China Sustainable Development Indicator System

2021 Report

COLUMBIA CLIMATE SCHOOL
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China Sustainable Development Indicator System: 2021 Report

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The Earth Institute's Research Program on Sustainability Policy and Management, part of the Columbia Climate School, is focused on building a research base to apply to real-world sustainability issues, with an emphasis on analysis at the organizational level. We seek to address the fundamental challenges facing professionals and policy makers implementing sustainability strategies and provide the data necessary for decision making. Our research cuts across sectors, geographies, and industries.

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China Sustainable Development Indicator System (CSDIS)

Columbia University's Earth Institute and the China Center for International Economic Exchanges have developed the **China Sustainable Development Indicator System (CSDIS)**, a ranking system that tracks the sustainability progress of the country and compares the sustainability performance of Chinese cities and provinces. Utilizing an integrated approach, which categorizes indicators by subject area while also considering the causal relationship among the fields, we designed a robust new sustainability metrics framework and two indicator sets that cover the economic, environmental, social and institutional aspects of sustainability for Chinese cities and provinces. The research team incorporated research and comparative analyses of existing frameworks in China and internationally, developing a framework comprised of five subject areas: 1) Economic Development, 2) Social Welfare and Livelihood, 3) Environmental Resources, 4) Consumption and Emissions, and 5) Environmental Management. Based on a total of 22 indicators for cities and 26 indicators for provinces within these categories, our report ranks 100 Chinese cities and 30 provinces on their sustainability performance and tracks the sustainability performance of China as a whole. We also conduct sustainability comparison studies between Chinese cities with other large international cities. Our goal is that this framework and these rankings will be used to help Chinese cities and provinces progress towards their sustainable development goals by showing how each individual entity performs in various realms of sustainability compared to others and, by encouraging healthy competition and development that is not solely focused on GDP growth, help create an overall more sustainable China.

Background

Sustainability has emerged as means of addressing interconnected and complex global issues, and sustainable development is now a widely-recognized goal among nations across the globe. Reducing emissions and promoting global environmental sustainability is a shared responsibility of all countries, but China's contribution is particularly important. Although the Chinese government has worked to establish a sustainable strategy for its development, the sheer pace of China's economic growth makes it a difficult task, and a standardized system to measure and mange sustainability is needed in order to seriously assess progress. To meet this need, a new sustainability indicator framework contingent on China's unique economic development status is necessary.

Although the concept of sustainable development has been widely accepted in China, the use of sustainability metrics is still in an early stage. Similar to what we see in the U.S., due to the lack of a clear definition of the number and applicability of the sustainability metrics that should be used, Chinese governments and private entities have a great deal of flexibility in choosing indicators, which impedes meaningful comparison on sustainability performance. This also makes it harder for decision makers to evaluate and compare the sustainability performance of different organizations, and to provide clear and standardized policy directives. A standardized and mature set of sustainability indicators and a governing framework for measuring those metrics are therefore needed in order to track, measure, and report on the progress of China's sustainable development and economic transformation. Consensus building is the hallmark of Chinese-style decision-making, making it important to achieve standardization in a country with a strong governmental and hierarchical culture.

Since 2020, COVID-19 has had a hugely devastating influence on global sustainable development, creating poverty in many states, creating economic losses, and revealing the shortcomings of global governance. This has also uncovered the need to work together and the idea of a shared community. In September, 2020, President Xi discussed the need to lower carbon dioxide emissions during the 75th United Nations General Assembly Meeting, promising that China will do whatever it takes

to significantly lower emissions by 2030 and approach carbon neutrality by 2060. The COVID-19 pandemic has reminded people that we need a more inclusive, resilient, and green economic recovery for a higher level of sustainable development. In order to achieve these goals, we need to better and more efficiently apply data analysis to global governance, national governance, and further the promotion of economic and social development. A comprehensive evaluation system for sustainable development that is consistent with global standards and applicable to domestic conditions is crucial for China. It is conductive to the implementation of the newly established Chinese development concepts of "innovative, coordinated, green, and open," and it is beneficial to supplement and improve the sustainable economic evaluation system according to GDP scale.

Since 2015, Columbia University's Earth Institute and the China Center for International Economic Exchanges have developed the China Sustainable Development Indicator System (CSDIS), a ranking system that tracks the sustainability progress of the country and compares the sustainability performance of Chinese cities and provinces. Utilizing an integrated approach, which categorizes indicators by subject area while also considering the causal relationship among the fields, we designed a robust new sustainability metrics framework and three indicator sets that cover the economic, environmental, social, and institutional aspects of sustainability for 100 Chinese cities, 30 provinces, and the country as a whole. We also conduct sustainability comparison studies between Chinese cities with other large international cities.

Our goal is that this framework will assist Chinese leadership in evaluating and monitoring progress towards their sustainable development agenda. Meanwhile, provincial and city rankings can be used by local governments to compare the effectiveness of their sustainability management with other jurisdictions and over time, so as to identify persistent gaps or best practices. Sustainability indicators will both guide the management of the Chinese economy and incentivize the implementation of environmental policies. These sustainability indicators must be able to define quality, evaluate both the impacts and challenges of sustainability policies, and allow for comparisons to be made across municipalities, regions, and cities, which play an integral role in reaching and achieving national environmental sustainability goals.

Framework, Methodology, and Data Collection

To develop the CSDIS, we began by conducting an extensive review of existing major international frameworks for aggregating multi-category sustainability performance indicators proposed by selected multilateral agencies, governmental organizations, and private corporations. Our methodology and underlying principles were designed to address different issues by developing an innovative indicator system that takes into account the volatility of data across time and geographic location, which most existing urban sustainability indicator systems do not. The five first-level categories we look at through this CSDIS framework are economic development, social welfare & livelihood, environmental resources, consumption and emissions, and environmental management. Since it's difficult to obtain some primary data, we applied different data analysis and weighting for the country-level (table-one), province-level (table-two), and city-level (table-three) analysis. Cities develop rapidly depend on their own policies and population expansion; therefore, it is even more important for us to study about the sustainable development structure for cities. Compared to cities, provinces are larger, covering different types of cities and area, and containing more diverse biodiversity. As a result, province-level analysis would be divided into more sub-categories. The indicators were gathered from different Chinese institutions and organizations, and the data we used for analysis are driven from different Chinese Index systems. In addition, we worked with AliResearch as well as Amap to obtain data and apply clarification on "Urban Road Area per Capita + Peak Congestion Delay Index."

Table 1: CSDIS Country Indicator Set and Weighting

First-Level Indicator	Second-Level Indicator	Third-Level Indicator	Weight
Economic Development (25%)	Innovation	Contribution Rate of Scientific and Technological Progress	2.08%
		R&D Spending per GDP	2.08%
		Intellectual Property per 10,000 People	2.08%
	Structural Update	High-Technology Industry Income to Industrial Value Ratio	3.13%
		Digital Economy Core Industry to GDP Ratio*	0.00%
		Digital Economy to GDP Ratio	3.13%
	Stability	GDP Growth %	2.08%
		Total Labor Productivity	2.08%
		Proportion of Working Age Population to Total Population	2.08%
	Development	Purchasing Power Parity	3.13%
		Total Import and Export per Capita	3.13%
Social Welfare & Livelihood (15%)	Education & Culture	Education to GDP Ratio	1.25%
		Average Education of Working Population	1.25%
		Public Cultural Institutions per 10,000 People	1.25%
	Social Security	Basic Social Security Coverage	1.88%
		Social Security and Employment Expenditure per Capita	1.88%
	Public Health	Average Life Expectancy	0.94%
		Government Health Expenditure per Capita	0.94%
		Incidents of Notifiable Infectious Diseases in Categories A and B	0.94%
		Health Technicians per 1,000 People	0.94%
	Equality	Poverty Rate	1.25%
		Disposable Income Ratio of Urban and Rural Residents	1.25%
		Gini Coefficient	1.25%
Environmental Resources (10%)	Land Resources	Carbon per Capita*	0.00%
		Forest Area per Capita	0.83%
		Arable Land per Capita	0.83%
		Wetland Area per Capita	0.83%
		Grassland Area per Capita	0.83%
	Water Resources	Water Resource per Capita	1.67%
		Proportion of Water Quality Sections in the First, Second, and Third Categories of River Basins	1.67%
	Air	Proportion of Days with Air Quality at Perfect Level and Above	3.33%
	Biodiversity	Biodiversity Level*	0.00%
Consumption and Emissions (25%)	Land Consumption	Added Value of Secondary and Tertiary Industries per Unit Construction Land	4.17%
	Water Consumption	Water Consumption per Unit of Industrial Added Value	4.17%
	Energy Consumption	Energy Consumption per Unit of Industrial Added Value	4.17%
	Main Pollutant Emissions	Chemical Oxygen Demand Emissions per Unit of GDP	1.04%
		Ammonia Nitrogen Emissions per Unit of GDP	1.04%
		SO2 Emissions per Unit of GDP	1.04%
		Nitrogen Oxides Emissions per Unit of GDP	1.04%

	Industrial Hazardous Waste Production	Industrial Hazardous Waste per Unit of GDP	4.17%
	Greenhouse Gas Emission	CO2 Emissions per Unit of GDP	2.08%
		Renewable Energy Consumption Accounts for the Proportion of Electricity Consumption in the Society	2.08%
Environmental Management (25%)	Governance Input	Ecological Construction Investment to GDP Ratio*	0.00%
		Fiscal Expenditure on Energy Conservation and Environmental Protection to GDP Percentage	2.08%
		Investment in Environmental Pollution Control to Investment in Fixed Assets Ratio	2.08%
	Wastewater Utilization Rate	Reclaimed Water Utilization Rate*	0.00%
		Urban Sewage Treatment Rate	4.17%
	Solid Waste Treatment	Comprehensive Utilization Rate of General Industrial Solid Waste	4.17%
	Hazardous Waste Treatment	Hazardous Waste Disposal Rate	4.17%
	Waste Gas Treatment	Disposal Rate*	0.00%
	Trash Treatment	Harmless Treatment Rate of Domestic Waste	4.17%
	Reduction of Greenhouse Gas Emissions	Annual Rate of Decline in Carbon Intensity	2.08%
		Annual Rate of Decline in Energy Intensity	2.08%

**%: These indicators are included in the country-level sustainability framework, but data are not currently available. Therefore, 0.00% weights are currently assigned to them, and will be updated once specific data are available in the future.*

Table 2: CSDIS Provincial Indicator Set and Weighting

First-Level Indicator	Second-Level Indicator	Third-Level Indicator	Weight
Economic Development (25%)	Innovation	Contribution Rate of Scientific and Technological Progress*	0.00%
		R&D Spending per GDP	3.75%
		Intellectual Property per 10,000 People	3.75%
	Structural Update	High-Technology Industry Income to Industrial Value Ratio	2.50%
		Digital Economy Core Industry to GDP Ratio*	0.00%
		Digital Economy to GDP Ratio	2.50%
	Stability	GDP Growth %	2.08%
		Total Labor Productivity	2.08%
		Proportion of Working Age Population to Total Population	2.08%
	Development	Purchasing Power Parity	3.13%
		Total Import and Export per Capita	3.13%

Social Welfare & Livelihood (15%)	Education & Culture	Education to GDP Ratio	1.25%
		Average Education of Working Population	1.25%
		Public Cultural Institutions per 10,000 People	1.25%
	Social Security	Basic Social Security Coverage	1.88%
		Social Security and Employment Expenditure per Capita	1.88%
	Public Health	Average Life Expectancy*	0.00%
		Government Health Expenditure per Capita	1.25%
		Incidents of Notifiable Infectious Diseases in Categories A and B	1.25%
		Health Technicians per Thousand People	1.25%
	Equality	Poverty Rate	1.88%
		Disposable Income Ratio of Urban and Rural Residents	1.88%
		Gini Coefficient*	0.00%
Environmental Resources (10%)	Land Resources	Carbon per Capita*	0.00%
		Forest Area per Capita	0.83%
		Arable Land per Capita	0.83%
		Wetland Area per Capita	0.83%
		Grassland Area per Capita	0.83%
	Water Resources	Water Resource per Capita	1.67%
		Proportion of Water Quality Sections in the First, Second, and Third Categories of River Basins	1.67%
	Air	Proportion of Days with Air Quality at Perfect Level and Above	3.33%
	Biodiversity	Biodiversity Level*	0.00%
Consumption and Emissions (25%)	Land Consumption	Added Value of Secondary and Tertiary Industries per Unit Construction Land	4.00%
	Water Consumption	Water Consumption per Unit of Industrial Added Value	4.00%
	Energy Consumption	Energy Consumption per Unit of Industrial Added Value	4.00%
	Main Pollutant Emissions	Chemical Oxygen Demand Emissions per Unit of GDP	1.00%
		Ammonia Nitrogen Emissions per Unit of GDP	1.00%
		SO2 Emissions per Unit of GDP	1.00%
		Nitrogen Oxides Emissions per Unit of GDP	1.00%
	Industrial Hazardous Waste Production	Industrial Hazardous Waste per Unit of GDP	4.00%
	Greenhouse Gas Emission	CO2 Emissions per Unit of GDP*	0.00%
		Renewable Energy Consumption Accounts for the Proportion of Electricity Consumption in the Society	4.00%
Environmental Management (25%)	Governance Input	Ecological Construction Investment to GDP Ratio*	0.00%
		Fiscal Expenditure on Energy Conservation and Environmental Protection to GDP Percentage	2.50%
		Investment in Environmental Pollution Control to Investment in Fixed Assets Ratio	2.50%
	Wastewater Utilization Rate	Reclaimed Water Utilization Rate*	0.00%
		Urban Sewage Treatment Rate	5.00%

	Solid Waste Treatment	Comprehensive Utilization Rate of General Industrial Solid Waste	5.00%
	Hazardous Waste Treatment	Hazardous Waste Disposal Rate	5.00%
	Waste Gas Treatment	Disposal Rate*	0.00%
	Trash Treatment	Harmless Treatment Rate of Domestic Waste	5.00%
	Reduction of Greenhouse Gas Emissions	Annual Rate of Decline in Carbon Intensity*	0.00%
		Annual Rate of Decline in Energy Intensity	2.50%

**%: These indicators are included in the country-level sustainability framework, but data are not currently available. Therefore, 0.00% weights are currently assigned to them, and will be updated once specific data are available in the future.*

Table 3: CSDIS City Indicator Set and Weighting

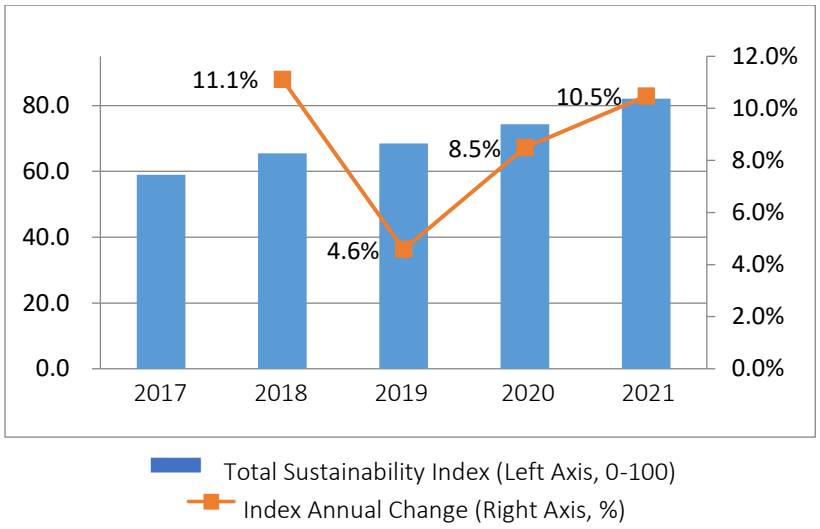
Category	Number	Indicator	Weight
Economic Development (21.66%)	1	GDP p.c.	7.21%
	2	Service Sector Added Value %	4.85%
	3	Unemployment %	3.64%
	4	Science and Technology Expenditure %	3.92%
	5	GDP Growth %	2.04%
Social Welfare & Livelihood (31.54%)	6	Housing-to-income Ratio	4.91%
	7	Physician Availability	5.74%
	8	Number of Beds per Thousand People in Medical and Health Institutions	4.99%
	9	Social Security Expenditure p.c.	3.92%
	10	Teacher Student Ratio in Middle and Elementary Schools	4.13%
	11	Urban Road Area per Capita + Peak Congestion Delay Index	3.27%
	12	Proportion of Residents Between Age 0 to 14	4.49%
Environmental Resources (15.05%)	13	Water Resources p.c.	4.54%
	14	Urban Green Space p.c.	6.24%
	15	Days Meeting Air Quality Index Level 2	4.27%
Consumption and Emissions (23.78%)	16	Water Consumption per Unit of GDP	7.22%
	17	Energy Consumption per Unit of GDP	4.88%
	18	Added Value of Secondary and Tertiary Industries per Unit Built-Up Land	5.78%
	19	Sulfur Dioxide Emissions per ¥ Value Added	3.61%
	20	Wastewater Emissions per ¥ Value Added	2.29%
Environmental Management (8.06%)	21	Centralized Treatment Rate of Sewage Plant	2.34%
	22	Fiscal Expenditure on Energy Conservation and Environmental Consumption to GDP Percentage	2.61%
	23	Comprehensive Utilization Rate of General Industrial Solid Waste	2.16%
	24	Harmless Treatment Rate of Domestic Waste	0.95%

**%: percent, p.c.: per capita, ¥: renminbi/yuan*

CSDIS Country-Level Data Analysis

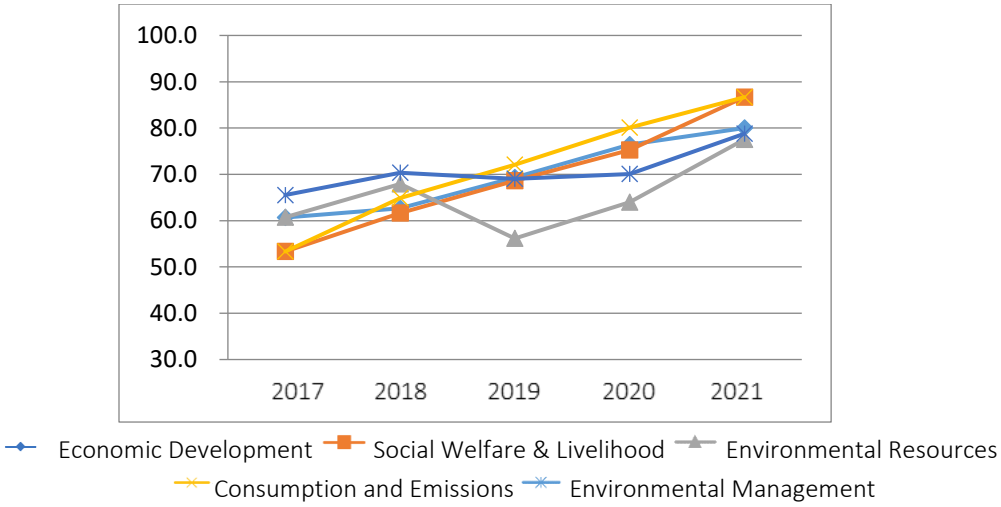
By analyzing the country-level data, we a stable improvement on sustainability development from 2017 to 2021. Country-wide, economic development has grown, and social welfare & livelihood has developed rapidly. The consumption and emissions category has also improved greatly. At the same time, work on improving environmental resources is still needed, as well as environmental management. More policies are needed for controlling emissions and developing stricter rules on environmental sustainability.

From graph 1 below, we can see that overall sustainability has steadily improved from 2017 to 2021, showing us that policies applied to all five categories have worked well. In 2017, the index for total sustainable development was 59.0, and though it slowed down in 2019, the number increased 39% to 82.1 in 2021. Among all five categories, environmental resources and environmental management still require more attention.



Graph 1: China Sustainable Development from 2017 to 2021

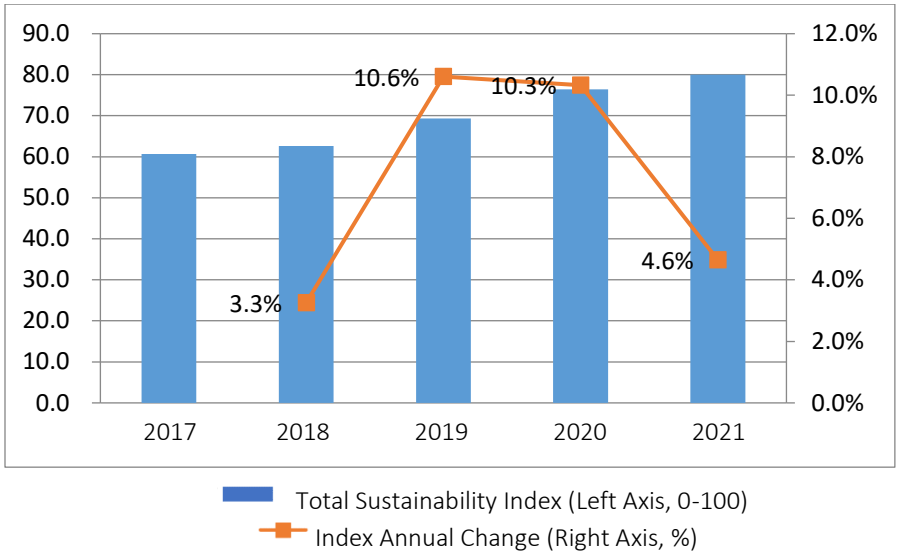
Looking at the first-level indicator graph (graph 2), we can see that from 2017 to 2021, "social welfare & livelihood" and "consumption and emissions" grew the fastest, followed by "economic development." Both "environmental resources" and "environmental management" dropped in 2019 but then increased.



Graph 2: CSDIS First-Level Indicator Development from 2017 to 2021

Country Analysis by Major Component of Sustainable Development

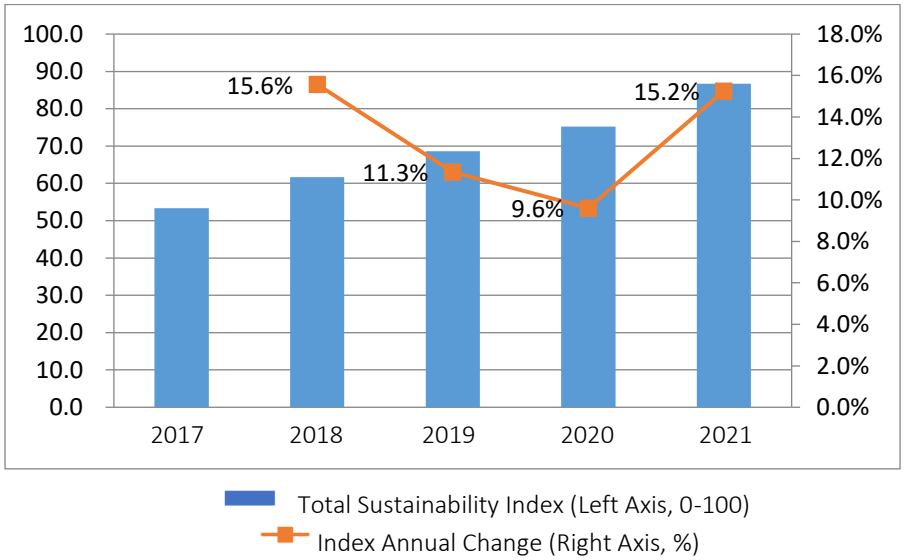
Economic Development



Graph 3: China's "Economic Development" from 2017 to 2021

In the "economic development" category, the Total Sustainability Index increased from 60.7 in 2017 to 80.0 in 2021. The average annual increase rate is over 3%, and the increase rate from 2018 to 2019 and 2019 to 2020 were both over 10%. Because of the slowdown of GDP and the increase amount of elder population in 2021, "economic development" slowed down as well. In general, there has been a huge jump in economic development from 2017 to 2021.

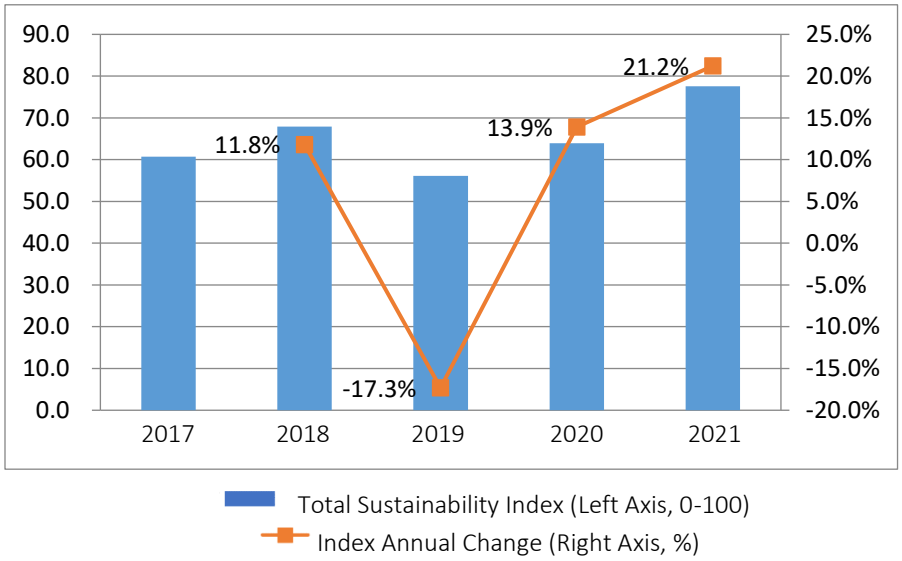
Social Welfare & Livelihood



Graph 4: China's "Social Welfare & Livelihood" from 2017 to 2021

"Social Welfare & Livelihood" has had an average annual increase rate of 9%. The "Social Welfare & Livelihood" Total Sustainability Index was 53.3 in 2017, increasing to 86.7 in 2021. In general, this category has improved greatly from 2017 to 2021, especially in areas such as education and culture, social security, public health, and equality.

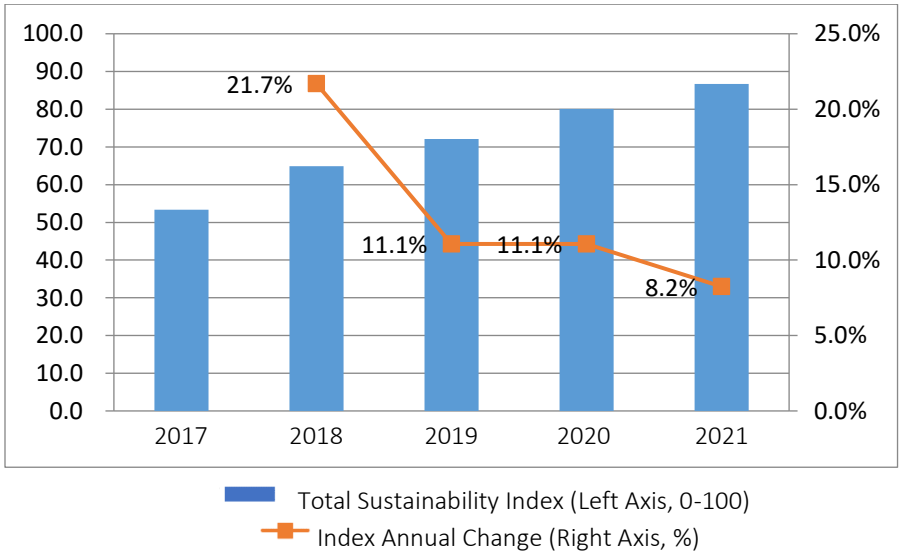
Environmental Resources



Graph 5: China's "Environmental Resources" from 2017 to 2021

The "Environmental Resources" category is greatly affected by climate change. There was a decrease in "Environmental Resources" in 2019, whereas all other years have an average annual increase rate of over 11%. In 2021, there was an increase of 21.2%. The number increased from 60.7 in 2017 to 77.5 in 2021. In general, there has been an improvement on "Environmental Resources" over this time period.

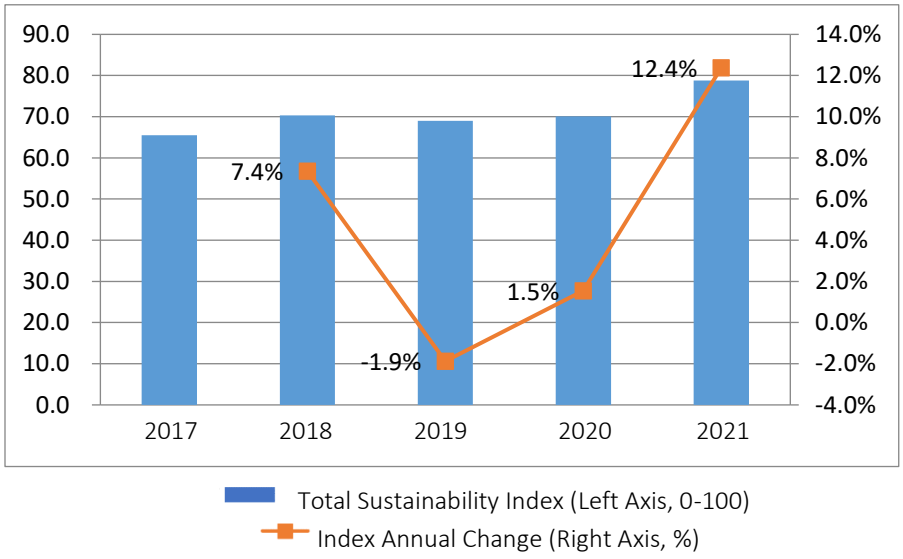
Consumption & Emissions



Graph 6: China's "Consumption & Emissions" from 2017 to 2021

The performance of "Consumption and Emissions" has been continuously improving from 2017 to 2021. There is a 62.5% increase in the performance index during this period. However, this increase has also been slowing down in the past five years, as indicated by the dwindling annual changes, with the most recent year scoring only 8.2% better than the previous year. While there has been great control on consumption and emissions, there's still a long way to go in this category.

Environmental Management



Graph 7: China's "Environmental Management" from 2017 to 2021

Despite a significant drop in the index annual change of "Environmental Management" in 2019, there has been a steady increase from 2017 to 2021. There was a 12.4% increase of this category in 2021 to 78.8. In general, there has been stable development of "Environmental Management," and with more policies on controlling pollution expanding throughout China, we expect to see higher increases in this category in the future.

CSDIS Province-Level Data Analysis

Province-Level Ranking

Our research group calculated and ranked 30 Chinese provinces for the general CSDIS ranking (excluding Hong Kong, Macau, and Taiwan; also excluding Tibet because of lack of data). Our rankings reveal that the centrally administered municipalities and coastal provinces in the east and south rank higher in sustainability performance. The top ten are Beijing, Shanghai, Zhejiang, Guangdong, Tianjin, Fujian, Jiangsu, Hubei, Chongqing, and Sichuan. Beijing, Shanghai, Zhejiang, Guangdong, and Tianjin rank high on economic development, social welfare & livelihood, consumption and emissions, and environmental management, but low on environmental resources. Beijing, Shanghai, and Zhejiang, three eastern provinces rank top three. Chongqing and Sichuan are the two western provinces that rank top ten. Hubei is the only top-ten province in the middle, and no province from the northeastern gets into top ten list.

Table 4: China Sustainable Development Indicator System (CSDIS) Province-Level Ranking

Province	2020 Ranking	2021 Ranking
Beijing	1	1
Shanghai	2	2
Zhejiang	3	3
Guangdong	5	4
Tianjin	15	5
Fujian	11	6
Jiangsu	4	7
Hubei	7	8
Chongqing	8	9
Sichuan	21	10
Hainan	19	11
Hunan	12	12
Jiangxi	13	13
Anhui	6	14
Shaanxi	22	15
Shandong	9	16
Yunnan	17	17
Henan	10	18
Hebei	16	19
Qinghai	28	20
Guizhou	14	21
Liaoning	23	22
Gansu	24	23
Guangxi	18	24
Shanxi	25	25
Inner Mongolia	20	26
Heilongjiang	30	27
Jilin	29	28
Xinjiang	27	29
Ningxia	26	30

Provincial Ranking by Major Component of Sustainable Development

Economic Development

In 2021, the top ten provinces in economic development are: Beijing, Shanghai, Guangdong, Tianjin, Jiangsu, Fujian, Zhejiang, Chongqing, Hubei, and Jiangxi. Provinces that rank towards the end are Xinjiang, Jilin, and Guangxi.

Beijing has been pushing a structural change in its economic development, focusing on building an elite economic structure, ranking high on “R&D Expenditure %,” “Intellectual Property per 10,000 People,” “High-Technology Industry Income to Industrial Value Ratio” and more. At the same time, Shanghai developed its free-trade zone, ranking top on “Intellectual Property per 10,000 People”, and on its development and openness. In addition, Guangdong is the No. 1 GDP province in China, ranking high on “Total Import and Export per Capita”, and “High-Technology Industry Income to Industrial Value Ratio”.

Social Welfare & Livelihood

In 2021, the top ten provinces on social welfare and livelihood indicator are: Beijing, Shanghai, Qinghai, Tianjin, Zhejiang, Chongqing, Liaoning, Jilin, Heilongjiang, and Jiangsu. Provinces that rank towards the end are Gansu, Guangxi, and Yunnan.

This year, the whole country has been working on developing social welfare, and all provinces have improved from the previous year. Beijing ranks high on "Average Education of Working Population," "Basic Social Security Coverage," "Governance Health per Capital" and more. Shanghai ranks second in "Average Education of Working Population." Zhejiang ranks second in "Health Technicians per 1,000 People."

Provinces like Gansu, Guizhou, and Yunnan rank behind on "Disposable Income Ratio of Urban and Rural Residents," suggesting the need for reducing this disparity.

Environmental Resources

In 2021, the top ten provinces on environmental resources are: Qinghai, Fujian, Jiangxi, Guizhou, Hainan, Guangxi, Yunnan, Sichuan, Zhejiang, and Hunan. Provinces that rank towards the end are Tianjin, Henan, and Shandong.

Natural and environmental resources are always considered precious elements of the country. With the idea of green and ecological development spread across China, more and more provinces are working to improve the air quality and water resources per capita.

Qinghai ranks high on "Water Resource per Capita" and "Grassland Area per Capita". Fujian ranks top in "Forest Area per Capita". Provinces like Tianjin, Henan, and Shandong still need to improve their air quality.

Consumption and Emissions

In 2021, the top ten provinces on environmental resources are: Beijing, Fujian, Guangdong, Zhejiang, Sichuan, Yunnan, Chongqing, Henan, Shanghai, and Shaanxi. Provinces that rank towards the end are Ningxia, Inner Mongolia, and Xinjiang.

China has focused on reducing pollution, and many provinces developed new economic policies to control emissions. Energy efficiency has also been improved through technologies. However, the central and western regions still rely on resource-intensive industries, facing higher resource consumption and pollutant emissions, putting pressure on the sustainability of the ecological environment.

Beijing ranks high on "Water Consumption per Unit of Industrial Added Value," "Energy Consumption per Unity of Industrial Added Value," and more. Provinces like Ningxia, Inner Mongolia, and Xinjiang still need to improve.

Environmental Management

In 2021, the top ten provinces on environmental resources are: Beijing, Tianjin, Hubei, Zhejiang, Shandong, Shanghai, Hebei, Anhui, Jiangsu, and Hunan. Provinces that rank towards the end are Jilin, Heilongjiang, and Inner Mongolia.

The Beijing-Tianjin-Hebei region and the Yangtze River Delta regions have invested heavily in environmental protection and energy conservation, which is reflected in the improvement of various resource utilization rates and household waste harmless treatment rate. Overall, the level of provincial environmental governance has a certain relationship with its economic development level and urban management level, and it is also closely related to the industrial structure of each province. The central and western provinces that rely heavily on resource consumption face more difficulties, and even if investment is increased, it may not be able to obtain a higher level of environmental management.

CSDIS City Data Analysis

City Ranking

In the 2021 CSDIS City Ranking, the top ten cities are: Hangzhou, Zhuhai, Guangzhou, Beijing, Wuxi, Shenzhen, Suzhou, Wuhan, Nanjing, and Zhengzhou. Zhuhai was the number one CSDIS city for the past three years, and it's the first time Hangzhou has been the top-ranked city. As the most developed region in China, the Pearl River Delta region, Zhuhai and Hangzhou, as well as the capital Beijing, and other Yangtze River Delta region all rank high in the CSDIS.

Table five shows the city ranking in 2021. Compared to last year's ranking, Hangzhou has risen three places, becoming the top one CSDIS city, Guangzhou has risen two places, and Suzhou and Hangzhou all moved up to the top ten. Zhuhai and Beijing both dropped one place, and Qingdao, Shanghai, and Xiamen have dropped from the top 10 list. Chengdu, Nanning, Mianyang, Chenzhou, Tongren, and Zunyi all moved up by ten places or more, whereas Nantong, Tianjin, Xuzhou, Yangzhou, Baotou, and Huhehaote all dropped by ten places or more.

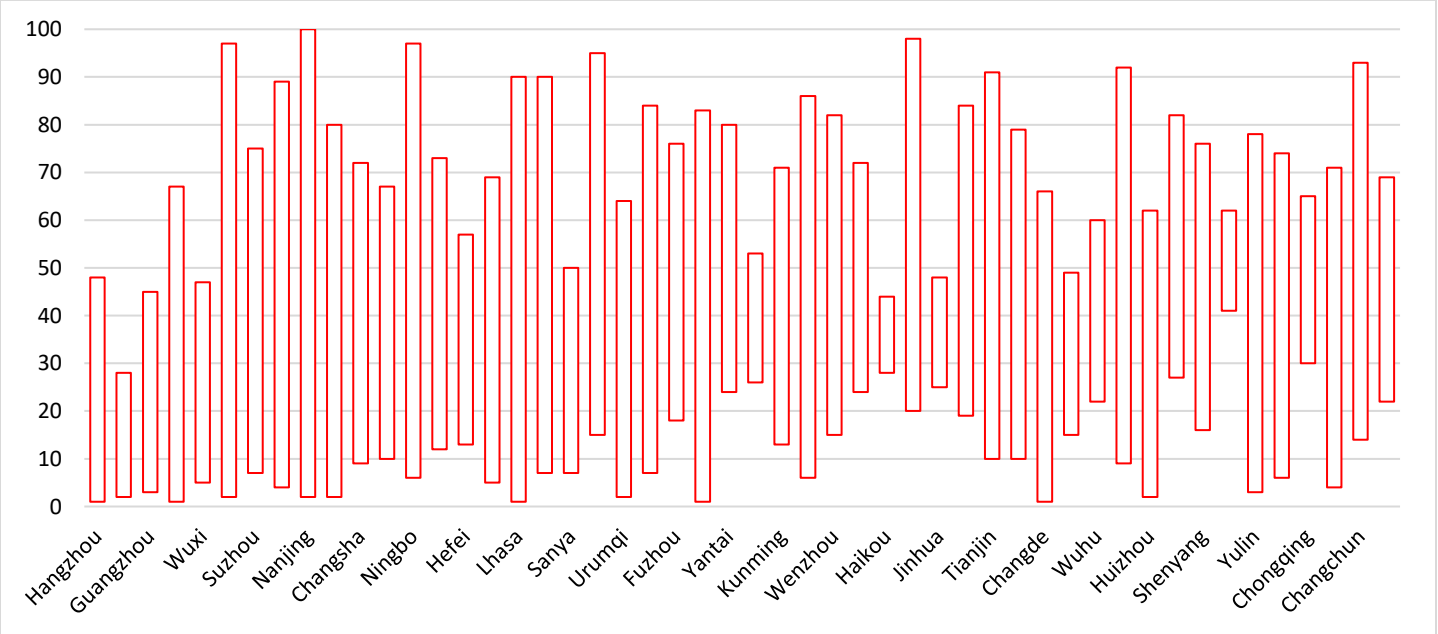
Table 5: China Sustainable Development Indicator System (CSDIS) City Ranking

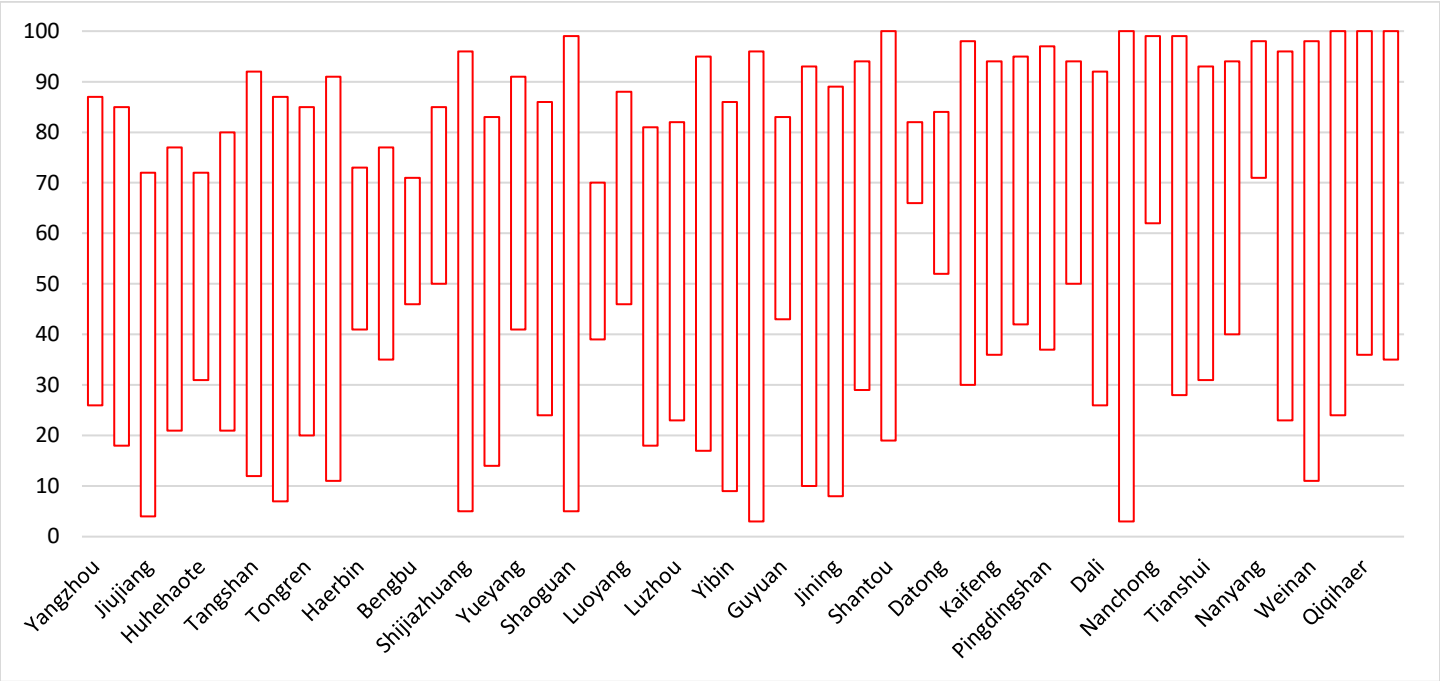
2021 Ranking	City	2021 Ranking	City
1	Hangzhou	51	Yangzhou
2	Zhuhai	52	Baotou
3	Guangzhou	53	Jiujiang
4	Beijing	54	Lanzhou
5	Wuxi	55	Hohhot
6	Shenzhen	56	Chenzhou
7	Suzhou	57	Tangshan
8	Wuhan	58	Huaihua
9	Nanjing	59	Tongren
10	Zhengzhou	60	Yinchuan
11	Changsha	61	Harbin
12	Qingdao	62	Zunyi
13	Ningbo	63	Bengbu
14	Xiamen	64	Xiangyang
15	Hefei	65	Shijiazhuang
16	Shanghai	66	Ganzhou
17	Lhasa	67	Yueyang
18	Jinan	68	Huangshi
19	Sanya	69	Shaoguan
20	Chengdu	70	Qinhuangdao
21	Urumqi	71	Luoyang
22	Xi'An	72	Guilin
23	Fuzhou	73	Luzhou
24	Taiyuan	74	Xuchang
25	Yantai	75	Yibin
26	Dalian	76	Mudanjiang
27	Kunming	77	Guyuan
28	Guiyang	78	Leshan
29	Wenzhou	79	Jining
30	Nanchang	80	Anqing
31	Haikou	81	Shantou
32	Nantong	82	Linqi

33	Jinhua	83	Datong
34	Karamay	84	Jinlin
35	Tianjin	85	Kaifeng
36	Yichang	86	Qujing
37	Changde	87	Pingdingshan
38	Nanning	88	Ganjiang
39	Wuhu	89	Dali
40	Quanzhou	90	Handan
41	Huizhou	91	Nanchong
42	Xuzhou	92	Baoding
43	Shenyang	93	Tianshui
44	Mianyang	94	Yinzhou
45	Yulin	95	Nanyang
46	Xining	96	Haidong
47	Chongqing	97	Weinan
48	Beihai	98	Dandong
49	Changchun	99	Qiqihar
50	Weifang	100	Yuncheng

City-Level Sustainable Development Balance

Looking at the five main categories, similar to the provincial ranking, city rankings also show an imbalance between the 100 cities. From Graph 8, the minimum and maximum numbers for the five main categories show that most cities still have a long way to go for developing a more sustainable system. Hangzhou ranks the first in overall CSDIS city ranking and places #4 in economic development and consumption and emissions; however, it's not performing well in environmental resources (#48) compared to Zhuhai. Both Zhuhai and Guangzhou have a rather balanced sustainable development in all five categories. Among the top ten list, Zhuhai is most balanced. While Beijing ranks #1 for economic development and consumption and emissions, it still ranks low on environmental resources (#61) and environmental management (#67). The city that is most imbalanced on its five-category measurement is Nanjing, which ranks #5 in the overall city ranking, and the most balanced city is Linyi, which ranks #82 in the overall city ranking.





Graph 8: CSDIS City Development Balance Graph

City Ranking by Major Component of Sustainable Development

Economic Development

The 2021 ranking on economic development indicator is similar to the one of 2020. The capital city, Beijing, has always been one of the leading cities on economic development indicators, as it was also the first on the ranking last year. It ranks top 10 on almost all sub-categories of economic development. Major cities along the eastern coast of China are performing the best on economic development. Nanjing's economic development is balanced, and has been doing better each year. Sanya and Ningbo get into the top 10 list for the first time. Sanya does well on promoting technology, and Ningbo does well on fiscal technology policy as well.

City	Ranking
Beijing	1
Nanjing	2
Guangdong	3
Hangzhou	4
Shenzhen	5
Wuhan	6
Sanya	7
Zhuhai	8
Suzhou	9
Ningbo	10

Social Welfare & Livelihood

In 2021, the top Chinese cities on social welfare are mostly inland cities. Besides Wuhan and Nanjing, none of the other cities overlap with the top cities on economic development. This suggests that the economic development and social livelihood are not synchronized, showing a rather surprising result given it is usually the economically advanced cities that have more resources at their disposal for social wealth provision and improvement. This also implies the imbalance development on economy and social welfare for different cities. Wuxi, Jinan, Nanjing, Changsha, and Yichang all ranks high on social welfare and livelihood.

City	Ranking
Taiyuan	1
Urumqi	2
Yulin	3
Wuhan	4
Wuxi	5
Xining	6
Jinan	7
Nanjing	8
Changsha	9
Yichang	10

Environmental Resources

Consistent with popular perception, cities with rich resources and better environmental performances are mainly concentrated in Guangdong, Guizhou, and other Southern China cities. These cities generally have better ecological environments and rich natural landscapes. Lhasa is ranked higher in terms of green space p.c. and water resources p.c. due to their sparsely populated population compared to other cities. Huizhou's environmental resource indicator is balanced, ranking just behind Lhasa. Huaihua, Shaoguan, and Mudanjiang all rank high on water resources p.c. It is the first time for Beihai and Leshan to get into the top ten list.

City	Ranking
Lhasa	1
Huizhou	2
Mudanjiang	3
Beihai	4
Shaoguan	5
Guiyang	6
Huaihua	7
Zhuhai	8
Quanzhou	9
Leshan	10

Consumption & Emissions

Similar to last year, cities with less resources pay more attention to minimizing the consumption and emissions, and developing pollution-control policies. This list is comprised of mainly major cities, which suggests that they are population centers with significant economic activities, yet these cities have also been leading in resource saving and emission control techniques. Most large cities have transferred out their heavy industries. Beijing does a great and balanced job on controlling its consumption and emission, and Shenzhen ranks right behind Beijing.

City	Ranking
Beijing	1
Shenzhen	2
Zhuhai	3
Hangzhou	4
Shanghai	5
Ningbo	6
Xi'An	7
Guangzhou	8
Suzhou	9
Qingdao	10

Environmental Management

The top ranked cities on environmental management have changed drastically than the list in 2020. Jiujiang, Shenzhen, Zhuhai, Jining, and Tianjin have jumped up to the top ten list, whereas Huizhou, Xuchang, Beihai, Tangshan, and Qinhuangdao has dropped out from the top ten list. The top ranked cities on environmental management include cities where natural scenery tourism is an important industry, such as Changde, and Jiujiang. Cities such as Zhengzhou, Handan, and Shijiazhuang have been the cities with greater environmental problems, especially in terms of air quality, but they have also tended to spend more resources and efforts on environmental conservation, ranking top on the environmental management indicators.

City	Ranking
Changde	1
Zhengzhou	2
Handan	3
Jiujiang	4
Shijiazhuang	5
Shenzhen	6
Zhuhai	7
Jining	8
Yibin	9
Tianjin	10

International City Comparison

International City Comparison Analysis

We compared the 100 Chinese cities with other international cities: New York, St. Paul, Paris, Barcelona, Singapore, and Hong Kong, China. Overall, Chinese cities perform well in economic development, with most mainland Chinese cities performing well in increasing GDP and reducing unemployment. However, Chinese cities perform worse than other

international cities in tertiary industry GDP ratio. In environmental resources category, the average green space per person is almost the same as "garden city" Singapore, with a number much higher than the other five international cities. However, this may result from different calculation methods of green space in each country or city; for example, some cities do not count empty land as green space. Chinese cities have similar numbers in social welfare and livelihood as other international cities. However, Chinese cities fall behind in the consumption and emissions category, especially in energy and water consumption, as well as air quality. At the same time, Chinese cities are similar with the international ones on environmental management.

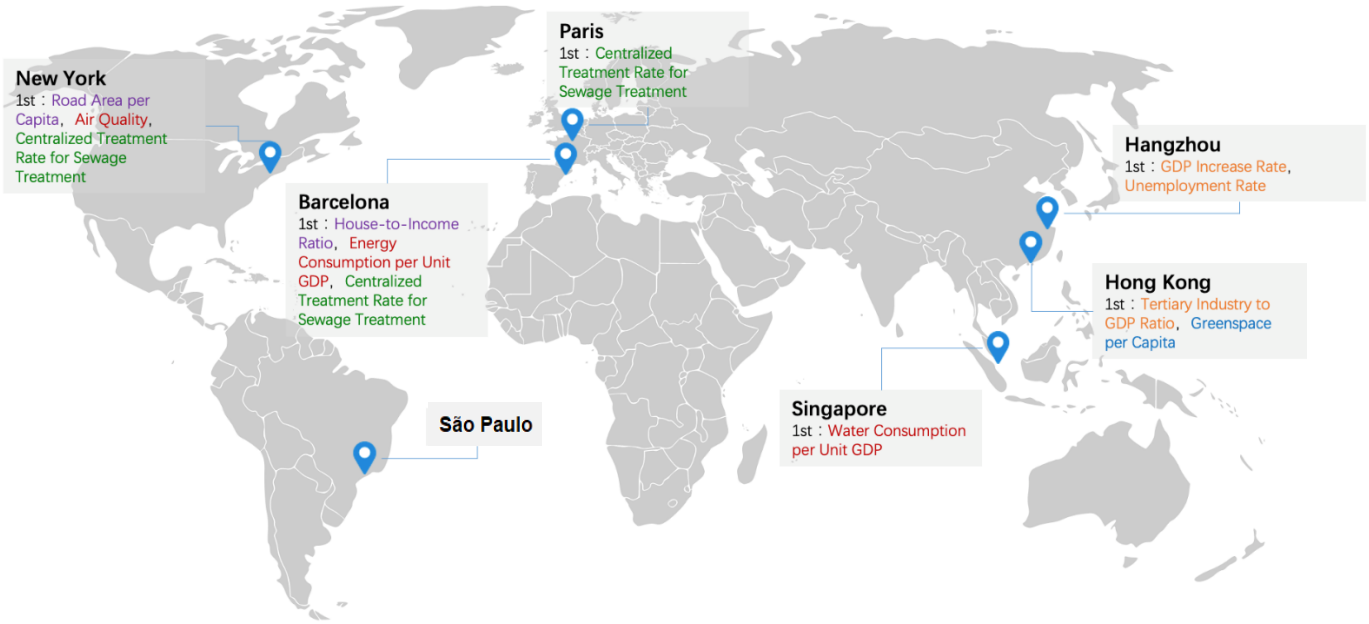


Figure 1: International City Comparison Map

In general, Chinese cities perform well in economic development, whereas the six international cities are more developed and perform better in consumption and emissions as well as environmental management. All cities perform rather equally on environmental resources and social welfare & livelihood.

Leading Cities in Major Components of Sustainable Development

Economic Development

- **GDP Increase Rate** 1st: Hangzhou
- **Tertiary Industry to GDP Ratio** 1st: Hong Kong
- **Unemployment Rate in Rural Areas** 1st: Hangzhou

Social Welfare & Livelihood

- **Road Area per Capita** 1st: New York
- **Price-to-Income Ratio** 1st: Barcelona

Environmental Resources

- **Urban Green Space per 10,000 People** 1st: Hong Kong

Consumption and Emissions

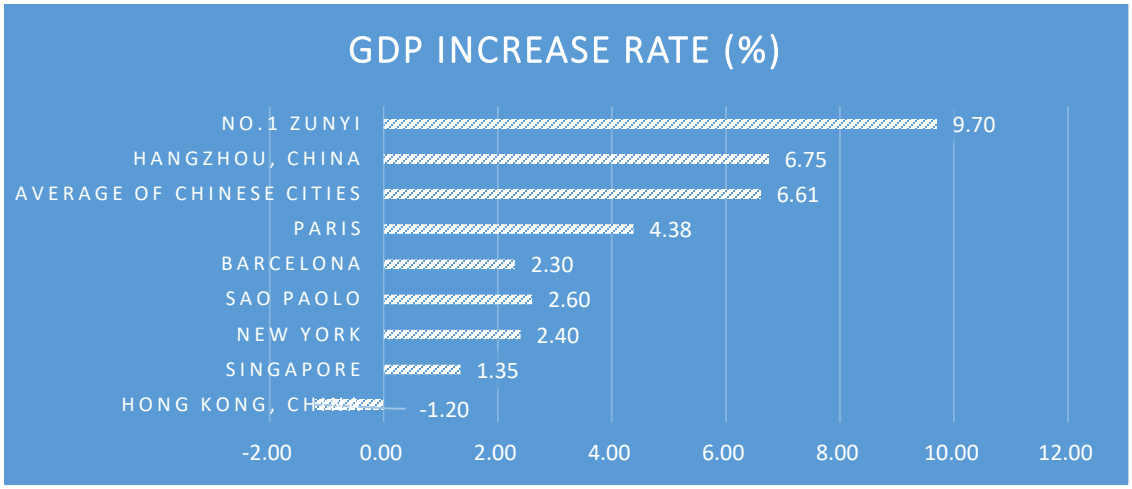
- **Water Consumption per GDP** 1st: Singapore
- **Energy Consumption per GDP** 1st: Barcelona
- **Air Quality** 1st: New York

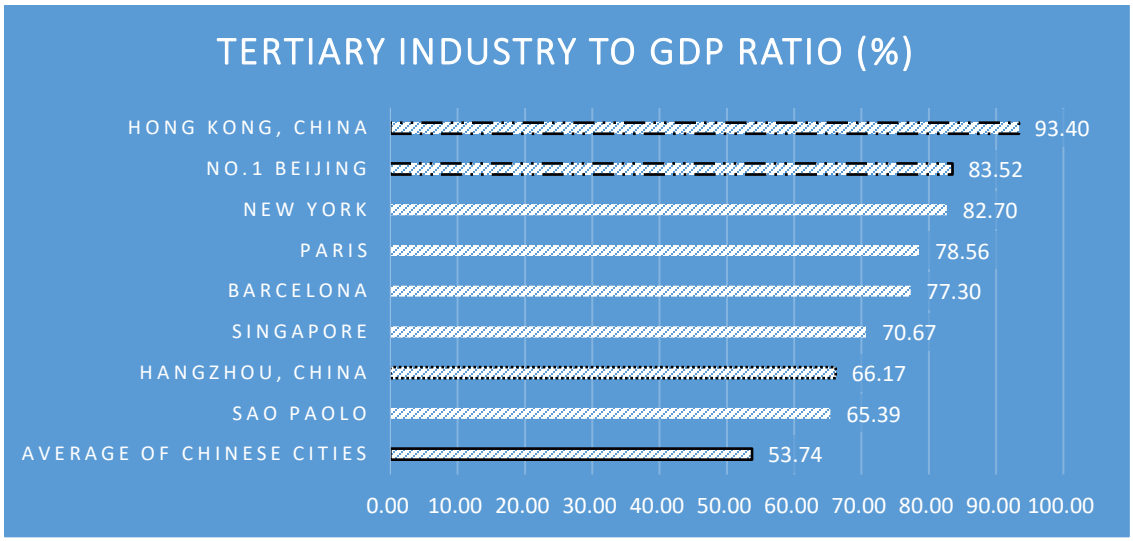
Environmental Management

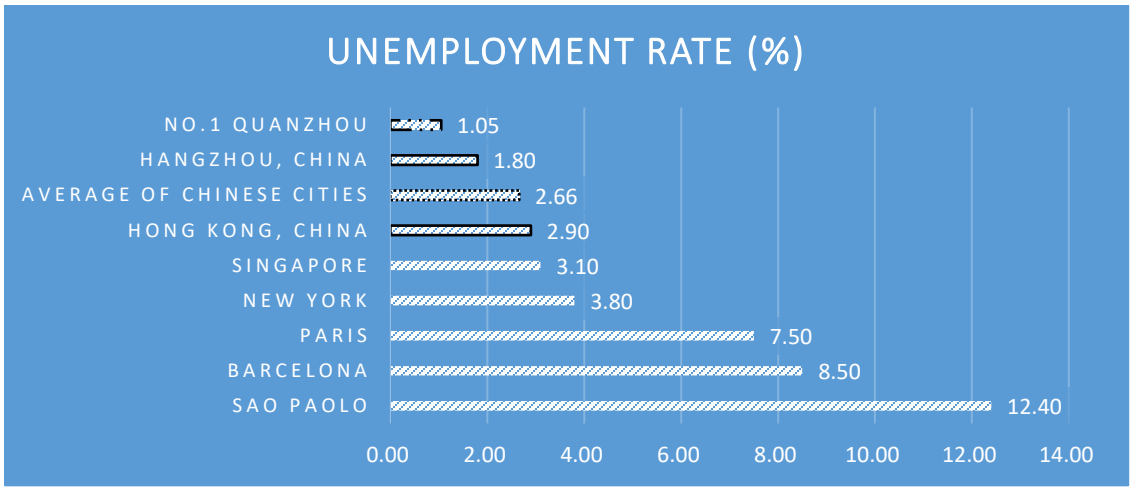
- **Centralized Treatement Rate of Sewage Treatment Plant** 1st: Barcelona, Paris, New York
- **Harmless Treatment Rate of Domestic Waste:** Most cities have reached 100%

Categorical Comparison

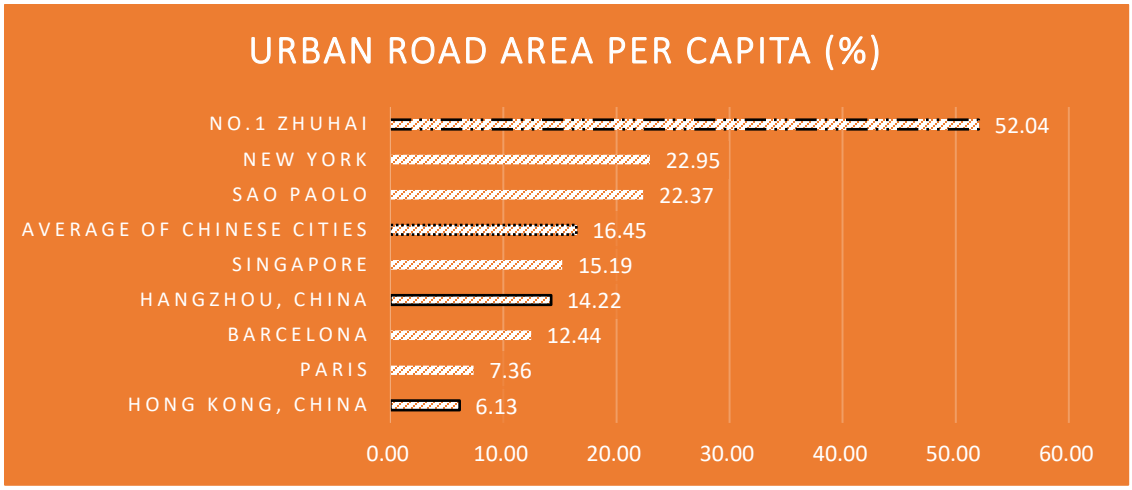
Economic Development

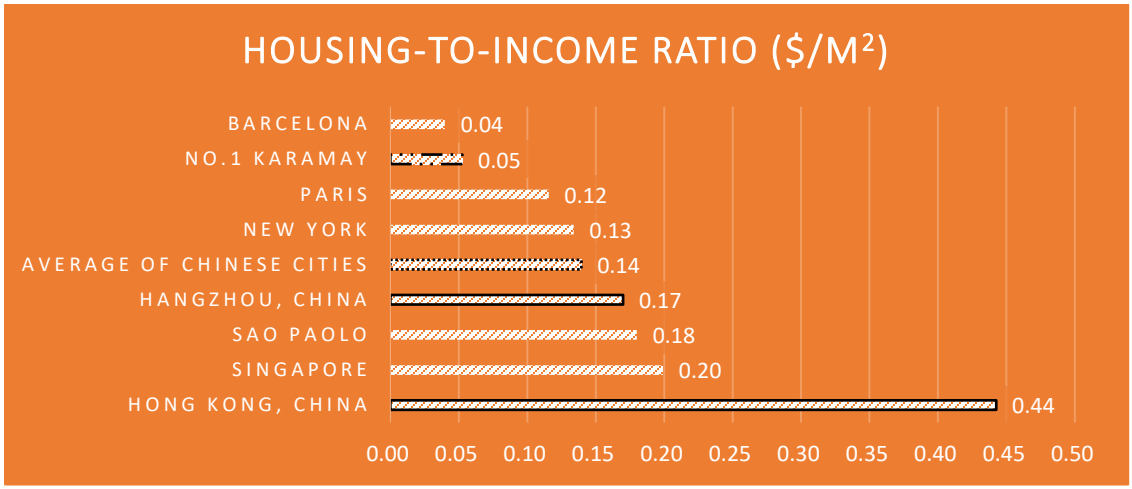




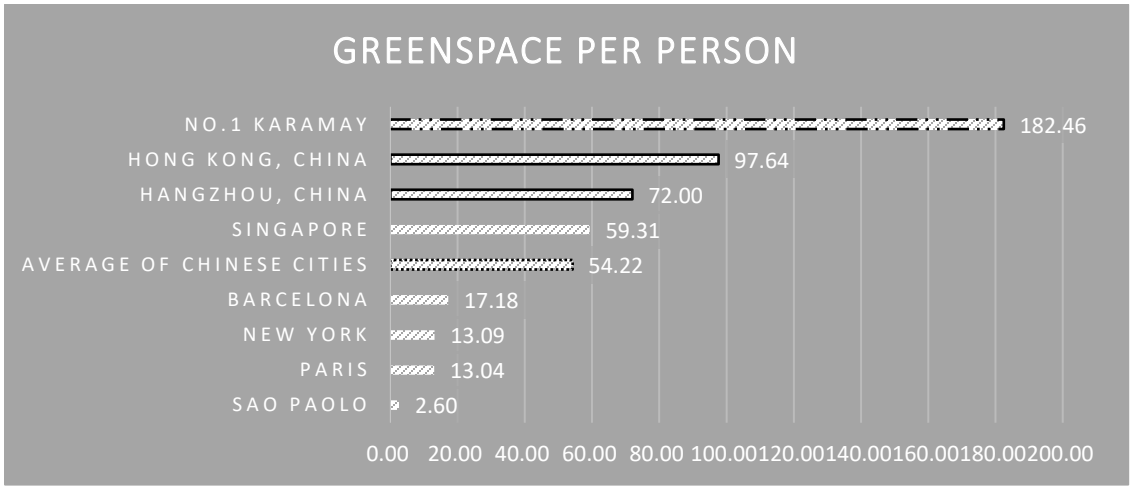


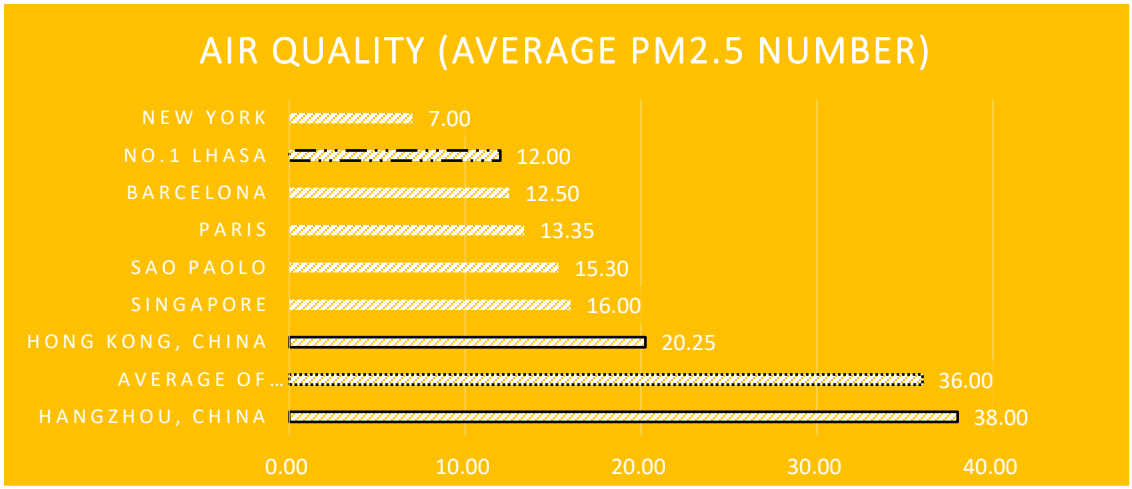
Social Welfare & Livelihood

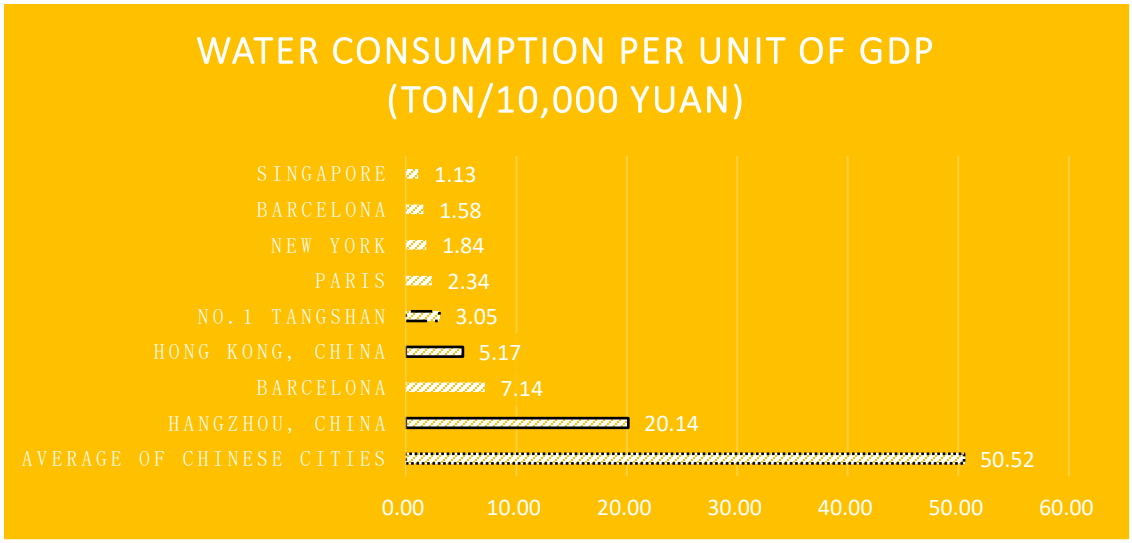


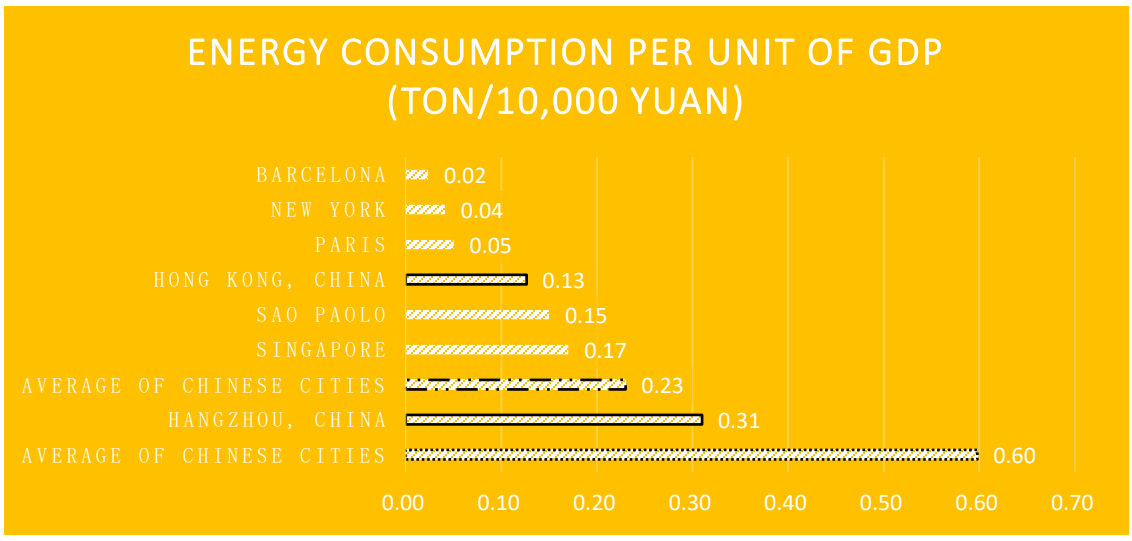


Environmental Resources

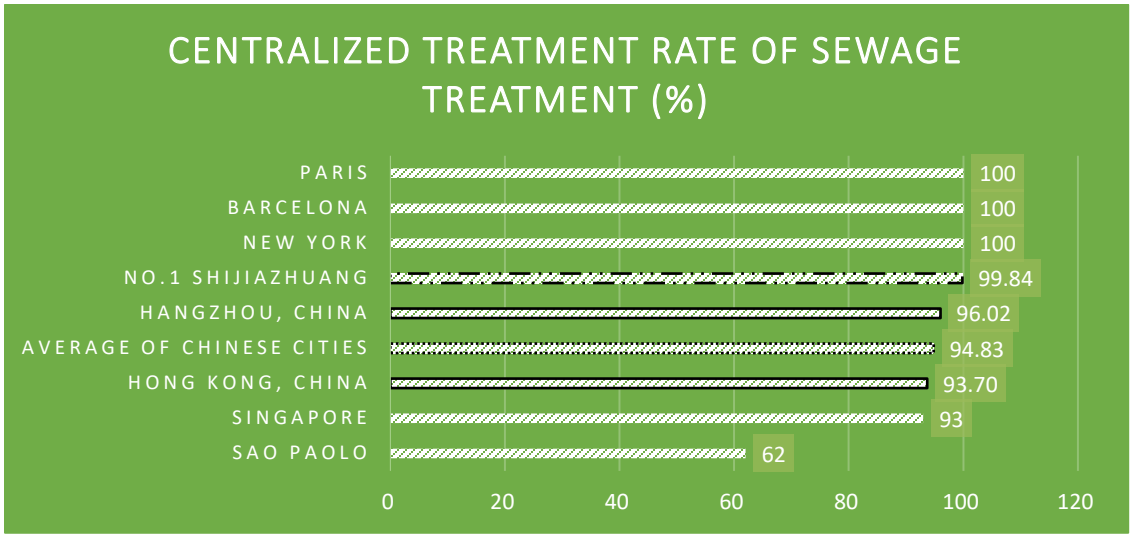


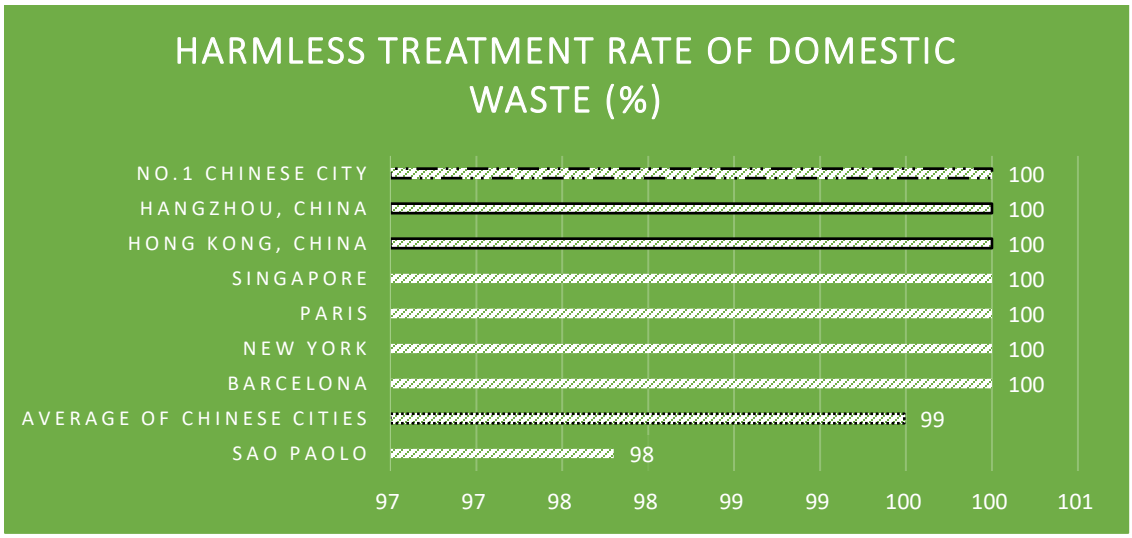

AIR QUALITY (AVERAGE PM2.5 NUMBER)
NEW YORK
NO.1 LHASA
BARCELONA
PARIS
SAO PAOLO
SINGAPORE
HONG KONG, CHINA
AVERAGE OF…
HANGZHOU, CHINA
7.00
12.00
12.50
13.35
15.30
16.00
20.25
36.00
38.00
0.00
10.00
20.00
30.00
40.00


WATER CONSUMPTION PER UNIT OF GDP
(TON/10,000 YUAN)
SINGAPORE
BARCELONA
NEW YORK
PARIS
NO.1 TANGSHAN
HONG KONG, CHINA
BARCELONA
HANGZHOU, CHINA
AVERAGE OF CHINESE CITIES
1.13
1.58
1.84
2.34
3.05
5.17
7.14
20.14
50.52
0.00
10.00
20.00
30.00
40.00
50.00
60.00


ENERGY CONSUMPTION PER UNIT OF GDP
(TON/10,000 YUAN)
BARCELONA
NEW YORK
PARIS
HONG KONG, CHINA
SAO PAOLO
SINGAPORE
AVERAGE OF CHINESE CITIES
HANGZHOU, CHINA
AVERAGE OF CHINESE CITIES
0.02
0.04
0.05
0.13
0.15
0.17
0.23
0.31
0.60
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70

Environmental Management





Conclusion

This publication has presented our China Sustainable Development Indicator System (CSDIS) and 2021 ranking results for 100 large and medium-sized Chinese cities and 30 Chinese provinces based on their sustainability performance, as well as country-level sustainable development analysis. Although often hampered by the availability (or lack thereof) of data on certain indicators that are important to sustainability analyses, we carefully selected indicators for cities, provinces, and the country, representing five categories of sustainable development, namely, economic development; social welfare and livelihood; environmental resources; consumption and emissions; and environmental management. In addition to the widely accepted triple-bottom-line of economy, society, and environment in describing sustainable development, we made a nuanced distinction between the available stock of environmental resources and the flow of those resources, and their implications in the form of consumption and emissions, given the myriad environmental problems China faces. We added the fifth category of environmental management since China has set ambitious environmental protection and conservation targets and has made tremendous efforts in combating environmental degradation.

Our urban sustainability ranking uses an innovative indicator weighting method that takes into account the volatility of data for each indicator across time and geographic location, which most existing urban sustainability rankings do not fully address. It is our hope that resources and other government efforts in combating environmental problems in the future will be better defined and data more accurately collected and recorded by government at all levels in China. Assessing urban sustainable development is a complex exercise that requires clear and measurable goals, accurate data, and a sound methodology. Sustainable development, by definition, measures more than just economic growth – it encompasses multiple facets of social welfare and environmental well-being. Although China has historically focused on GDP growth as a single indicator to measure economic progress, there is no single indicator that can measure and fully capture progress in sustainable development. There is no panacea for achieving sustainability, as demonstrated by the inclusion of the distinct and varied indicators in our assessment. Every city or province should chart their own course depending on their geographic and resource constraints, while using this ranking as a guide to identify areas of weakness compared to other cities and provinces, and improve upon the areas of sustainability that can have the greatest impact.