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Research Article

The Driving Path of China's Urban Resilience Enhancement in the Digital Economy Era

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Promoting the development of China's digital economy and the level of urban disaster reduction and governance is of great significance for accelerating the improvement of China's urban resilience and promoting the coordinated development of regional cities. This paper analyzed the spatial and temporal distribution characteristics and driving paths of urban resilience in 31 Chinese provinces, autonomous regions, and municipalities directly under the central government and proposed relevant measures to promote urban resilience. First, the urban resilience evaluation system was constructed and the entropy value method was applied to calculate the urban resilience index of each region. Second, the spatial distribution of urban resilience was explored based on the urban resilience index of each region. Finally, a qualitative comparative analysis method was used to explore the driving paths of urban resilience enhancement. The study showed that there were large regional differences in the urban resilience index, with an overall spatial pattern of "good in the east, middle in the center, and low in the west" and an overall trend of gradual increase. There are five configuration paths to generate a high urban resilience index, which can be specifically digital industry-driven path, technology factor-driven path, government input- and talent pool-driven path under market factors, technology factor- and government factor-driven path, and government investment- and infrastructure-driven path under market factors, and it is found that the digital industry-driven path is a more common path of digital economy-driven urban resilience improvement in China. The finding of this study reveals the nature of complex interactions among drivers in the process of urban resilience enhancement in China, which breaks through the limitations of traditional statistical analysis methods and provides a new perspective for the study of urban resilience issues.

1. Introduction

In recent years, Chinese society is still in a period of rough growth in the pursuit of urbanization, and cities are still not well-equipped to respond to crises. Under the impact of uncertainty risks, cases of catastrophic consequences, such as loss of life and property, failure of urban function, and imbalance of social order have occurred repeatedly, making urban security development disturbed and impacted by many uncertain factors [1–3]. Therefore, China has successively proposed the construction of sponge cities, climate-resilient cities, and other pilot projects to improve the level of urban resilience development and, in 2020, for the first time from the national strategic level, to make clear requirements for the construction of resilient cities so that the construction of resilient city rises to promote the modernization of the national governance system and governance capacity is an important focus point. A resilient city is a city that has the ability to withstand, adapt, and quickly recover in an inverted environment, and it is a new paradigm of urban security development. We need to plan from the strategic height of integrated development and safe development, promote the institutionalization and standardization of resilient city construction, reduce uncertainty and vulnerability in the development process, and achieve sustainable urban development.

Since the 21st century, the resilience theory has been introduced into the economic and social fields and urban systems, and concepts such as "resilient city" or "urban resilience" have emerged [4]. Since the concept of resilient cities was introduced, the United Nations, the World Bank, and the Rockefeller Foundation, among others, have conducted a lot of research studies on resilient cities [5, 6], but there is still no consensus on the scientific definition of resilient cities [7]. With the deepening of people's awareness and understanding of the concept of resilience, the connotation of resilience has been developed, and scholars have begun to integrate resilience with urban studies, thereby opening up new horizons for the urban emergency management research [8]. And with the rapid growth of global urbanization and the rapid accumulation of various risks, this topic has quickly become an academic hotspot [9], and the research results have had an important impact on the modern urban planning and construction concepts. However, different research fields have different focuses on urban resilience research, resulting in the lack of a unified approach to measuring urban resilience. However, taken together, the evaluation index system of urban resilience is divided into five main dimensions: ecological, infrastructural, community, institutional, and economic [10, 11]. In addition, the quantitative measures of urban resilience by scholars in different fields differ, mainly in the following three methods: indicator evaluation, resilience time function evaluation, and model simulation [12]. Commonly used numerical calculation methods for index evaluation include the following: structural equation method, entropy weight method, hierarchical analysis method, and principal component analysis method. In terms of theoretical and empirical research studies, the research studies on urban resilience in China at this stage mainly focuses on the evaluation of urban disaster resilience [7] and the comprehensive evaluation of urban resilience [13, 14]. And some scholars also empirically analyze the dynamic changes and influencing factors of urban resilience in each province and city from the perspective of time and space [15, 16]. Compared with the policies, implementing agencies, and multisectoral coordination mechanisms for building a resilient city in developed countries [17, 18], China started late in the application of building a resilient city, and there are many deficiencies. In planning and construction, there is a lack of applied governance research and policy guidance for urban resilience [19]. In cognition, society as a whole and individual residents lack scientific knowledge of urban resilience. In terms of driving factors, there is a lack of research on the impact of configuration effects of multiple driving factors on urban resilience [20]. To this end, it is of great practical significance to scientifically explore the spatial and temporal evolution characteristics of China's urban resilience development level and identify the driving factors of urban resilience development, in order to optimize China's urban development pattern and to realize the modernization of urban governance system and governance capacity.

In the face of the increasing prominence of urban safety and development issues, the rise of the digital economy has prompted various parts of China to sound the call to build digital cities, creating favorable conditions and solutions for fostering new advantages in urban development. Jing [21] proposed a theoretical framework of the digital economy for the high-level development of urban resilience in the context of new opportunities for digital economy development in the new era. Tan et al. [22] proposed that, in the process of high-level urban resilience enhancement, the digital economy is the focal point for promoting safe urban development. Therefore, due to its innovative nature and industrial spillover effect, the digital economy plays an increasingly important role in promoting the upgrading of urban economic structure, production efficiency, green development, and improving people's living standards and is an inevitable trend for the high level of resilient urban development in China. The data related to the "White Paper on the Development of China's Digital Economy" released by the China Academy of Information and Communication Research in 2021 show that the scale of China's digital economy continued to expand in 2020, and the scale of digital industrialization and industrial digitization accounted for 20% and 80% of the digital economy, respectively, and the new digital economy gradually formed around the world has become a driving force to promote enterprise development and a stabilizer to cope with the downward pressure of the economy. Therefore, promoting the development of the digital economy and using the influence of the digital economy to enhance the efficiency of national governance and urban resilience is an important issue that needs to be addressed nowadays. In view of this, based on the urban resilience practices of 31 provinces, autonomous regions, and municipalities directly under the central government in China, this paper proposes the following two questions in light of the current shortcomings of urban resilience research studies in China: what are the development trends, regional differences, and spatial relationships of urban resilience in each province in China? What condition configurations exist to drive urban resilience improvement?

In order to answer the abovementioned questions, this study searched for the influencing factors of urban resilience enhancement based on the conditions of China's digital economy development and constructed a comprehensive evaluation index of urban resilience based on the urban resilience practice of 31 Chinese provinces, autonomous regions, and municipalities directly under the central government, calculated the urban resilience index using the entropy value method, and then explored the spatial and temporal differences and driving paths of urban resilience among provinces and municipalities. In this paper, given that the effects of different factors on the urban resilience index are not independent, they can affect the improvement of urban resilience by linkage matching to produce different configuration paths. Therefore, from the perspective of configuration analysis, this paper used fuzzy set qualitative comparative analysis (fsQCA) to explore the influence mechanism of the conditional configuration of urban resilience drivers. The answers to the abovementioned questions can help make up for the shortcomings in the current urban resilience practice process, can provide a reference for local governments to formulate policies related to building a resilient city, and can help society as a whole and individual residents to understand the development trend and spatial and temporal differences of urban resilience in a scientific and reasonable manner. In addition, the answers to the abovementioned questions can broaden the perspective of urban resilience-related research studies, address the shortcomings of traditional statistical analysis, provide a new research perspective for understanding the complex interactions among the drivers of urban resilience [23], and provide useful references for promoting the comprehensive modernization of urban governance capacity and governance system.

The marginal contributions of this paper are as follows: First, due to the regional resource endowment status, development foundation, and other factors, the development of urban resilience in China is still characterized by obvious geographical differences. As an integrated, dynamically evolving development system, urban resilient development varies significantly by regional development context when faced with uncertain perturbations. In view of this, this paper analyzed the spatial pattern and drivers of urban resilience development in China based on a spatiotemporal analysis. It is expected to provide some cognitive basis and guiding significance for the development of urban resilience in China. Second, given that the urban resilience index is a comprehensive evaluation system, this paper constructed the urban resilience evaluation system from the perspectives of ecological resilience, economic resilience, social resilience, infrastructure resilience, and institutional resilience. It is expected to provide a useful reference for future research studies on urban resilience. Third, the qualitative comparative analysis method was introduced to identify the influence mechanism of urban resilience from the perspective of group analysis, which breaks through the traditional analysis methods based on independent variables and one-way linear influence relationships and provides a new research perspective for the study of urban resilience driving paths.

2. Study Design and Data Selection

2.1. Region Selection. With the deepening of the reform and opening-up policy, China has gradually developed into the world's second-largest economy, its international influence is increasing, and its economic and social development has entered a new normal. However, with economic and social development, China still faces many difficulties and challenges such as the severe ecological and environmental situation, unbalanced regional development, and the difficult task of industrial transformation and upgrading [24]. In the face of uncertain disturbance factors, the development level of urban resilience will be affected by the regional development background, leading to differences in the influencing factors of urban resilience in different regions. Therefore, this paper selected 31 Chinese provinces, autonomous regions, and municipalities directly under the central government as the case subjects of the study based on the previous studies (given the availability of data, the study cases do not include Taiwan Province of China and Hong Kong and Macau special administrative regions) [16]. Studying the spatial and temporal distribution and drivers of urban resilience in each province of China will help to improve the overall level of urban governance, thus further contributing to the modernization of the national governance system and governance capacity. The study region is shown in Figure 1.

2.2. Research Framework. The research study mainly includes two parts: the spatial and temporal difference analysis and the configuration analysis of driving factors of urban resilience. Spatial characterization of urban resilience: first, we selected appropriate urban resilience evaluation indicators based on the previous studies; second, the urban resilience index was calculated by using the entropy method. Finally, according to the urban resilience index, the spatial distribution characteristics of urban resilience was analyzed by drawing a spatial distribution map with ArcGIS software, and the spatial autocorrelation test of urban resilience was conducted with Stata software, and we aimed to provide an effective reference for the analysis of influencing factors of urban resilience enhancement in China.

Configuration analysis of urban resilience driving factors: first, the influencing factors of urban resilience were selected based on the literature review; second, the QCA was applied to study the sustainable and high-quality development paths to improve the regional urban resilience from the perspective of configuration path, and multiple driving paths to improve urban resilience were confirmed. Combined with the research ideas of spatiotemporal difference analysis and configuration analysis of urban resilience, a research framework model is constructed, as shown in Figure 2.

2.3. Data Selection

2.3.1. Outcome Variables. Studies on urban resilience evaluation indices have shown that the urban resilience index is a comprehensive evaluation system and that there are interactions between the subsystems [25–28]. Drawing on existing research results [29], we build an urban resilience evaluation index consisting of five subresilience systems: ecological resilience, economic resilience, social resilience, infrastructure resilience, and institutional resilience, including a total of 33 secondary indicators, taking into account the actual situation of urban development in China. Among them, ecological resilience emphasizes the ability to resist risks such as degradation of natural resources, deficiencies in ecological governance systems, reduction of public green spaces, and natural disasters, for which eight indicators, including precipitation, were selected for evaluation. Economic resilience emphasizes a city's ability to quickly recover its industrial structure and adjust its economic recovery in a timely manner in the face of unknown economic pressures and shocks, for which six indicators, including GDP per capita, were used for evaluation. Social resilience is an important guarantee for the stable development of the city and the happy life of its residents, for which seven indicators such as per capita disposable income were chosen for evaluation. Infrastructure resilience emphasizes the ability to protect residents' daily lives, withstand

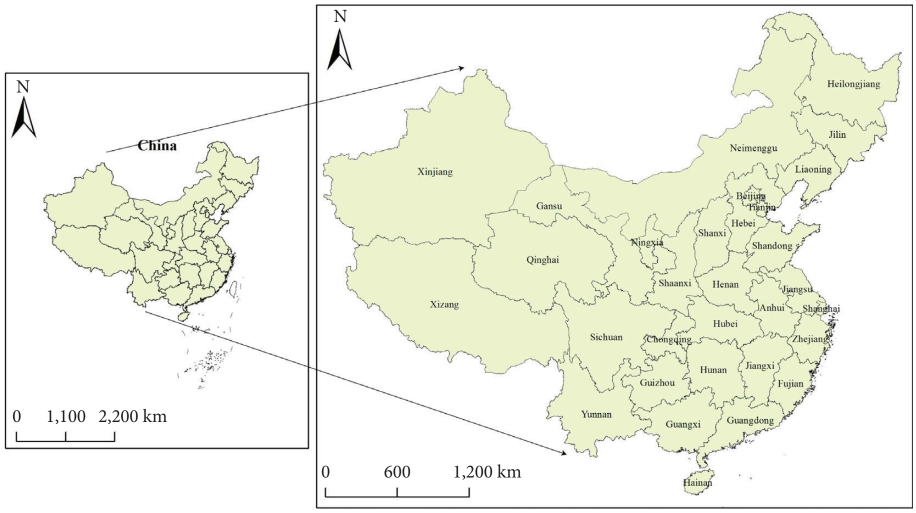

Figure 1: The study region.

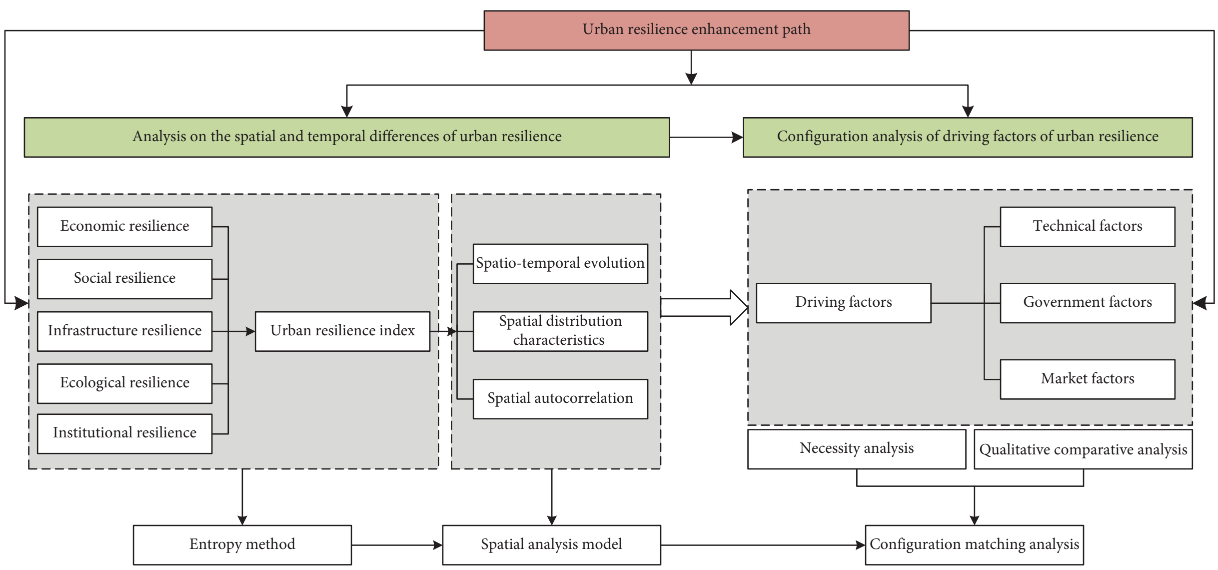

Figure 2: Analysis framework of adaptation paths for urban resilience improvement.

disaster risks, and return to normal operation in a timely manner after a disaster, and it is an important vehicle for urban development, for which eight indicators such as for the number of beds in medical institutions per 10,000 people were selected for evaluation. Institutional resilience emphasizes the ability of city macroinstitutional development to handle risks, for which four indicators were selected for evaluation. The abovementioned data were obtained by manually searching the statistical yearbooks of 31 provinces, autonomous regions, and municipalities directly under the Central Government of China through China's economic and social big data research platform.

To effectively avoid the randomness of subjective weighting, we used the entropy method to calculate the urban resilience index of 31 provinces, autonomous regions, and municipalities directly under the Central Government of China from 2016 to 2020. The specific calculation steps were borrowed from the study of Liu et al. [30], and the maximum-minimum processing method with the best processing effect was selected to standardize the data to make them comparable. The formula of the urban resilience index is as follows, and the indicators of urban resilience at all levels are shown in Table 1.

$$\mathrm{URI} = \sum_{i}^{n} a_i X_i; \sum_{i}^{n} a_i = 1, \tag{1}$$

where URI represents the urban resilience index, a_i represents the weight of each secondary indicator, and X_i represents the standardized secondary indicators.

2.3.2. Condition Variables. This paper drew on the research experience of Zhu and Sun [31] to find the influencing factors of urban resilience in terms of government factors, market factors, and technical factors. And with reference to the research experience of Guo and Huang [32], six

Table 1: Urban resilience index.

Primary indicators	Secondary indicators	Unit	Weight	Direction
Ecological resilience	Precipitation	100 million·m^3	0.0437	+
	Number of natural disasters	times	0.0117	–
	Greenery coverage of urban area	%	0.0222	+
	Urban sewage treatment rate	%	0.0148	+
	Comprehensive utilization rate of industrial solid waste	%	0.0108	+
	Harmless disposal rate of domestic waste	%	0.0050	+
	Park and greenbelt area per capita	m^2	0.0174	+
	Proportion of environmental protection investment in financial expenditure	%	0.0293	+
Economic resilience	GDP per capita	Yuan	0.0468	+
	Proportion of tertiary industry in GDP	%	0.0658	+
	Unemployment rate	%	0.0166	–
	Tax revenue as a percentage of fiscal revenue	%	0.0289	+
	Per capita deposit balance	Yuan	0.0897	+
	Urbanization level	%	0.0122	+
Social resilience	Disposable income per capita	Yuan	0.0615	+
	Number of practicing (assistant) physicians per 10,000 people	Person	0.0351	+
	Illiteracy rate	%	0.0053	–
	Proportion of public security expenditure in financial expenditure	%	0.0321	+
	Population density	Person/10^6 m^2	0.0174	–
	Proportion of population with minimum living standard	%	0.0212	–
	Aging level	%	0.0193	–
Infrastructure resilience	Number of beds in medical institutions per 10000 people	pcs	0.0351	+
	Urban water supply capacity	10^4 m^3/day	0.0498	+
	Urban water supply penetration rate	%	0.0087	+
	Urban gas penetration rate	%	0.0059	+
	Number of public buses and trams per 10,000 people	pcs	0.0210	+
	Urban road area per capita	$m^2/10^4$ people	0.0113	+
	Public toilets per 10,000 people	pcs	0.0329	+
	Per capita urban construction area	$m^2/10^4$ people	0.0432	+
Institutional resilience	Proportion of public management and social organization personnel per 10,000 people	People	0.0368	+
	Proportion of public service expenditure in fiscal expenditure	%	0.0123	+
	Number of health institutions per 10000 people	pcs	0.0486	+
	Per capita domestic water consumption	$m^3/10^4$ people	0.0876	+

conditional variables, such as digital services, input strength, industrial development, market potential, infrastructure, and talent pool, were selected, which not only reflect the level of China's digital economy but also are highly correlated with the influencing factors of urban resilience. The conditional variables were defined by drawing on the research experience of relevant scholars and combining the research topic and data availability of this paper. We selected the overall index of online government service capability published by the e-Government Research Center of the Central Party School of China to measure the level of digital services, and the data for the remaining measurement condition variables were obtained from the National Bureau of Statistics and the China Statistical Yearbook. The conditional variables definitions are specified in Table 2.

3. Analysis of Research Results

3.1. Analysis on Spatiotemporal Evolution and Spatial Characteristics of Urban Resilience Index. To explore the spatiotemporal evolution and spatial distribution characteristics of the urban resilience index in each province of China, this paper used ArcGIS software to map the spatial distribution of the urban resilience index. The spatial distribution map of the urban resilience index for 2016, 2018, and 2020 is shown in Figure 3. The natural breakpoint method was used to classify the urban resilience index into the following five levels: excellent (marked dark in Figure 2), good, medium, average, and poor (marked light in Figure 3), and then, the spatial distribution characteristics were analyzed [33].

As can be seen from Figure 3, the overall urban resilience index of each province from 2016 to 2020 shows a differentiated spatial distribution pattern of good in the east, middle in the center, and low in the west. The overall level of urban resilience development moves upward, showing a relatively concentrated spatial distribution pattern, with relatively few cities with excellent urban resilience index and mainly distributed in the developed eastern coastal provinces. The number of provinces with less than a medium urban resilience index is higher, mainly concentrated in the central and western regions. The regional range of the urban resilience index for average and poor levels gradually decreases during the sample study period, and the regional range of the city resilience index for medium levels gradually increases. Specifically, the provinces with excellent levels of urban resilience index in 2016 and 2018 were Guangdong, Zhejiang, Jiangsu, Shandong, Beijing, and Shanghai, mainly concentrated in the eastern region of China. In 2020, the provinces with excellent levels of urban city resilience index were Guangdong, Jiangsu, and Beijing. Although the number of provinces with excellent level of urban resilience index decreased slightly, the number of provinces with medium and above level urban resilience index increased. And the urban resilience index in central and western regions shows a better upward trend. This is mainly because this paper adopts the natural breakpoint method to classify the urban resilience level of each region with a fixed division ratio. And compared with the provinces with excellent urban resilience index, the growth rate of urban resilience index in the provinces below the medium level is relatively fast. The abovementioned results also reflect that the disparity between regions in China's urban resilience index is gradually decreasing and the differentiated distribution is weakening.

3.2. Spatial Autocorrelation Test

3.2.1. Global Moran Index. In order to study the spatial relationship of urban resilience, this paper used Stata15.0 statistical software to test the spatial autocorrelation of the urban resilience index. Spatial autocorrelation is a method for analyzing the similarity of attribute values in spatial adjacency or spatial adjacent regions [34, 35]. The currently recognized global Moran index is represented as follows [35–37]:

$$\text{Moran's } I = \frac{\text{n}}{\sum_{i=n}^{n}\left(x_i - \overline{x}\right)^2} * \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}\left(x_i - \overline{x}\right)\left(x_j - \overline{x}\right)}{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}}, \quad (2)$$

where Moran'sI represents the Moran index, x_i represents the urban resilience index of the i th region, n represents the number of regions, and W_{ij} represents the spatial weight coefficient matrix.

As can be seen from Table 3, the global Moran index of the urban resilience index is significantly positive for the years 2015 to 2020. The Moran index passes the significance test at the 1% level in 2016, 2017, and 2020 and at the 5% level in 2018 and 2019. The results indicate that there is a strong positive spatial autocorrelation and a strong spatial agglomeration pattern in the urban resilience index of Chinese provinces. The largest value of the Moran index is 0.225 in 2020, indicating that the urban resilience agglomeration phenomenon is the most obvious and the spatial spillover effect is the most obvious in Chinese provinces in 2020. Overall, the urban resilience Moran index from 2016 to 2020 shows a fluctuating upward trend, with a large overall fluctuation, but the upward trend is not obvious. In 2012, China raised the topic of "resilient city" construction and has been exploring the path of a resilient city construction that fits the characteristics of Chinese cities. However, due to the late introduction, insufficient improvement of relevant policies, and low penetration of implementation measures in various regions, the overall urban resilience Moran index has not shown a rapid growth trend, while China's economy continues to develop positively. It also reflects that, now and in the future, enhancing urban resilience should

Table 2: Variable definitions' table.

Variable names		Variable code	Variable definitions
Government factors	Digital services	DS	The overall index of online government service capability published by the e-Government Research Center of the Central Party School of China
	Input strength	IS	Science and technology expenditure/local general public budget expenditure (%)
Market factors	Industrial development	ID	Information technology service industry revenue/regional GDP (%)
	Market potential	MP	E-commerce transactions per capita (yuan)
Technical factors	Infrastructure	IF	Internet broadband penetration rate (%)
	Talent pool	TP	Information transmission, software, and information technology service industry urban units employed (10^4 people)

Figure 3: Spatial distribution of urban resilience index.

attract sufficient attention from Chinese provinces, and the sustainable development path of urban resilience enhancement should be adhered to.

3.2.2. Local Moran Index. The local Moran index autocorrelation can be tested by the local Moran index [38]. Its formula is as follows:

$$I_i = \frac{y_i - \overline{y}}{S^2} * \sum_{j=i}^{n} W_{ij}\left(y_i - \overline{y}\right),$$
$$S^2 = \frac{1}{\mathrm{n}}\sum_{i=1}^{n}\left(y_i - \overline{y}\right)^2 \overline{y} = \frac{1}{n}\sum_{i=1}^{n} y_i, \tag{3}$$

where I_i represents the local Moran index, y_i represents the urban resilience index of the i th region, n represents the number of regions, and W_{ij} represents the spatial weight coefficient matrix.

The local Moran scatter plots of the urban resilience index in 2016, 2018, and 2020 are shown in Figure 4. The local Moran indices for these three years are 0.222, 0.127, and 0.225, respectively, which indicate that the urban resilience index in the Chinese region has a strong spatial autocorrelation and a more stable spatial development pattern. The local Moran scatter plot reveals that the urban resilience index of most provinces is located in quadrants 1 and 3, and the provincial urban resilience index shows two patterns of differentiation, with a strong autocorrelation and dependence on the geographic spatial distribution of urban resilience index clustering [39]. Comprehensive local Moran scatterplots for 2016, 2018, and 2020 reveal that the high-high agglomeration type provinces are mainly concentrated in Shandong, Guangdong, Jiangsu, Zhejiang, Shanghai, and Beijing, which are developed provinces in the eastern and coastal regions of China, and this type of provinces have close industrial development exchanges, significant urban resilience index diffusion effects, and basically form a pattern of synergistic development with neighboring provinces. This is because the developed provinces in eastern China and coastal areas have a good foundation for development and have good human, industrial, scientific, technological, cultural, and political resources, and their economies have been in a leading position for a long time, while the level of economic development directly affects the construction of infrastructure and the maturity of social development, coupled with the implementation of policies such as integrated urban environment and cross-regional collaborative governance in recent years, the ecosystem resilience has generally improved, and the overall regional urban resilience is higher. There is a tendency for the spatial distribution pattern of central and western cities to transition to high-value areas. Low-low agglomeration areas, mainly located in central and western cities in China, have an overall low urban resilience due to economic, transportation, resource, and environmental constraints, but the number of low-low agglomeration provinces is gradually decreasing from 2016 to 2020. From the macrolevel, this is mainly due to the impact of policies such as the strategic goal of common prosperity, the “Belt and Road” initiative and the construction of a resilient city, as well as the improvement of regional transportation networks such as high-speed rail and highways, which further promote the synergistic political,

Table 3: Global Moran index of urban resilience index.

Year	MI	E (I)	Sd (I)	Z value	P value
2016	0.222	−0.033	0.090	2.844	0.002
2017	0.224	−0.033	0.090	2.864	0.002
2018	0.127	−0.033	0.089	1.798	0.036
2019	0.169	−0.033	0.089	2.275	0.011
2020	0.225	−0.033	0.090	2.864	0.002

economic, and cultural development of provinces nationwide. At the same time, in recent years, affected by natural disasters, Chinese provinces have increased infrastructure investment in response to earthquakes, freezing, floods ,and other disasters, and the resilience of infrastructure systems has generally improved. From the microlevel, since the implementation of the regional synergistic development strategy, the central and western regions have developed rapidly, especially the provinces of Hunan, Hubei, and Sichuan, relying on the natural transportation, resource, and industrial advantages of the Yangtze River Economic Belt, and have vigorously developed their own advantageous industries such as electronic information, life medical care, high-end equipment manufacturing, and ecological food, and the industrial economy has steadily risen. The good industrial development and the steady rise of the economy have also created more employment opportunities in Hunan, Hubei, and Sichuan, attracting more people to the cities and significantly increasing the level of urbanization. The rising level of urbanization has led to an increase in the overall income levels and educational attainment of residents and an increase in the urban public infrastructure such as hospitals and schools. As a result, urban resilience has generally increased in the central and western regions. In general, the resilience of cities in central and western China has generally improved, for example, the urban resilience index of Sichuan Province has surpassed that of some eastern provinces.

3.3. QCA

3.3.1. Data Calibration. When fsQCA is used for analysis, it converts the condition and outcome variables into fuzzy sets, thus satisfying the Boolean logic of QCA [40]. Therefore, drawing on the study of Rihoux and Ragin [41], we set three anchor points for the calibration of the variable data: a full membership (fuzzy score = 0.75), a full nonmembership (fuzzy score = 0.25), and a crossover point (fuzzy score = 0.5). The localization points and calibrated fuzzy values of each variable are shown in Table 4.

3.3.2. Truth Table Construction. After calibrating the data, the software was used to calculate and obtain the truth table. Sixty-four combinations could be obtained from the six condition variables, and when using fsQCA, we could set the consistency and case frequency thresholds to filter out the solutions that met the requirements. Referring to the mainstream practice, we selected the rows with an original consistency threshold of below 0.8 and a frequency threshold of 1 for deletion and obtained the truth table, as shown in Table 5. No contradictory configuration appears in the truth table. Thus, the current data could be used for analysis in the following step [42].

3.3.3. Necessary Condition Analysis. After calibrating the data, we analyzed the data to determine the necessary conditions using fsQCA software. The results are shown in Table 6. As can be seen from Table 7, the consistency of the condition variables is all less than 0.9 and is not a necessary condition for the outcome variables, so no further verification of the necessity of these condition variables is required.

3.3.4. Conditional Configuration Analysis. Then, according to the research purpose, the configuration analysis of the condition variables was carried out to study the adaptation path of urban resilience enhancement. As the study consisted of small and medium caseloads, the mainstream approach was adopted, and we chose to set a consistency threshold of 0.8, a PRI consistency of 0.7, and a frequency threshold of 1 [43].

Three types of solutions, the complex solution, parsimonious solution, and the intermediate solution, are usually obtained through sufficiency configuration analysis. Regarding the presentation mode of configuration analysis results proposed by Ragin and Fiss, the intermediate solution of the report was selected, and the simple solution was used as an auxiliary explanation [44]. The analysis results of fsQCA3.0 software are shown in Table 7. From the consistency index, it can be seen that there are five first-order equivalent configurations that constitute sufficient conditions for the high urban resilience index. In addition, the consistency of the solution is 0.946, implying that 94.6% of the cases satisfying the 5 driving paths would exhibit the high urban resilience index, and the coverage of the solution is 0.7292, implying that the 5 development paths explain 72.9% of the cases. Both the consistency and coverage of the solutions indicate that each configuration has substantial explanatory power for the improvement of urban resilience in China, and together, they explain the high urban resilience index. The detailed description of each configuration is as follows:

(1) Digital Industry Driven Path. The first combination path shows that in cities with high talent reserves, government service capacity and market potential will better drive high-quality urban development and improve the urban resilience index if their digital industry development level is high. Among them, government digital services, market potential, and talent reserve are the core conditions, and industrial development is the marginal antecedent condition. Promoting the orderly digital transformation of the real economy is an important measure to achieve stable and orderly economic growth in China. The deep integration of the digital economy and the real economy can enhance the innovation power of the real economy, expand the development space of the real economy, promote the

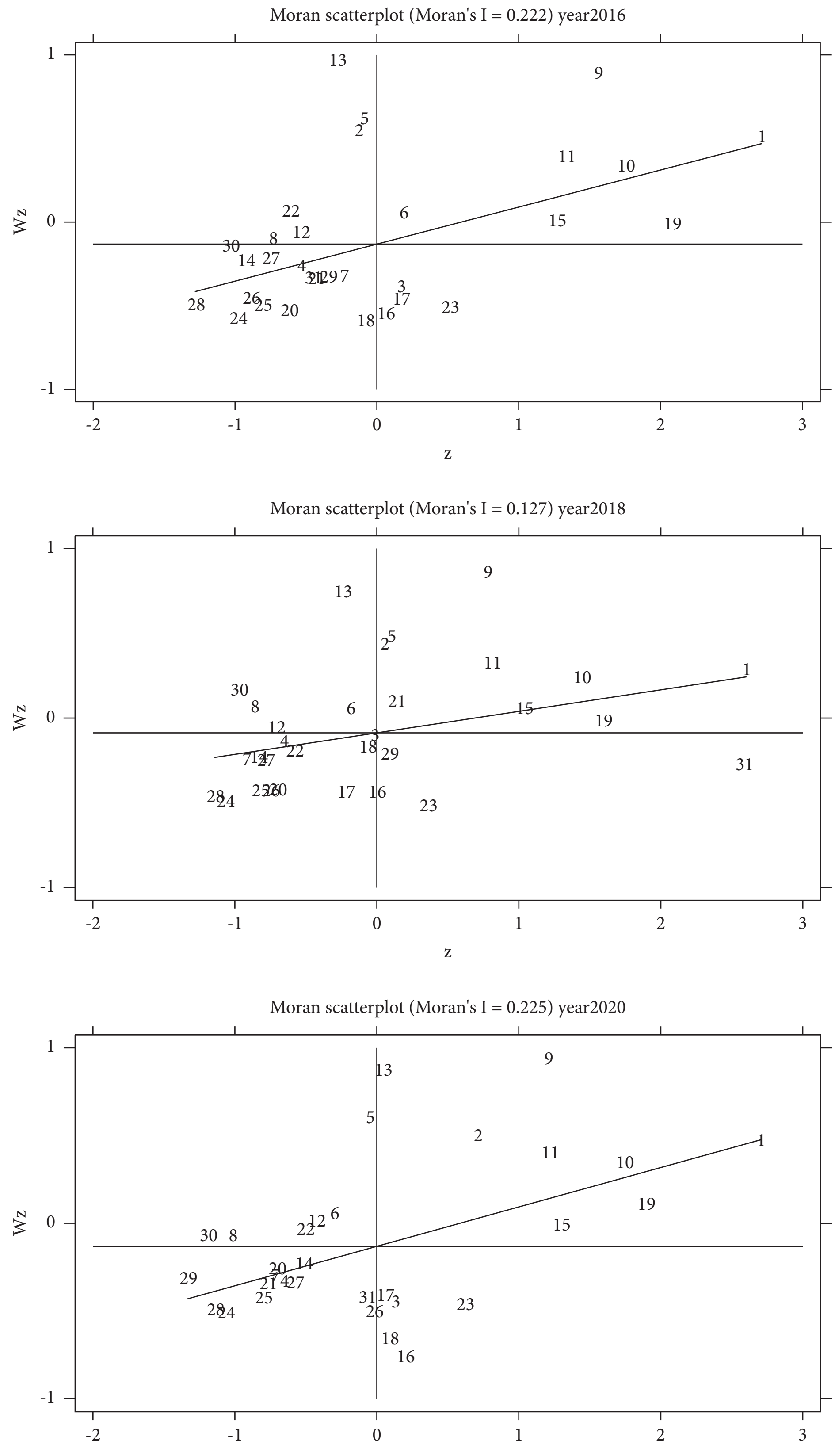

Figure 4: Scatter map of the local Moran index of urban resilience index. The provinces are coded by numbers as follows: 1, Beijing; 2, Tianjin; 3, Hebei; 4, Shanxi; 5, Inner Mongolia; 6, Liaoning; 7, Jilin; 8, Heilongjiang; 9, Shanghai; 10, Jiangsu; 11, Zhejiang; 12, Anhui; 13, Fujian; 14, Jiangxi; 15, Shandong; 16, Henan; 17, Hubei; 18, Hunan; 19, Guangdong; 20, Guangxi; 21, Hainan; 22, Chongqing; 23, Sichuan; 24, Guizhou; 25, Yunnan; 26, Tibet, 27, Shaanxi; 28, Gansu; 29, Qinghai; 30, Ningxia; 31, Xinjiang.

Table 4: Variable calibration anchor points.

Variable	Code	Calibration		
		Full nonmembership	Crossover point	Full membership
Condition variables	DS	76.2550	85.1000	95.3800
	IS	0.6999	1.6343	5.3223
	ID	0.2477	2.4660	25.9761
	MP	3995.3040	10922.5492	94777.8112
	IF	0.2670	0.3395	0.4415
	TP	1.000	8.5000	59.4000
Outcome variables	URI	0.2320	0.3240	0.4750

Table 5: Truth table.

No.	DS	IS	ID	MP	IF	TP	Number of cases	Cases	Original consistency
1	1	1	0	0	1	1	1	Hebei	0.9929
2	1	1	1	1	0	1	1	Guangdong	0.9860
3	0	1	1	1	0	1	1	Shandong	0.9763
4	1	0	1	1	0	1	1	Hubei	0.9599
5	0	1	1	1	1	0	1	Tianjin	0.9429
6	1	0	0	1	1	1	1	Anhui	0.9412
7	0	0	1	1	0	1	1	Liaoning	0.9393
8	0	0	0	1	0	0	1	Inner Mongolia	0.9304
9	0	1	0	1	1	0	1	Hainan	0.9261
10	0	0	0	0	0	1	1	Hunan	0.9201
11	1	1	0	0	0	1	1	Henan	0.9127
12	1	1	1	1	1	0	1	Chongqing	0.9055
13	0	1	1	0	1	1	1	Shaanxi	0.8941
14	1	0	0	1	0	0	1	Jiangxi	0.8750
15	0	1	0	0	0	1	1	Heilongjiang	0.8247
16	1	1	0	0	0	0	1	Yunnan	0.8183
17	1	0	0	0	1	0	1	Ningxia	0.7944
18	0	1	0	0	1	0	1	Gansu	0.7896
19	1	0	0	0	0	0	1	Guizhou	0.7114
20	0	1	0	0	0	0	1	Qinghai	0.6735
21	1	0	1	1	1	1	2	Beijing and Fujian	0.9760
22	0	0	0	0	1	0	2	Shanxi and Xinjiang	0.7351
23	0	0	1	0	0	0	3	Jilin, Guangxi, and Tibet	0.7383
24	1	1	1	1	1	1	4	Shanghai, Jiangsu, Zhejiang, and Sichuan	0.9961

optimization of the institutional environment of the real economy, accelerate the green transformation of the real economy, and thus can improve the quality of economic supply of the city. Therefore, under this path, the integration of the real economy and digital economy can provide a special path for the digital industry development to achieve the goal of perfecting the quality of the urban supply system and improving the urban resilience index. Comparing the five configurations of the high urban resilience index, it can be found that the coverage index of C1 is significantly greater than C2, C3, C4, and C5. It explains 58% of the outcome variable, covering eight cases, and is a more common path for the digital economy to drive the improvement of urban resilience in China.

(2) Technology Factor Driven Path. The second combined path shows that cities with high digital technology conditions can find urban development momentum and can promote the improvement of urban resilience through integration with government service capacity and market potential. The second combined path shows that cities with high digital technology conditions can find urban development momentum through integration with government service capacity and market potential to achieve the goal of promoting increased urban resilience. When a city is subjected to severe shocks and natural persecution, a large number of human resources and excellent infrastructure services are inevitably needed to maintain the normal function of the city, and a high human reserve and infrastructure are conducive to enhancing urban resilience by strengthening the city's resilience and recovery, self-regulation, and creativity. Xu and Deng [45] mentioned that after an external shock to urban economies, highly qualified digital talents can fully release the market consumption demand through their stronger creativity and can gain room for maneuver for urban economic development by stabilizing the market domestic demand, so as to play a role in protecting the urban economy. At the same time, a good government digital service environment is conducive to the formation of a highly orderly resource operation

Table 6: Test of necessity for condition variables.

Variable	Consistency	Coverage
DS	0.8081	0.7216
~DS	0.5465	0.5126
IS	0.6333	0.6387
~IS	0.6445	0.5395
ID	0.7553	0.7811
~ID	0.5556	0.4557
MP	0.7806	0.8820
~MP	0.6086	0.4678
IF	0.7256	0.7136
~IF	0.6353	0.5434
TP	0.7877	0.8397
~TP	0.5796	0.4644

mode to improve the efficiency of factor allocation, compensate for market failures, and enhance the city's ability to withstand external shocks. Under this path, high technological conditions combined with high market potential and government service help Chinese cities to carry out innovative activities and mobilize domestic market demand during the adaptive adjustment period of high-quality development, thereby ensuring effective improvement of urban resilience.

(3) Government Input and Talent Pool Driven Path under Market Factors. The third path suggests that in cities with low levels of digital infrastructure development, high digital industry development and market potential, combined with excellent human resources and government investment, can contribute to generating a high urban resilience index. A high talent pool means that the city has the potential for a good digital economy, which can drive the traditional industry to achieve digital transformation and stimulate the market to fully release consumer demand. Talent resource is the main force in achieving high-quality development in China and is the backbone of the process of promoting urban resilience enhancement [31]. Adequate government investment in science and technology research and development provides sufficient financial support for the digital construction of the city, which can attract more scientific talents, help break the barriers to the flow of talent elements, reserve scientific and technical service talents for the city, and enhance the innovation power of the social. Under this path, digital talents guide the progress of technology and economy in the market through their strong creativity, so as to effectively stimulate market demand. In the benign development pattern of "internal circulation" and "double circulation" in China, sufficient consumption potential can stimulate the endogenous power of economic growth, release the purchasing power of all people, stimulate the vitality of urban markets, promote the technical progress of the macroeconomic system as a whole, improve the economic supply level of urban systems, and thus enhance the ability of cities to resist risks.

(4) Technology Factor and Government Factor Driven Path. The fourth combination path is dominated by the technical factor and government factor, both of which have a common purpose to jointly promote the resilience of Chinese cities. Through its powerful creativity, the new-age digital technology strengthens disaster resilience and promotes the optimization of industrial structure, thus enhancing urban vitality and improving urban resilience. Urban resilience enhancement should break through the traditional technical capacity framework and rely on new products, technologies, and concepts in the development process of digital economy and integrate digitalization, informatization, intelligence, and other related technologies and development models into urban construction to help enhance the ability of cities to withstand risks and disasters. The digital development of the government helps to guide the generation of new business models and formats, improve the intelligence of social development, widely apply digital products to all aspects of social construction, strengthen the informatization and intelligence of the whole city, and further improve the mobility of the city to cope with risks. Therefore, the high innovation of digital technology, which significantly enhances the level of industrial technology, provides good technical conditions for urban resilience enhancement, and the high social service of government digital service, which significantly enhances urban intelligence, provides a solid political guarantee for urban resilience enhancement.

(5) Government Investment and Infrastructure-Driven Path under Market Factors. The fifth path suggests that in cities with low digital services and talent pool, high digital industry development and market potential, paired with excellent infrastructure and government investment, can yield high urban resilience indices. A disaster warning system is the first barrier to a resilient city against disasters, preparing cities in advance for shocks and reducing the extent of damage to urban facilities and social order. Having the advanced infrastructure in cities helps to improve the capacity of data storage, analysis, and transmission, so that early warning systems can quickly and accurately analyze possible disasters and complete timely information transmission, thus enhancing the resilience of early warning systems. The government's adequate investment in science and technology research and development can provide sufficient financial support for urban digital construction, which can help promote urban information communication, disaster early warning system, and other infrastructure construction. At the same time, a good market environment can also promote the continuous change of industrial technology, which has a positive effect on the construction of urban infrastructure and the speed of public information dissemination. Therefore, under this path, through market factors and effective investment of government funds, digital infrastructure can be well built and the city's ability to withstand disturbances and shocks from uncertainties will be enhanced.

3.3.5. Robustness Test. In line with the mainstream practice of QCA, robustness testing is achieved mainly by increasing the level of consistency and adjusting the calibration anchor point of the variables. Therefore, we increased the PRI

Table 7: The results of the configuration analysis.

Condition variable	C1	C2	C3	C4	C5
DS	●	●		●	⨂
IS		⊗	•	•	●
ID	•		•	⊗	●
MP	●	●	•	⊗	●
IF		●	⊗	●	•
TP	●	●	•	●	⊗
Consistency	0.9765	0.9529	0.9827	0.9929	0.9429
Original coverage	0.5867	0.4286	0.3222	0.2969	0.2679
Unique coverage	0.1241	0.0197	0.0098	0.0176	0.0472
Consistency of solution			0.9460		
Coverage of the solution			0.7292		
Typical cases	Beijing, Shanghai, Guangdong, Zhejiang, Jiangsu, Fujian, Sichuan, and Hubei	Beijing and Fujian	Shandong and Guangdong	Hebei	Tianjin

Note. "●" means that the core antecedent condition exists; "•" means that the marginal antecedent condition exists; the existence of factors plays an auxiliary role. "⨂" means that the core antecedent condition is missing; "⊗" means that the marginal antecedent condition is missing; "○" means that the existence or nonexistence of the condition variables is irrelevant to the result, which is represented as a blank cell in the table (no graph).

consistency level from 0.70 to 0.85, and the three configurations of the new test results were consistent with the original results, except for the lack of configurations corresponding to C2 and C5 due to the increase in the PRI consistency level. And then, the calibration anchor points of the condition variables were adjusted, and each step of the fsQCA was repeated after the calibration anchor points were adjusted, and the four configurations of the new test results were consistent with the original results except for the lack of the group corresponding to C2. There is no significant change in the coverage and consistency of the results of the two robustness tests compared to Table 6, which indicates that the findings are reliable [46, 47].

4. Discussion

First, in terms of spatial distribution characteristics, there are large regional differences in China's urban resilience index, which overall shows a strong spatial dependence and differential distribution characteristics. Specifically, provinces in eastern and coastal China, such as Shandong, Guangdong, Jiangsu, Zhejiang, Shanghai, and Beijing, have higher resilience indexes and show high-high aggregation distribution characteristics. Compared with the eastern region, the urban toughness index in the central and western regions of China is relatively poor and belongs to the low-low agglomeration area of the urban resilience index. These results are generally consistent with the findings of the previous studies [16]. This is mainly because, since the reform and opening up, the eastern and coastal provinces of China have been the key development areas of China. At the same time, they have a better development base, with good human, industrial, scientific, technological, cultural, and political resources, and a long-term leading economy. In recent years, the central and western regions have developed rapidly, and the provinces are in a period of rapid economic development and a critical period of urbanization. However, due to the constraints of transportation, resources, environment, and industrial structure, the infrastructure construction and economic development in the central and western regions are still relatively backward, and the room for further improvement of the urban resilience index is still large.

Second, from the spatial evolution trend, the spatial pattern of the urban resilience index in the central and western regions shows a gradual growth trend and good development momentum. In recent years, with the continuous promotion of ecological civilization construction, environmental pollution, ecosystem degradation, and frequent disasters in the central and western regions have formed a push-back mechanism for sustainable urban development, making them pay more attention to the ecological civilization construction, and the economic, social, and ecological recovery of each region has continued, and urban resilience has been gradually improved [48]. In addition, with the continuous promotion of regional coordinated development strategies such as the rise of central and western development, the regional transportation road networks such as high-speed rail and highways in central and western regions have been further improved, which promotes the synergistic political, economic, and cultural development of provinces nationwide.

Finally, from the perspective of conditional configuration analysis, none of the influencing factors selected in this study can be considered as necessary conditions for the improvement of urban resilience in China alone. Meanwhile, this study provides 5 driving paths for China's urban resilience improvement. A comparative analysis of the five driving paths reveals that the digital industry-driven path is the most common path driving urban resilience development across Chinese provinces. This is because the continuous upgrading of industrial structure is a key factor in promoting sustainable urban development, and the effective operation of market mechanisms is an important condition for urban development. This shows that resilient urban development needs to create a good market environment while continuously promoting the transformation and upgrading of industrial structures. These results are generally consistent with the findings of the previous studies that industrial upgrading should be promoted in the process of sustainable urban development [23]. In addition, there are alternative relationships between different drive paths. Although the five paths are the results of the linkage and matching of different influencing factors, their ultimate impact results in promoting the generation of a high urban resilience index. This reveals that each province should fully consider its own resource conditions and play the role of linkage matching between influencing factors, so as to better serve the construction of resilient cities.

5. Research Conclusion and Policy Suggestion

5.1. Research Conclusion. Taking 31 provinces, autonomous regions, and municipalities directly under the Central Government of China as sample cases, this study conducted configuration analysis, explored the temporal and spatial differences of urban resilience in China and the configuration paths driving urban resilience improvement in the digital economy era, and revealed the complex and diverse interactions between the influencing factors of urban resilience improvement in China.

First, through the analysis of the spatial and temporal differences of the urban resilience index, it was found that there were strong spatial agglomeration patterns and spatial differences in the urban resilience index of Chinese provinces, and the overall trend showed the spatial distribution characteristics of good in the east, middle in the center, and low in the west. This also means that it is necessary to analyze the diversity of urban resilience driving paths from the perspective of condition configuration. Second, from the condition configuration analysis, the condition variables could not be used alone as necessary conditions for the urban resilience enhancement in China. Meanwhile, this study provides five driving paths for urban resilience enhancement in China, which can be specifically by digital industry-driven path, technology factor-driven path, government input- and talent pool-driven path under market factors, technology factor- and government factor-driven path, and government investment- and infrastructure-driven path under market factors, while it is found that the digital industry-driven path is a more common path to drive urban resilience development in China. Third, in general, the improvement of the urban resilience in China was the synergetic effect of multiple factors of the digital economy, and each factor was effectively combined through different paths to enhance the urban resilience index in China.

5.2. Policy Suggestion. First, give full play to the market potential and optimize the level of urban resilience. C3 and C5 configurations show that market factors promote urban resilience enhancement by influencing government and technological factors. Good digital industry can drive the city's technological progress by increasing productivity and innovation capacity. The advantages of good digital consumption can give full play to the established dynamics of China's large market, and then drive the synergistic progress of industry and urban economy through the pulling power of market consumption to enhance the supply capacity of urban economy. This reveals that China should not only effectively play the driving role of the digital economy in the formation of a strong domestic market when enhancing urban resilience but also start to promote the digitalization, intelligence, and networking of traditional industries, as well as specifically locate the market demand in the process of urban resilience enhancement and open up new product sales markets based on the existing technology accumulation to provide product and technology support for urban resilience enhancement.

Second, the characteristics of urban resilience influencing factors are fully utilized to better serve the effective development of urban resilience. Urban resilience enhancement should break through the traditional technical capacity framework and rely on new products, technologies, and concepts in the process of social development and integrate digitalization, informatization, intelligence, and other related technologies and development models into urban construction to enhance the capacity of cities in terms of resisting disasters and shocks. We should take advantage of the high innovation of the digital economy to promote the technology level of traditional industries, realize the rapid upgrading of infrastructure, and promote the coordinated progress of the ecological environment, infrastructure, social system, and economic development as a whole, thus improving the ability of the urban system to withstand risks. We should leverage the high social serviceability of digital government to accelerate the level of digitalization, informatization, and intelligent services in cities, and on this basis, continuously improve the modernization of urban governance systems and governance capacity, enhance the function of urban systems, optimize the operation mode of resources, and improve the level of urban resilience with more scientific public policies and more efficient governance capacity.

Third, understand the driving path of urban resilience and formulate urban resilience development plans that conform to local characteristics. In the process of promoting urban resilience through digital economy, local governments can refer to the five driving paths proposed in this study to formulate urban resilience development plans that conform to local characteristics. For example, for cities with good government digital services, market consumption potential, and talent pool, but with marginal conditions for digital industry development, the distinctive path of digital industry development can be adopted to integrate the city's traditional industries with the new-age economy, thereby promoting regional urban resilience enhancement (C1). In cities with low investment conditions for government science and technology R&D, we should actively give play to the innovation of technical conditions, drive the effective integration of technology with government service capacity and market potential, to find urban development momentum and to promote a higher level of urban resilience (C2). In areas where market potential and digital industries are less well developed, the city should give full play to the synergy between government factors and technology factors to jointly promote regional urban resilience enhancement (C4). In addition, by reviewing the five configuration paths, it is found that optimizing a single factor is not the precondition to drive the urban resilience improvement, indicating that the urban resilience improvement is the result of the interaction of various influencing factors, which enlightens cities not to be limited to optimizing a single influencing factor driving the urban resilience improvement, but to pay attention to the linkage matching of government, technology, and market, and clarify the complexity of the digital economy driving the urban resilience improvement, and then, formulate the urban flexible shaping scheme in line with the regional characteristics.

Data Availability

The data used to support the findings of the study are available from the corresponding authors upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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References

[1] M. Alberti, J. M. Marzluff, E. Shulenberger, G. Bradley, C. Ryan, and C. Zumbrunnen, “Integrating humans into ecology: opportunities and challenges for studying urban ecosystems,” *BioScience*, vol. 53, no. 12, pp. 1169–1179, 2003.

[2] J. Ahern, “From fail-safe to safe-to-fail: sustainability and resilience in the new urban world,” *Landscape and Urban Planning*, vol. 100, no. 4, pp. 341–343, 2011.

[3] F. Liu, Z. Zhang, L. Shi et al., “Urban expansion in China and its spatial-temporal differences over the past four decades,” *Journal of Geographical Sciences*, vol. 26, no. 10, pp. 1477–1496, 2016.

[4] M. W. Fishwick, “The resilient city: how modern cities recover from disaster,” *Journal of American Culture*, vol. 28, no. 4, p. 456, 2005.

[5] Y. Jabareen, “Planning the resilient city: concepts and strategies for coping with climate change and environmental risk,” *Cities*, vol. 31, pp. 220–229, 2013.

[6] R. Leichenko, “Climate change and urban resilience,” *Current Opinion in Environmental Sustainability*, vol. 3, no. 3, pp. 164–168, 2011.

[7] S. Meerow, J. P. Newell, and M. Stults, “Defining urban resilience: a review,” *Landscape and Urban Planning*, vol. 147, pp. 38–49, 2016.

[8] H. Ernstson, S. E. Van Der Leeuw, C. L. Redman et al., “Urban transitions: on urban resilience and human-dominated ecosystems,” *Ambio*, vol. 39, no. 8, pp. 531–545, 2010.

[9] Y. Chen and K. Li, “Overseas studies progress and practice exploration on resilient city: based on the perspective of public administration,” *Chinese Public Administration*, vol. 33, no. 1, pp. 137–143, 2017.

[10] Y. Lin, C. Peng, P. Chen, and M. Zhang, “Conflict or synergy? Analysis of economic-social-infrastructure-ecological resilience and their coupling coordination in the Yangtze River economic Belt, China,” *Ecological Indicators*, vol. 142, Article ID 109194, 2022.

[11] X. Dong, T. Shi, W. Zhang, and Q. Zhou, “Temporal and spatial differences in the resilience of smart cities and their influencing factors: evidence from non-provincial cities in China,” *Sustainability*, vol. 12, no. 4, p. 1321, 2020.

[12] C. C. Shi, X. P. Zhu, C. X. Wang, and F. Wu, “Review and prospect of resilient cities: from the perspective of urban complex systems,” *Acta Ecologica Sinica*, vol. 43, no. 04, pp. 1726–1737, 2023.

[13] H. Q. Miu and N. Y. Wang, “An urban resilience measurement system based on decomposing post-disaster recovery process,” *Journal of Natural Disasters*, vol. 30, pp. 10–27, 2021.

[14] L. N. Liu and Y. L. Lei, “Research on the resilience changes and influencing factors of China’s provincial capital cities,” *Science and Technology and Economy*, vol. 35, no. 01, pp. 1–5, 2022.

[15] K. Peng, X. He, and C. Xu, “Coupling coordination relationship and dynamic response between urbanization and urban resilience: case of Yangtze River delta,” *Sustainability*, vol. 15, no. 3, p. 2702, 2023.

[16] L. Bai, C. Xiu, X. Feng, D. W. Mei, and Z. Wei, “A comprehensive assessment of urban resilience and its spatial differentiation in China,” *World Regional Studies*, vol. 28, no. 06, pp. 77–87, 2019.

[17] M. Bloomberg, *A Stronger, More Resilient New York*, PlaNYC Report, New York, NY, USA, 2013.

[18] Y. Shao, O. Soda, and J. Xu, “Capital building for urban resilience: the case of reconstruction planning of kesennuma city, miyagi prefecture, Japan,” *Procedia Environmental Sciences*, vol. 36, pp. 122–129, 2016.

[19] M. D. Zhang and X. Q. Feng, “Resilient city: a new model of urban sustainable development,” *Journal of Zhengzhou University*, vol. 51, no. 02, pp. 59–63, 2018.

[20] R. D. Zhao, C. L. Fang, and H. M. Liu, “Progress and prospect of urban resilience research,” *Progress in Geography*, vol. 39, no. 10, pp. 1717–1731, 2020.

[21] L. B. Jing, “Theoretical connotation, operational logic and new opportunities inthe background of digital economy of resilient cities,” *Guizhou Social Sciences*, vol. 373, no. 1, pp. 108–115, 2021.

[22] R. H. Tan, S. Y. Chen, and T. Wang, “Research on digital platform for optimizing resilient city construction: taking Beijing city sub-center as an example,” *Urban Problems*, vol. 318, no. 01, pp. 86–94, 2022.

[23] Y. Wang, X. Fang, S. Yin, and W. Chen, “Low-carbon development quality of cities in China: evaluation and obstacle analysis,” *Sustainable Cities and Society*, vol. 64, Article ID 102553, 2021.

[24] W. N. Adger, D. Yang, X. Wu et al., “Development of multidimensional water poverty in the Yangtze River Economic belt, China,” *Journal of Environmental Management*, vol. 325, Article ID 116608, 2023.

[25] W. N. Adger, "Social and ecological resilience: are they related?" *Progress in Human Geography*, vol. 24, no. 3, pp. 347–364, 2000.

[26] H. R. Heinimann and K. Hatfield, "Infrastructure resilience assessment, management and governance–state and perspectives," *Resilience and Risk*, pp. 147–187, Springer, Heidelberg, Germany, 2017.

[27] S. T. Pickett, B. McGrath, M. L. Cadenasso, and A. J. Felson, "Ecological resilience and resilient cities," *Building Research and Information*, vol. 42, no. 2, pp. 143–157, 2014.

[28] J. Simmie and R. Martin, "The economic resilience of regions: towards an evolutionary approach," *Cambridge Journal of Regions, Economy and Society*, vol. 3, no. 1, pp. 27–43, 2010.

[29] L. M. Bai, C. L. Xiu, X. H. Feng, D. W. Mei, and Y. Wei, "Comprehensive assessment of urban resilience in China and its spatial and temporal variation characteristics," *World Regional Studies*, vol. 28, no. 06, pp. 77–87, 2019.

[30] X. A. Zhu and G. D. Wei, "Discussion on excellent standards of dimensionless methods in entropy method," *Statistics and Decisions*, vol. 422, no. 02, pp. 12–15, 2015.

[31] J. H. Zhu and H. X. Sun, "Research on spatial-temporal evolution and influencing factors of urban resilience of China's three metropolitan agglomerations," *Soft Science*, vol. 34, no. 02, pp. 72–79, 2020.

[32] L. Guo and Z. K. Huang, "An empirical study on the influence factors of the construction of digital government," *Social Sciences in Hunan*, vol. 208, no. 06, pp. 64–75, 2021.

[33] K. Kern and S. Söderström, "The ecosystem approach to management in the Baltic Sea Region: analyzing regional environmental governance from a spatial perspective," *Marine Policy*, vol. 98, pp. 271–277, 2018.

[34] V. Tarokh, N. Seshadri, and A. R. Calderbank, "Space-time codes for high data rate wireless communication: performance criterion and code construction," *IEEE Transactions on Information Theory*, vol. 44, no. 2, pp. 744–765, 1998.

[35] Y. Kong, W. He, L. Yuan et al., "Decoupling economic growth from water consumption in the Yangtze River Economic belt, China," *Ecological Indicators*, vol. 123, Article ID 107344, 2021.

[36] K. M. Johnson, P. R. Voss, R. B. Hammer, G. V. Fuguitt, and S. McNiven, "Temporal and spatial variation in age-specific net migration in the United States," *Demography*, vol. 42, no. 4, pp. 791–812, 2005.

[37] Y. Xiong, D. Bingham, W. J. Braun, and X. J. Hu, "Moran's I statistic-based nonparametric test with spatio-temporal observations," *Journal of Nonparametric Statistics*, vol. 31, no. 1, pp. 244–267, 2019.

[38] J. Zhang, Y. Chang, L. Zhang, and D. Li, "Do technological innovations promote urban green development?—a spatial econometric analysis of 105 cities in China," *Journal of Cleaner Production*, vol. 182, pp. 395–403, 2018.

[39] Y. H. Ren, L. Xu, and W. H. You, "A spatial econometric model and its application on the factors of financial industry agglomeration," *Journal of Quantitative and Technological Economics*, vol. 27, no. 05, pp. 104–115, 2010.

[40] C. Q. Schneider and C. Wagemann, *Set-theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis*, Cambridge University Press, England, UK, 2012.

[41] B. Rihoux and C. C. Ragin, *Configurational Comparative Methods: Qualitative Comparative Analysis (QCA) and Related Techniques*, Sage Publications, 2008.

[42] C. C. Ragin, *Redesigning Social Inquiry: Fuzzy Sets and beyond*, University of Chicago Press, Chicago, IL, USA, 2019.

[43] Y. Du, Q. Liu, and J. Cheng, "What kind of ecosystem for doing business will contribute to city-level high entrepreneurial activity? A research based on institutional configurations," *Journal of Management World*, vol. 36, no. 09, pp. 141–155, 2020.

[44] C. C. Ragin and P. C. Fiss, *Net Effects Analysis versus Configurational Analysis: An Empirical Demonstra*, University of Chicago Press, Chicago, IL, USA, 2008.

[45] Y. Xu and H. Deng, "Diversification, innovation capability and urban economic resilience," *Economic Perspectives*, vol. 714, no. 8, pp. 88–104, 2020.

[46] J. Q. Cheng, J. L. Luo, Y. Z. Du, and Q. C. Liu, "What kinds of entrepreneurial ecosystem can produce country-level female high entrepreneurial activity?" *Studies in Science of Science*, vol. 264, no. 4, pp. 695–702, 2021.

[47] M. Zhang, W. H. Chen, and H. L. Lan, "Why do Chinese enterprises completely acquire foreign high-tech enterprises—a fuzzy set qualitative comparative analysis (fsQCA) based on 94 cases," *China Ind. Econ.*vol. 373, no. 04, pp. 117–135, 2019.

[48] L. Yuan, R. Li, W. He et al., "Coordination of the industrial-ecological economy in the yangtze river economic belt, China," *Frontiers in Environmental Science*, vol. 10, p. 451, 2022.