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A review and reconstruction of the evaluation index system for high-quality development of urban agglomerations

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Abstract: Since 2010, research literature on the evaluation of high-quality development in urban agglomerations has been analyzed by sorting and examining publication time, sources, indicator composition, research areas, methods, and data sources. This review summarizes academic achievements and identifies existing problems in this field. Based on this analysis, a new indicator system for the healthy development of Chinese urban agglomerations has been developed, incorporating both quantitative and qualitative perspectives. The goal is to provide a scientific and comprehensive evaluation framework for the sustainable development of Chinese urban agglomerations.

Keywords: *High-quality development, Indicator system, Reconstruction, Research review, Urban agglomeration.*

1. Introduction

The development experience of world-class urban agglomerations shows that high-quality development of urban agglomerations can optimize the regional development pattern and drive the high-quality development of the entire economy [1]. Currently, China has entered a new stage of high-quality development driven by urban agglomerations. Therefore, in order to continuously promote the high-quality development of the Chinese economy, promoting the high-quality development of urban agglomerations has become an important basis. This is not only an inherent requirement to adapt to the new stage of economic and social development, but also an inevitable choice for China to cope with the new global competition pattern [2]. Based on this, as an important growth pole for economic development, how to construct a high-quality development evaluation mechanism for urban agglomerations and explore the path of high-quality development has gradually become a research hotspot.

This article focuses on this topic and searches for domestic and foreign literature since 2010. It is found that constructing an evaluation index system for high-quality development of urban agglomerations from different perspectives has achieved some results and played an important role in promoting China's urbanization construction. Looking at the existing achievements, it can be found that the evaluation index system is diverse, with different perspectives and diverse system compositions. The evaluation targets are uneven, with most quantitative indicators and few qualitative indicators. This requires a scientific examination of the existing evaluation system, based on fully absorbing previous research results, to reconstruct a more scientific and comprehensive evaluation system from both qualitative and quantitative perspectives, which can comprehensively reflect the high-quality development of urban agglomerations. The construction of a new evaluation system should be able to more comprehensively display the overall development of urban agglomerations, covering multiple aspects such as the health level of economic development, social development, overall health level of

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residents' lives, health level of resources and ecological environment, and health level of urban residents' living environment, providing theoretical support for research on urban agglomeration development.

2. Literature Review

The high-quality development of urban agglomerations is a new issue facing economic and social development in a new era. The academic community lacks a comprehensive and unified understanding of the connotations and essence of concepts such as high-quality development of urban agglomerations, quality of urbanization development, and quality of healthy urbanization development. The existing research content can be divided into three categories: connotation research, construction of evaluation index system, and regional spatiotemporal development and evolution.

2.1. The Connotation of High-Quality Development in Urban Agglomerations

In the study of the connotation of high-quality development in urban agglomerations, many Western scholars explore the quality of urban development from an economic perspective [3, 4]. They mainly focus on theoretical exploration of green ecological development similar to high-quality development, including development methods, system coordination, and sustainable development concepts. Grossman and Krueger [5] and Gatrell and Jensen [6] a considerable number of scholars measure the level of high-quality economic development from the perspective of total factor productivity or green total factor productivity [7]. Equating total factor productivity with a level of high-quality development does not highlight the rich connotations of high-quality development. High quality development means high-quality demand, high-quality supply, high-quality factor allocation, high-quality input-output, high-quality income distribution, and high-quality economic cycle, which means more emphasis on incorporating people's livelihood, ecology, income, and distribution into the indicator system Breton [8]. Mlachila, et al. [4] pointed out that high-quality economic development in developing countries can solve prominent imbalances and inadequacies in economic and social development, solve high-speed and sustainable economic development, and better promote comprehensive progress of people and society.

On the basis of green development, domestic scholars have further enriched the connotation of high-quality development. The standards for high-quality economic development include dimensions such as effectiveness, adequacy, coordination, innovation, sustainability, sharing, and stability of economic development [9]. Scholars have explored the connotation and evaluation index system of high-quality development from multiple fields and perspectives such as economy, society, politics, culture, and ecology [10] focusing on the five development concepts of "innovation, coordination, green, openness, and sharing" [11].

Since 2017, China has conducted valuable qualitative discussions on the high-quality development of urban agglomerations. Chen, et al. [12] pointed out that high-quality development of urban agglomerations is a highly influential and radiating urban agglomeration, an innovative urban agglomeration with high operational efficiency, and a cultural urban agglomeration that inherits innovation, inclusiveness, and harmony Zhao, et al. [13]. Xu [14] and Tu and Wang [15] proposed suggestions to promote high-quality development of urban agglomerations from the perspectives of building smart city clusters and improving the balance of urban agglomerations. The quantitative research on the high-quality development of urban agglomerations mainly includes the impact of the agglomeration of certain industries on the high-quality development of urban agglomerations [16] the integration of urban agglomerations [17] the sustainable development of urban agglomerations [18] and the quality of urban development within urban agglomerations [19]. Some scholars equate high-quality development with the quality of urban economic development, quality of life, ecological quality, etc. [20, 21] ignoring important aspects such as the healthy development of urban-rural integration, urban resident life, and ecological health development. Most existing literature is still limited to the dimension of urban development, lacking discussion on the unit of urban agglomerations. Basic issues

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such as what constitutes high-quality development of urban agglomerations and how to measure them lack unified standards.

Table 1.
Comparison of definitions of high-quality development of urban agglomerations by scholars.

Visual Angle	Representative Literature	Define Core
Cultivate modern metropolitan areas	Hu, et al. [22]	On the basis of analyzing the inherent logical relationship between urban agglomerations, urban agglomerations, and new urbanization, this paper explores strategies to cultivate the development of urban agglomerations and promote high-quality development of urban agglomerations.
The relationship between urban environment and economic growth	Grossman and Krueger [5]	No evidence that environmental quality deteriorates steadily with economic growth Furthermore, for most indicators, economic growth brings an initial phase of degradation followed by a subsequent phase of improvement
Integrating Industrial Agglomeration and Technological Innovation into the Research Framework	Liu, et al. [23] and Chen, et al. [12]	Incorporate industrial agglomeration and technological innovation into the research framework, with technological innovation as a mediating variable, and analyze the impact of heterogeneity on high-quality development from different industrial types and urban agglomerations.
Reflecting the current situation of human survival and quality of life	Breton [8]	Evaluate the "driving force intensity" of promoting the development of urbanization systems; Reflect the mechanism structure and division of labor coordination of urbanization development; The "Fairness" of Urbanization Development
Effectiveness, coordination, innovation, sustainability, sharing, and stability	Ren [9]	From four perspectives: urbanization, urban competitiveness, quality of life for urban residents, and citizen satisfaction. The evaluation of urban development quality should be guided by public satisfaction.
Construction of smart city clusters	Xu [14]	Through scientific planning, accelerating infrastructure construction, opening up and coordinating data resources, promoting industrial intelligence and cluster development, and improving the localization rate of core technologies, we will accelerate the construction of the Beijing Tianjin Hebei smart city cluster.
Total factor productivity	Beugelsdijk, et al. [7]	The significant and sustained differences in economic development among EU countries in the sub regions can be largely attributed to differences in total factor productivity.
The Promotion of Urban Agglomeration Policies	Zhang and Feng [24]	By adjusting the development policies of urban agglomerations, we can drive the economic development of urban agglomerations in four aspects: regional integration, opening up to the outside world, industrial structure adjustment, and input-output, and promote the improvement of economic quality.
qualitative analysis	Mlachila, et al. [25]	External factors such as political stability, public poverty alleviation expenditures, macroeconomic policies, social change and economic growth, public poverty alleviation expenditures, macroeconomic stability, financial development, institutional quality, and foreign direct investment.
True value rationality, sustainable development perspective	Jinbei [26]	In the stage of high-quality development, there must be a new driving force mechanism with more genuine value rationality, that is, a more conscious focus on development strategic goals that can more directly reflect the people's aspirations and the true purpose of economic development. The inherent requirement of this new driving force mechanism is the effective integration of market economy instrumental rationality and economic development

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		intrinsic rationality.
Efficiency, Livelihood, Coordination, Green, and Openness	Xiao, et al. [27]	Large economic output and development speed; In line with China's new development concept; Being able to accurately grasp practical issues in development; The indicators are measurable.
Three perspectives: system balance view, economic development view, and people's livelihood orientation view	Zhao, et al. [28]	Reflected at the three levels of macroeconomics, industry, and enterprises, constrained by the stage of economic development, social and cultural environment, and policy and legal environment, based on the quality of factors, innovation drive, and quality technology foundation, the goal is to meet the growing needs of the people for a better life.

Based on Table 1, this article summarizes the literature on high-quality development of urban agglomerations from 2013 to 2023. By searching for core journals and identifying node articles with high download volumes, comparative analysis is conducted. Scholars have found that their understanding of high-quality development is not uniform. Many scholars still continue to use measurement methods for the quality of economic growth, such as directly defining high-quality development of urban agglomerations using the level of total factor productivity [29]. This is very one-sided, and this single indicator is difficult to summarize the connotation of high-quality development. Therefore, adopting a reasonable and more policy oriented evaluation system is a method adopted by many scholars. Liu, et al. [23] and Chen, et al. [12] both believe that industrial clusters and technological innovation are important factors affecting the high-quality development of China's urban agglomeration economy, and industrial clusters can generate intermediary effects through technological innovation. This evaluation method can incorporate indicators such as people's livelihood, green, coordination, and openness into the evaluation system, making the evaluation more comprehensive. However, due to different understandings of high-quality development in urban agglomerations among scholars, the indicators chosen also vary. Xu [14], Wang, et al. [30] and Zhang and Feng [24] respectively evaluate the high-quality development of urban agglomerations from the perspectives of smart urban agglomerations, urban functional zoning, and the formulation of urban agglomeration policies.

As an inevitable product of national industrialization and urbanization, the quality of urban agglomeration development should reflect more on the side of healthy development, rather than just focusing on the indicator of economic growth. High quality development can effectively achieve the successful transformation of economic and social structure; Realize the improvement of economic and social quality and the increase of quantity; The development results can benefit people's livelihoods, enhance the happiness index of residents, improve the health index of residents, improve the urban ecological environment, and improve resource utilization efficiency; Helps to narrow the wealth gap and eliminate poverty.

2.2. Overall Situation of the Evaluation System for High-Quality Development of Urban Agglomerations

Through the organization of research on the evaluation of high-quality development, it is found that these studies mainly focus on the construction of evaluation indicator systems and mathematical modeling. A relatively mature scientific evaluation model has been formed in academic fields outside of China, including the DPSIR evaluation model [31] and the three system model [32] which have been widely applied; The construction of China's evaluation system for high-quality development mainly revolves around new development concepts. For example, Li and Ren [33] evaluated the internal economic operation process, power transformation, form evolution, and structural adjustment of China's high-quality development evaluation system in the new era, exploring the implementation path of China's high-quality development. There are also some literature studies from the perspectives of regional coordinated development, regional integration [34] and industrial collaborative innovation

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[35]. These studies have laid the foundation for high-quality development research in urban agglomerations.

Using keywords such as "high-quality development of urban agglomerations", "healthy development of urban agglomerations", "development quality of urban agglomerations", and "quality evaluation of urban agglomerations", we selected literature with high download volume from the Chinese core journals of Peking University included in ScienceDirect, China National Knowledge Infrastructure (CNKI) full-text database, and CSSCI indexed journals. We constructed a comparative analysis from the aspects of age, achievement names, literature sources, basic composition of indicator systems, research areas, research methods, and indicator data sources, as shown in Table 2.

Table 2.
Comparative analysis of the evaluation index system, research objects, and research methods for high-quality development of urban agglomerations.

Literature sources	Result Name	Nature and Main Composition of Indicators	Research area	research method	data sources
Jia and Yun [36]	Measurement of urbanization quality and analysis of regional differences in the Beijing Tianjin Hebei metropolitan area	4 secondary indicators and 18 tertiary indicators, covering the proportion of non-agricultural population, college students, and built-up area.	Beijing, Tianjin, and some prefecture level cities in Hebei Province	Entropy method	Most indicator data comes from statistical yearbooks
Kim, et al. [31]	A new approach to measuring green growth: Application to the OECD and Korea	5 secondary indicators and 12 tertiary indicators for cross-border comparison of green growth strategies	30 OECD countries, including South Korea.	OECD framework	National statistical data available for each country
Hou, et al. [37]	Construction and Application of Urban Agglomeration Governance Evaluation System under the Background of High Quality Development: Taking the Yangtze River Delta Urban Agglomeration as an Example	5 primary indicators, 13 secondary indicators, and 42 tertiary indicators. Covering 5 dimensions of economy, society, culture, ecology, and management	There are a total of 41 cities in the Yangtze River Delta urban agglomeration.	Multi level and multi indicator evaluation	Statistical data, geographic data, open source data
Dadashpoor and Malekzadeh [38]	Driving factors of formation, development, and change of spatial structure in metropolitan area: A systematic review		115 articles published between 1999 and 2019	Literature review and comprehensive evaluation	Data from published literature
Li and Fang [39] economic geography	A Study on the Quality Zoning of Urbanization in Economically Developed Regions Based on Catastrophe Theory	5 secondary indicators and 18 tertiary indicators, covering per capita GDP, per capita green space area, urban-rural income gap, urban-rural health level gap, etc.	13 prefecture level cities in Jiangsu Province	Catastrophic series method and systematic clustering analysis method	China City, Jiangsu Province, Jiangsu Health Statistical Yearbook
Simon, et al. [40]	Developing and testing the Urban Sustainable	Seven drafts were listed, totaling 14	Bangalore, Cape Town,	Literature review and	Technical report by the Bureau of

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	Development Goal's targets and indicators - a five city study	indicators. Mainly related to urban sustainable development goals. Try to compress the number of indicators as much as possible to meet the feasibility of various urban dimensions.	Gothenburg, Manchester, Kisumu	comprehensive evaluation	the United Nations statistical commission (UNSC)
Xia and Cheng [41] urban planning forum	A Study on the Index Evaluation System of Urbanization Quality - Based on Empirical Analysis in Zhejiang Province	16 secondary indicators and 55 tertiary indicators, covering population intelligence, housing monitoring, ecological suitability, education popularization, commercial convenience, etc.	Vice provincial cities, prefecture level cities, counties, and county-level cities in Zhejiang Province.	cluster analysis	Most indicator data is sourced from the Zhejiang Statistical Yearbook over the years
Zha, et al. [42]	A study on dynamic evolution, regional differences and convergence of high quality economic development in urban agglomerations	We have established an evaluation system consisting of 5 primary indicators, 15 secondary indicators, and 18 tertiary indicators.	Three major urban agglomerations in the Yangtze River Basin of China	TOPSIS; Kernel density estimation; Dagum Gini coefficient	China Urban Statistical Yearbook, CEIC database, and statistical bulletins of various cities over the years, patent data from CNRDS database
Mlachila, et al. [25]	A Quality of Growth Index for Developing Counties: A proposal	The quality of development is influenced by six dimensions: political stability, public poverty alleviation expenditure, macroeconomic stability, financial development, institutional quality, and foreign direct investment	Over 90 countries from 1990 to 2011.	Not displayed	Statistical economic data from various countries
Xu and Ni [43]	Analysis of the Current Situation and Differences in Sustainable Competitiveness of the Seven Major Urban Agglomerations in China	6 primary indicators and 24 secondary indicators.	China's Seven Mature Urban Agglomerations, 130 Cities	Dagum Gini coefficient and its decomposition method	China Urban Statistical Yearbook 2016, Statistical Bulletin of Various Cities 2016, and Web Crawler Search
Li and Cao [44]	Measurement of High Quality Economic Development of Urban Agglomeration in the Middle Reaches of the Yangtze River	Build 6 dimensions and set 17 primary indicators and 27 secondary indicators.	30 cities in the Development Plan for the Urban Agglomeration in the Middle Reaches of the Yangtze River	Improved entropy weight TOPSIS method	2019 China Urban Statistical Yearbook, 2019 Statistical Yearbooks of Each City, and Official Website of the National Bureau of Statistics

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He and Ni [45]	Research on the Quality of Urbanization in China	Build an urbanization quality evaluation index system with seven primary indicators and 30 secondary indicators.	31 provincial-level administrative regions in China	Comparative calculation	Data from the 6th National Population Census in 2010
Hou [46]	Measurement and comparison of high-quality development in Chinese urban agglomerations	5 primary indicators, 15 secondary indicators, and 40 tertiary indicators	146 prefecture level cities in China	Entropy weight TOPSIS analysis method	China Urban Statistical Yearbook 2018
Tu, et al. [47]	Evaluation of High Quality Development Level of Chengdu Chongqing Urban Agglomeration	There are a total of 16 indicators in three major areas: economic development quality, social development quality, and ecological environment quality	36 cities within the Chengdu Chongqing urban agglomeration	Spatial correlation dimension, entropy method, and modified gravity model	Statistical Yearbook of Sichuan Province 2018, Chongqing Statistical Yearbook 2018, China Urban Statistical Yearbook 2018, etc

From Table 2, the research scope of foreign countries is mostly at the national and urban levels, while China has seen a large number of high-quality development achievements related to urban agglomerations since 2020. Through the comparison of main literature, it was found that the existing problems are the high similarity of the constructed indicator system, high repeatability of indicators, more quantitative indicators, and fewer qualitative indicators. The source of indicator data mainly relies on official statistical yearbooks, and rarely comes from field visits, surveys or questionnaires. In terms of evaluation methods, most of them use entropy method, comprehensive index method, principal component analysis method, comprehensive analysis and other methods for evaluation, which have high similarity and insufficient innovation.

2.3. Comparative analysis of quantitative indicator systems for high-quality development of urban agglomerations

In CNKI and ScienceDirect searches, fuzzy searches were conducted using search terms such as "high-quality evaluation index system for urban agglomerations" and "development evaluation for urban agglomerations". A total of 122 relevant literature were retrieved for sorting, and Table 3 was compiled based on the node literature with high citation frequency that has been retrieved in Table 2.

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Table 3.
Comparison of perspectives covered by the evaluation index system for high-quality development of urban agglomerations.

Index Literature	Economic Develop	Social development and progress	Per capita income	Public infrastructure	Ecology Resource Environment	Public safety services	Space structure	Technological innovation	Open sharing	Social harmony
Jia and Yun [36]	√		√	√				√	√	
Cui [48]	√		√	√						
Kim, et al. [31]	√	√		√	√				√	
Hou, et al. [37]	√	√	√	√	√	√			√	
Dadashpoor and Malekzadeh [38]	√	√	√	√	√		√	√	√	
Zha, et al. [42]	√	√	√	√	√			√		
Mlachila, et al. [25]	√	√	√	√	√		√		√	
Xu and Ni [43]	√	√			√	√			√	√
He and Ni [45]	√	√	√		√	√		√	√	
Li and Cao [44]	√	√	√	√	√		√		√	
Liu [49]	√	√		√	√			√		√
Han [50]	√	√	√						√	√
Wang, et al. [30]	√	√			√		√	√	√	
Zhang and Feng [24]	√			√	√	√		√	√	
Han [50]	√	√		√	√		√	√	√	
Ma and Xu [51]	√	√			√				√	√
Xiao [52]	√	√	√		√	√		√	√	√
Hou [46]	√	√	√	√	√			√	√	√
Tu, et al. [47]	√	√	√		√		√			√

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By searching for literature, starting from 2015, scholars gradually began to focus on the quality of urban agglomeration development as their research object. However, it was not until 2019 that a large number of scholars began to focus on the theme of "high-quality development of urban agglomerations". The main dimensions of research mainly revolve around five aspects: innovation, coordination, green, openness, and sharing. Different scholars have different understandings and indicator designs for a certain dimension. Careful comparison of various indicator systems constructed by different scholars reveals that: firstly, different scholars have significantly different views on the composition of the same dimensional indicator system. For the same indicator, some scholars include it in the evaluation system of economic development quality, while others include it in the evaluation system of social development quality; 2、 In terms of the overall composition of the indicator system, there are defects such as repeated use of indicators and unclear definition of indicators; 3、 The indicators selected by a few scholars have difficulty in obtaining data sources, such as some indicators reflecting air quality that are difficult to obtain for underdeveloped cities, or it is difficult to accurately and continuously obtain relevant data, which inevitably affects the accuracy of evaluation results.

3. Methodology

3.1. Composition Logic of Evaluation Indicators for High-Quality Development of Urban Agglomerations

On the basis of summarizing the connotation of high-quality development in urban agglomerations, the evaluation system for the development of urban agglomerations not only needs to reflect economic structure and efficiency, improve factor productivity indicators, but also indicators that focus on improving people centered happiness, as well as indicators that reflect economic vitality and innovation [53]. The development goal cannot be a single economic growth, starting from the overall value orientation, pursuing the synergy of economy, society, and ecology, and relying more on talent, technology, knowledge, etc. in the factor structure to promote the transformation of development momentum. Therefore, the evaluation of high-quality development of urban agglomerations relies solely on quantitative economic indicators, and the evaluation results cannot achieve comprehensive coverage, especially fuzzy indicators such as the happiness and satisfaction of urban residents, the level of civic civilization, the level of urban mental health, and social harmony, which cannot be directly quantitatively evaluated. Qualitative analysis is needed, and quantitative analysis is needed on the basis of qualitative analysis. Based on this, this study jointly constructs an evaluation index system for the high-quality development of Chinese urban agglomerations from both quantitative and qualitative perspectives, as shown in Figure 1:

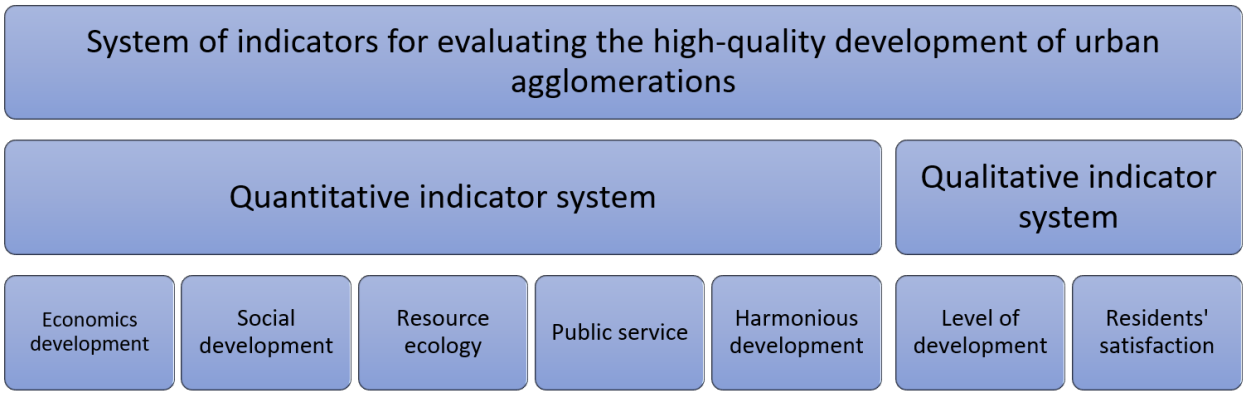


Figure 1.
Composition of Evaluation Index System for High Quality Development of Urban Agglomeration.

The evaluation index system for the high-quality development of Chinese urban agglomerations consists of two main parts: a quantitative index system and a qualitative index system. It has the

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following characteristics: firstly, the two parts are independent of each other and form a complete evaluation system, which completes the evaluation of the high-quality development of urban agglomerations from both quantitative and qualitative aspects. The second and second parts complement each other, which can compensate for the shortcomings of qualitative evaluation through quantitative evaluation, and also make up for the shortcomings of quantitative evaluation through qualitative evaluation. The simultaneous use of both can achieve comprehensive, multi angle, multi indicator, multi caliber, and comprehensive quantitative evaluation of high-quality development of urban agglomerations, making the evaluation results comprehensive, scientific, authentic, and trustworthy.

3.2. Construction of a Quantitative Indicator System for Evaluating the High-Quality Development of Urban Agglomerations

Drawing on previous research experience, based on the understanding of the connotation and characteristics of the governance system of urban agglomerations in the context of high-quality development, highlighting the global leadership of the indicator system and the availability of data, a quality and efficiency evaluation indicator system for urban agglomeration development is formed, which mainly includes the following five dimensions of understanding:

3.2.1. The Healthy Development of Urban Agglomeration Economy

Continuously improving the quality and efficiency of urban economic development within urban agglomerations, deepening industrial division of labor among cities within the region, achieving a relatively balanced spatial structure, and enabling efficient operation of various elements within urban agglomerations. By improving the level of infrastructure services, we can control the disorderly spread of urban agglomerations. Being able to achieve the improvement of total factor productivity in urban agglomerations, enabling technological progress and efficiency to play a major role in economic growth. Enhance the economic agglomeration and scale effects of central cities, and achieve low-carbon, environmental protection, and sustainable development in the process of economic development. The selected indicators mainly include per capita GDP, GDP growth rate, per capita actual utilization of foreign investment, proportion of tertiary industry output value, energy consumption reduction rate per unit GDP, annual patent authorization, per capita disposable income growth rate of urban residents, added value of fixed assets, per capita consumption expenditure, etc.

3.2.2. The Healthy Development of Social Undertakings

To better meet the people's expectations for a better life and adapt to the flow, development, and changing needs of urban population. Bridging the imbalance in regional and internal development, and highlighting the allocation of resources that are fair, public, and public welfare. Narrowing regional and intercity disparities, promoting the construction of infrastructure and public services, and better serving the needs of population mobility. The education level, income distribution, wealth gap, and social security situation of the people in a high-quality urban agglomeration are important indicators for the healthy development of social undertakings. The main indicators selected for this include urban per capita housing area, per capita consumption expenditure, unemployment insurance coverage rate, education expenditure proportion, regional development difference coefficient, and the number of insured migrant workers.

3.2.3. Healthy Development of Resources and Ecological Environment

Building a low-carbon, environmentally friendly, and safe ecological and green development pattern, focusing on the needs of residents for high-quality living, actively advocating the governance thinking of mountains, rivers, forests, fields, lakes, and grasslands, protecting the environment, guarding ecological security boundaries, and providing diverse and high-quality ecological spaces. The interaction and development of economy, society, and ecology are directly related to the sustainable

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development of urban agglomerations. In the selection of indicators, the main focus is on indicators related to environmental quality, including the proportion of days with air quality reaching level 2 or above to the whole year, PM2.5 concentration, annual average concentration of carbon monoxide, industrial wastewater discharge standards, proportion of environmental protection expenditure to fiscal expenditure, proportion of environmental pollution control investment to GDP, industrial exhaust emissions, and green coverage rate in built-up areas.

3.2.4. The Healthy Development of Resident Security and Public Services

Innovate the governance model of urban agglomerations, promote regional resource sharing, improve various public infrastructure, and achieve fair, reasonable, and efficient distribution of core public service resources such as healthcare and education. The availability of material resources such as material security for residents' health, medical service security, and sports social security in society is the foundation for promoting the healthy development of residents. The main indicators include the number of health institutions, the number of medical beds per 10000 people, the number of community service facilities, health expenditure, the number of health practitioners, the per capita area of public sports facilities, the growth of urban fitness path project, the growth of village farmers' fitness project, the improvement of per capita housing area, Internet penetration, rural tap water penetration, basic social insurance coverage, etc.

3.2.5. Coordinated Development of Urban Agglomerations and Regional Integration

A reasonable scale structure system is an important guarantee for the high-quality development of urban agglomerations, which is related to the rational allocation of various resources within the urban agglomerations and the overall function. Pay attention to the excavation of cultural values, stimulate cross regional consumption in culture, tourism, and other areas, and shape regional urban brands and character. Therefore, in the evaluation index system, it is necessary to consider indicators that reflect the coordinated development of urban agglomerations and regional integration, such as the coefficient of urban development differences and the income gap among residents. The application of new technologies such as big data, the Internet of Things, and artificial intelligence drives the transformation of regional social production modes, the reconstruction of production relations, and the reconstruction of production spaces [37].

Based on the previous logical analysis, a quantitative evaluation index system for the high-quality development of urban agglomerations has been formed, as shown in Table 4.

Table 4.
Quantitative Evaluation Index System for High Quality Development of Urban Agglomeration

Dimension layer	Indicator layer	Indicator attributes	Selection criteria
Healthy economic development	GDP growth rate (%)	+	① Relative indicators mainly measure the speed of economic development; ② The four indicators of gross regional product, local fiscal revenue, added value of fixed assets and social fixed assets investment mainly reflect the healthy development of local economy; ③ The added value of high-tech enterprises and the profits and taxes of enterprises above designated size mainly reflect the driving effect of urbanization on local economic development; ④ The per capita actual utilization
	Per capita GDP growth rate (%)	+	
	Growth rate of per capita disposable income of urban residents (%)	+	
	Growth rate of per capita consumer spending (%)	+	
	The proportion of output value of the tertiary industry (%)	+	
	Reduction rate of energy consumption per unit GDP (%)	-	
	Total labor productivity (yuan/person)	+	
	Regional Gross Domestic Product (100 million yuan)	+	
	Local fiscal revenue (100 million yuan)	+	
	Value added of fixed assets (100 million yuan)	+	
	Social fixed assets investment (100 million yuan)	+	
	Value added of high-tech enterprises (100 million	+	

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	yuan)		of foreign investment reflects the driving force of external forces on the high-quality development of urban agglomerations; ⑤ The annual patent authorization reflects the driving effect of urban agglomeration's technological innovation capability.
	Profit and tax amount of enterprises above designated size (100 million yuan)	+	
	Per capita actual utilization of foreign investment (100 million yuan)	+	
	Annual Patent Authorization Quantity (pieces/piece)	+	
Social healthy development	Per capita housing area of urban residents (square meters)	+	① The first three indicators mainly examine the living environment, social employment, and social consumption of residents; ② Various social security measures are important indicators reflecting the high-quality development level of urban agglomerations. ③ The educational resources enjoyed by residents are the driving force for the healthy development of society. The more developed the education is in a city, the stronger the driving force for social development.
	Urban registered unemployment rate (%)	-	
	Per capita consumption expenditure (yuan)	+	
	Participation rate of migrant workers in social security (%)	+	
	Unemployment insurance coverage rate (%)	+	
	Occupational pension insurance coverage rate (%)	+	
	Education expenditure as a percentage of GDP (%)	+	
	Number of public libraries	+	
	Average years of education for urban population (year/person)	+	
	Number of criminal cases filed per 10000 people (cases/10000 people)	-	
Healthy development of resources and ecological environment	Per capita park green space area (square meters/person)	+	① Focus on examining the degree of improvement in the living environment, ecological environment, and living environment of residents during the process of high-quality development; ② Focus on examining the investment and effectiveness in ecological environment protection and pollution control during the process of high-quality development; ③ The impact of healthy economic development on resource utilization and environmental protection.
	Per capita urban road area (square meters/person)	+	
	Urban built-up area (square kilometers)	+	
	Green coverage rate in built-up areas (%)	+	
	Standard discharge of industrial wastewater (100 million cubic meters)	-	
	The proportion of environmental protection expenditure to fiscal expenditure (%)	+	
	The proportion of investment in environmental pollution control to GDP (%)	+	
	Industrial exhaust emissions (10000 tons)	-	
	Comprehensive utilization rate of solid waste (%)	-	
	Urban domestic sewage treatment rate (%)	+	
	Urbanization rate (%)	+	
	Sulfur dioxide emissions (10000 tons)	-	
	Smoke (powder) dust emissions (10000 tons)	-	
	Harmless treatment rate of urban household waste (%)	+	
	The proportion of days when air quality reaches level 2 or above in the whole year (%)	+	
The Healthy Development of Resident Security and Public Services	Number of health institutions	+	② The selection of various indicators should not only reflect the improvement of the government's public service level, but also demonstrate the specific performance of residents in terms of physical and mental health.
	Popularity rate of tap water (%)	+	
	Gas penetration rate (%)	+	
	Number of medical beds per 10000 people (number)	+	
	Number of community service facilities	+	
	Health expenses pointed out (10000 yuan)	+	
	Number of healthcare professionals (person)	+	
	Per capita land area for public sports facilities (m^2/person)	+	
	Growth of Urban National Fitness Path Project (km)	+	
	Growth of Rural Farmers' Sports and Fitness Projects (km)	+	
	Per capita housing improvement (m^2/r people)	+	
	Internet penetration rate (%)	+	

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	10000 people own public vehicles (vehicles/10000 people)	+	
	Urban population density (person/km2)	+	
	Basic social security coverage rate (%)	+	
Coordinated development of regional integration	Gini coefficient	-	① The first three coefficients mainly examine the development of social integration; ② The following indicators reflect the driving effect of urbanization construction on improving people's livelihoods and enhancing the level of public welfare.
	Engel's coefficient	-	
	Coefficient of regional economic development differences	-	
	Income gap between urban and rural residents	-	
	The difference in Engel's coefficient between urban and rural residents	-	

Note: The "+" in the "Indicator Attribute" column represents a positive indicator, and the larger the value, the better; "-" represents a reverse indicator, with a smaller value indicating better performance.

4. Results

Qualitative indicators mainly come from a subjective perspective, using large-scale field surveys to understand the subjective evaluation and emotional understanding of the public towards the high-quality development of urban agglomerations, aiming to compensate for the shortcomings of quantitative indicators. The construction of a qualitative indicator system mainly refers to the discussion of the establishment logic of the evaluation indicator system by previous scholars, and is formed based on field research [54]. Based on this, an evaluation system of 30 qualitative indicators was constructed from two aspects: the degree of high-quality development of urban agglomerations and the satisfaction of urban residents, as shown in Table 5.

Table 5.
Composition of Qualitative Evaluation Index System for Urban Agglomeration Development Quality.

Evaluation Indicators		**Check √ In the Options You Agree With**			
		High	**Medium (High)**	**Commonly**	**Low**
City City Group Hair Exhibition Cheng Degree Of Measure Review	Reduction of ecological and cultural differences between cities				
	The degree of increase in per capita income of residents				
	The degree of increase in the ratio of resident income to housing prices				
	The degree of narrowing the gap in regional economic development				
	The degree of regional ecological resource and environmental differences				
	The transportation connectivity of urban agglomerations				
	The degree of improvement in regional scientific and technological innovation capabilities				
	Satisfaction with harmonious economic and social development				
	Satisfaction with the efficiency of comprehensive utilization of natural resources				
	The degree of improvement in public moral awareness among residents				
	Resident medical and health security situation				
	Popularity of green and low-carbon economic development concepts				
	Regional haze weather control situation				
	The convenience level of public resources such as education and healthcare				
	Overall coverage of residents in society				
	Community environment construction and maintenance level				
	The degree of harmonious coexistence among residents				

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	The degree of public safety guarantee within urban agglomerations				
Residence civil full meaning degree of measure review	Satisfaction of urban residents with employment services				
	Satisfaction level of urban residents with social security				
	Satisfaction level of urban residents with social security				
	Satisfaction of urban residents with food safety				
	Satisfaction of urban residents with drug safety				
	Satisfaction level of urban residents with compulsory education				
	Satisfaction of urban residents with healthcare				
	Satisfaction of urban residents with government information disclosure				
	Satisfaction of urban residents with public transportation services				
	Satisfaction of urban residents with infrastructure construction				
	Satisfaction of urban residents with environmental quality of life				
	Satisfaction of urban residents with the construction of cultural and sports facilities				

5. Discussion and Conclusions

This article summarizes the literature on high-quality development of urban agglomerations since 2010, explores the connotation of high-quality development, sorts out the evaluation of these studies on high-quality development, and compares and analyzes the evaluation indicators. Based on this understanding, the evaluation index system for the high-quality development of Chinese urban agglomerations has been reconstructed, providing a scientific, comprehensive, and sustainable index system for the evaluation of the healthy development of urban agglomerations.

Based on the literature review and the reconstruction of the indicator system, the following suggestions are proposed:

Firstly, the evaluation index system needs to comprehensively display various dimensions, and one should not neglect the other. Many cities, especially underdeveloped urban agglomerations, have obvious shortcomings in the concept of high-quality development and still prioritize economic growth as their primary goal. The backwardness of development concepts is the reason for the overall lag in the development of urban agglomerations and the low quality of development.

Secondly, further in-depth research is needed on the measurement criteria for the innovation capability and openness level of urban agglomerations. Scholars have discussed these two dimensions and selected indicators that vary greatly, possibly due to limitations in data availability. But the results calculated in this way lack unified guidance and can only be justified within their own system.

Thirdly, as a strategic support for the high-quality development of urban agglomerations, urban agglomerations should develop more suitable dynamic evaluation indicators. In recent years, the Outline of China's 14th Five Year Plan has clearly proposed "developing and strengthening urban agglomerations and metropolitan areas" [55] focusing on the comprehensive effects of China's urban agglomeration and metropolitan area construction, cultivating growth poles and power sources for high-quality development, which will become a research direction in the future.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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