “barely coordinated” stage, and the other 2 are in a “nearly imbalanced” stage with a coupling coordination degree of approximately 0.5. Therefore, among the selected 31 provinces (municipalities and regions) in China meeting the criteria for Type-I, Type-II and

Type-IV regions, very few have a coupling coordination degree being above the “barely coordinated” level.

#### The international comparison of coupling coordination degree between inheritance of local culture and new-style urbanization

What’s more, seeing with a global view, the inheritance of the local culture is cooperating well with new-style urbanization in Japan and Korea. Limited by the data resources, statistical indexes and statistical results, the data in Japan and Korea are relatively complete. This paper calculates the degree of coupling coordination between inheritance of the local culture and new-style urbanization of Japan and Korea in 2017. (see in Table 5). We can see that the index of the local culture inheritance and the index of new-style urbanization in China were relatively lower than the indexes in Japan, but higher than the indexes in Korea in 2017. In 2017, China, Japan and Korea had nearly same coupling degree between inheritance of the local culture and new-style urbanization, while the Japan enjoyed the highest coupling coordination degree between inheritance of the local culture and new-style urbanization followed by China and Korea. Therefore, the coupling degree and coupling coordination degree between inheritance of the local culture and new-style urbanization in China have been consistent with the international.

The reason why the inheritance of the local culture can cooperate well with new-style urbanization in Japan and Korea mainly includes 2 lessons. Firstly, the government highly pays attention to the inheritance of the local culture. In 1950, Japanese government issued the *Cultural Properties Protection Act*, which clearly regulated related legal responsibilities, rights and obligations in different parties. The parties include governments, local public organizations, owners and managers of cultural heritage and ordinary citizens. This also further developed the experience of the national system for cultural heritage protection. In 1962, the *Korean Cultural Property Protection Law* was issued by South Korea government. It focused on the protection of cultural heritage with various forms as well as implemented culture census, grading and numbering system, which effectively protected the South Korean the local culture by the law. However, the

**Table 5** The coupling comparison of the local culture inheritance and new-style urbanization in China, Japan and Korea

Country	Index of inheritance of local culture	Index of new-style urbanization	Degree of coupling	Degree of coupling coordination	Type of coupling coordination
China	0.9554	0.9543	0.5000	0.6910	Slightly Imbalanced
Japan	0.9423	0.9325	0.5000	0.6846	Slightly Imbalanced
Korea	0.9332	0.9125	0.5000	0.6793	Slightly Imbalanced

*Law of the People's Republic on the Protection of Cultural Relics* has been issued by Chinese government in 1982, which was issued 39 years later than Japan, 20 years later than South Korea. This law has kindly influenced the protection of Chinese local culture. The second lesson is that the promotion of national quality can help strengthen the local culture protection of all the people. It is showed that the promotion of national quality is good for the inheritance of the local culture [20, 21]. In 2017, the adults who were more than 25 years old in Japan have been educated about 12.8 years on average, while in Korea, they were educated about 12.1 years on average. Chinese adults were educated for 9.21 years on average. Therefore, Chinese people needs to improve the national quality so that they can better protect the local culture.

### Conclusions and implications

All the above analysis further indicates that in terms of the time characteristics, the coupling development of Chinese local culture inheritance and new-style urbanization has experienced the disorder stage, transition stage and coordination stage from 1991 to 2017. We can see that the coupling development of Chinese local culture inheritance and new-style urbanization is developing towards high coupling degree. However, Li Qian et al. believe such relatively isolated one-line development of each process fails to facilitate effective and profound integration of these two processes, resulting in relatively weak coupling between the two and a somewhat antagonistic state that the two has always remained in, and this period of slightly coordinated coexistence between the two processes will last for five years [22].

The coupling degree and coupling coordination degree of Chinese local culture inheritance and new-style urbanization are same with the international, but there is still a huge gap existing in national quality compared with the developed countries due to China implementing the culture protection law late, which partially cause the low coupling coordination degree of the coordinated development in Chinese local culture inheritance and new-style urbanization. There are significant differences among various regions across China in the degree of coupling coordination between the inheritance of the local culture and the new-style urbanization, featuring a gradual decline in the coupling coordination degree from east to west, and economically underdeveloped regions, especially ethnic minority-inhabited regions, are facing even greater pressure regarding the coordinated coexistence between the inheritance of the local culture and the new-style urbanization.

According to the research, we can find that there is an obvious coupling coordination development trend

in Chinese local culture inheritance and new-style urbanization. Chinese experience great shows that Chinese government must release and perfect related laws as soon as possible while promoting the urbanization development to better protect the local culture on one hand, on the other hand, Chinese government needs to focus on promoting the national quality, improving the social relations and developing the ecological environment to achieve the new-style urbanization. Other developing countries should learn this experience.

Lewis Mumford declares that culture is deemed the soul and life of a city, and a city is the carrier of and presenting stage for culture [23]. The advancement of new-style urbanization should focus on the improvement of its intrinsic quality, cater to the needs of people, and aim to minimize unnecessary impact on and damage to the local culture, incorporate and highlight more responsibility for facilitating the inheritance of local culture, and actively promote "people-oriented urbanization" thorough the ideological guidance of the local culture. On the other hand, the upgrading transformation of urbanization to new-style urbanization should serve as a new opportunity for the inheritance of the local culture. The inheritance of the local culture should utilize the opportunities generated by the new-style urbanization process, including new market, talents and funds and further explore the functional value of the local culture in the context of new-style urbanization, to promote the development of tourism and other related industries, extend the economic benefits generated from the inheritance of the local culture and further establish a sustainable mechanism for inheritance and innovation of the local culture. In general, the inheritance of the local culture and the new-type urbanization should coordinate with each other and serve as an opportunity for each other to maximize the full potential, so that the coupling and coordination between the two processes can be further strengthened to guarantee further sustainable and coordinated development.

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#### Author contributions

Lu Yan conceived the research; Lu Yan, Xia Shen collected data; Lu Yan analyzed the data; Lu Yan, Xia Shen, and L-PL writing and review. All authors read and approved the final manuscript.

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#### Availability of data and materials

Materials are available via request luyan6677@163.com.



## Declarations

### Competing interests

The authors declare that they have no competing interests.

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