China Sustainable Development Indicator System

2022 Report

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China Sustainable Development Indicator System: 2022 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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The China Center for International Economic Exchanges (CCIEE) is China's leading think tank aimed at promoting international economic research and exchanges and providing consulting services. CCIEE combines the expertise of political officials, business leaders, and academics.

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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 101 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.

The concept of sustainable development has been widely accepted as one of the most crucial topics in China and worldwide. China is actively working on implementing the United Nations Sustainable Development Goals, but the lack of a clear definition of the number and applicability of the sustainability metrics that should be used impedes more meaningful progress. 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.

Since 2020, COVID-19 has had a hugely devastating influence on global sustainable development, creating poverty in many countries, 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. Though most countries are making progress on recovering from the pandemic, they need a huge amount of human capital, energy, and economic power to fight against its lingering effects. In the past few years, China has worked on eliminating poverty, protecting the oceans, using sustainable and renewable products, fighting against global climate change, and protecting ecosystem diversity. In order to better 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.

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 101 Chinese cities, 30 provinces, and the country as a whole. We have included the city of Ordos from Inner Mongolia to our 101 Chinese city analysis to get a better understanding of the sustainable development in the northwestern areas of China. We also conduct sustainability comparison studies between Chinese cities with other large international cities. This year, we included Eindhoven, Netherlands, as a new international city for our analysis.

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 1), province-level (Table 2), and city-level (Table 3) 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%

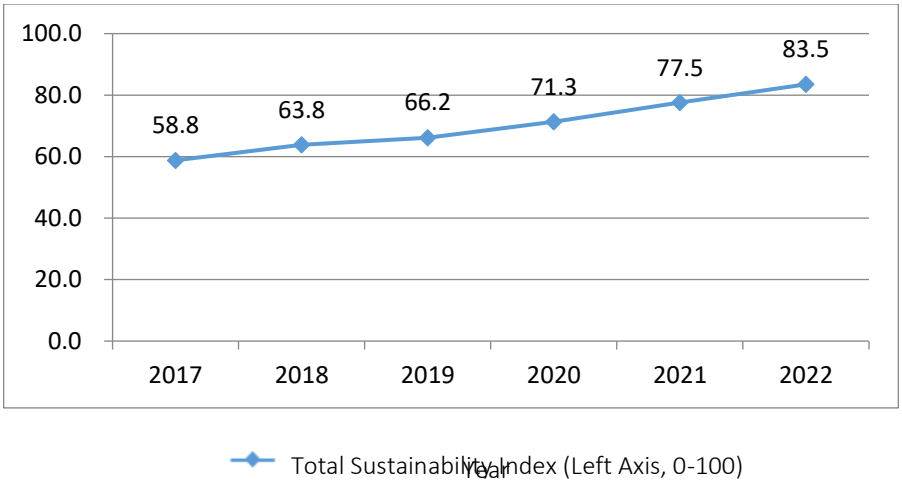
**%: percent, p.c.: per capita, ¥: renminbi/yuan*

CSDIS Country-Level Data Analysis

By analyzing the country-level data, we observe a stable improvement in sustainable development from 2017 to 2022. Country-wide, all five categories have increased rapidly. One of the most impressive recent improvements is that by the end of 2020, China successfully eliminated extreme poverty, which is a milestone in the "Social Welfare & Livelihood" category, making an important contribution to the cause of global poverty alleviation.

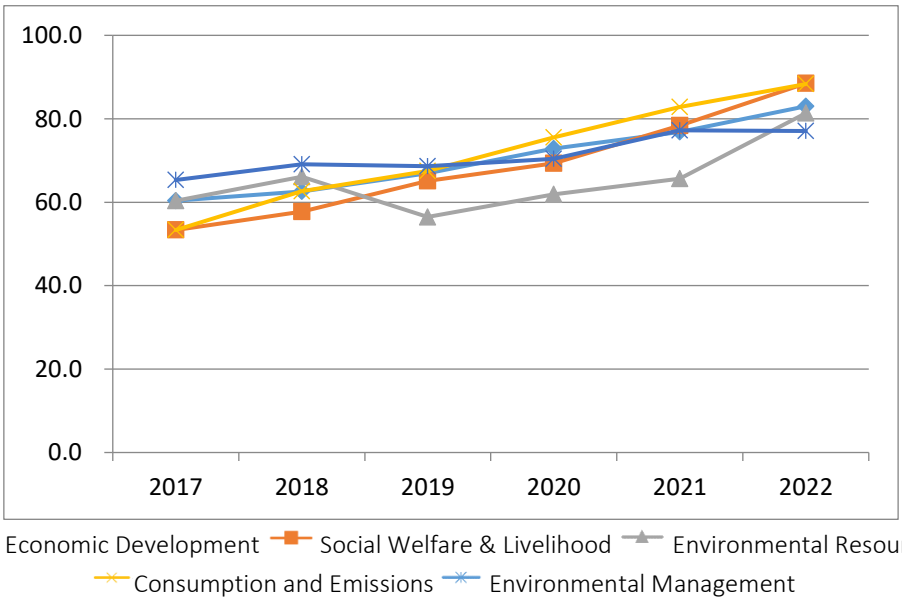
Graph 1 below shows that overall sustainability has steadily improved from 2017 to 2022, showing us that policies applied to all five categories have worked well. In 2017, the index for total sustainable development was 58.8, and though it slowed down in 2019, the number increased 42% to 83.5 in 2022.

Graph 1: China Sustainable Development from 2017 to 2022



Graph 2 below shows that from 2017 to 2022, all five indicators have improved. Except for a dip in "Environmental Resources" performance in 2019, China has improved its sustainable development in all aspects.

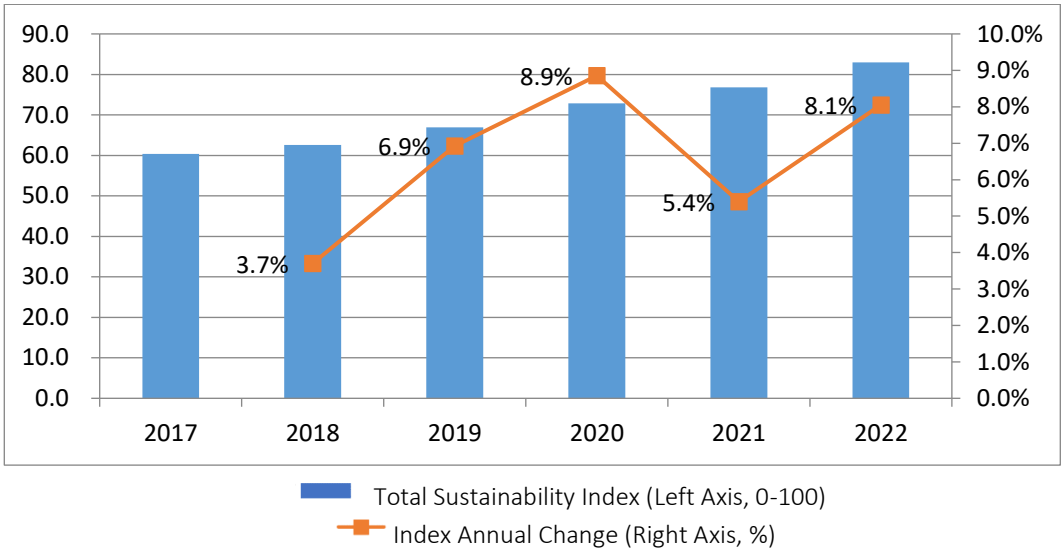
Graph 2: CSDIS First-Level Indicator Development from 2017 to 2022



Country Analysis by Major Component of Sustainable Development

Economic Development

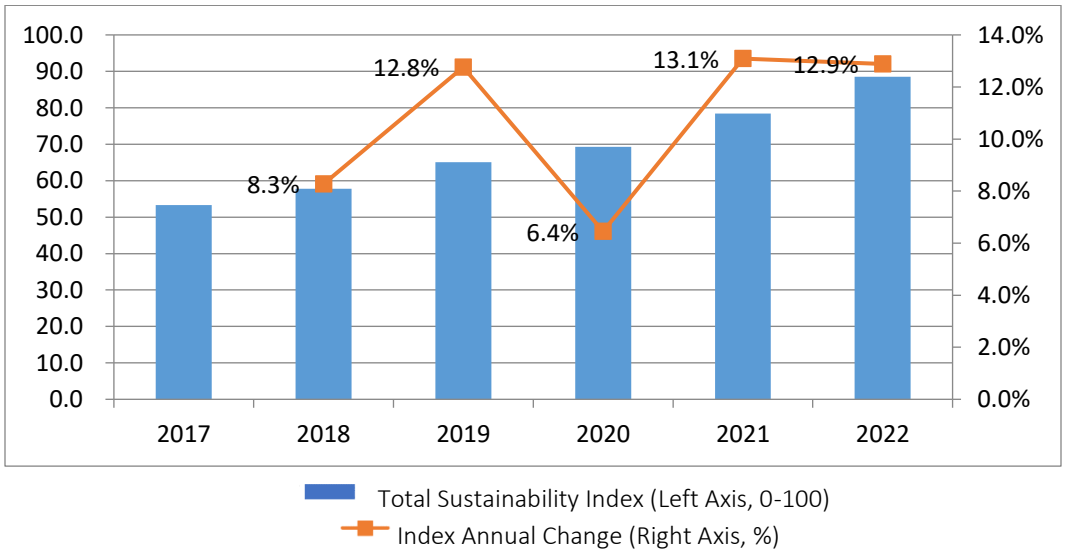
Graph 3: China's "Economic Development" from 2017 to 2022



In the "Economic Development" category, the Total Sustainability Index increased from 60.4 in 2017 to 83.0 in 2022. The average annual increase rate is over 3%, and the increase rate from 2019 to 2020 and 2021 to 2022 were both over 7.5%. Because of the slowdown of GDP and increased elder population during the Covid pandemic, economic development slowed down slightly from 2020 to 2021, but in general, there has been a large improvement in economic development.

Social Welfare & Livelihood

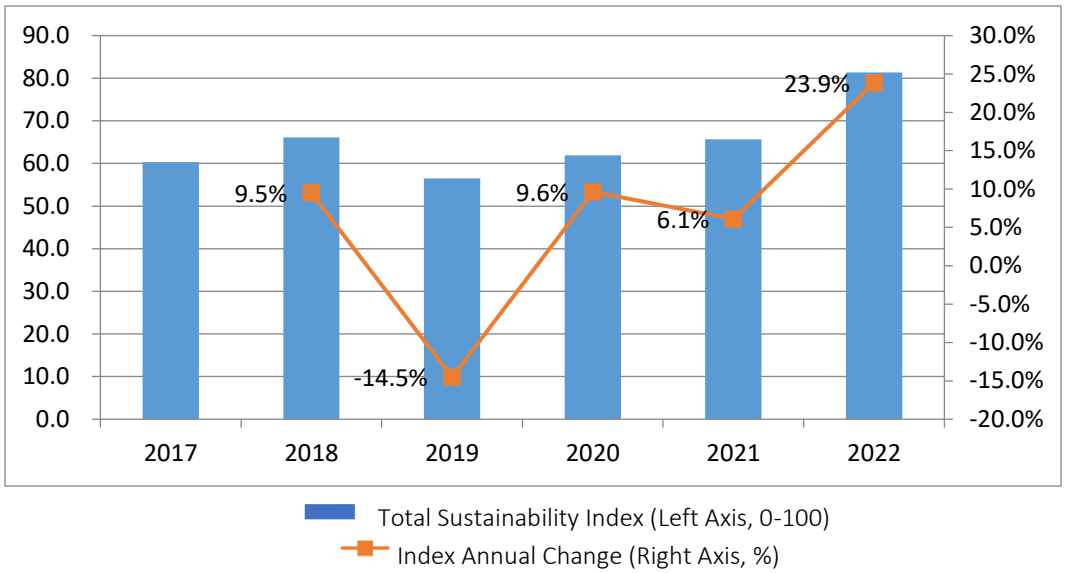
Graph 4: China's "Social Welfare & Livelihood" from 2017 to 2022



"Social Welfare & Livelihood" has had an annual increase rate of over 6% from 2017 to 2022. The Total Sustainability Index for this category was 53.3 in 2017, increasing to 88.5 in 2022. In general, this category has improved greatly during this period, especially in areas such as education and culture, social security, public health, and equality.

Environmental Resources

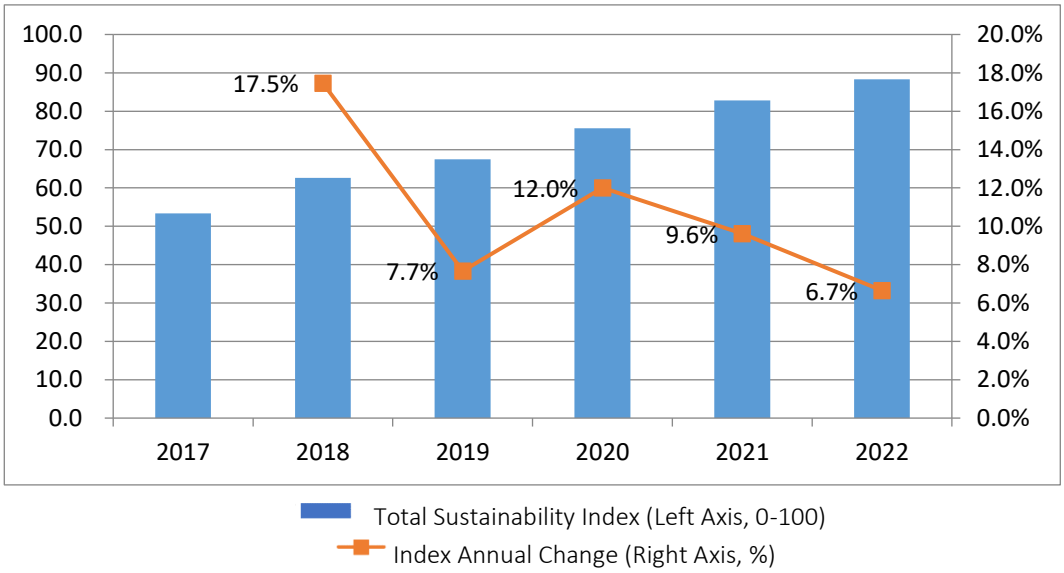
Graph 5: China's "Environmental Resources" from 2017 to 2022



The "Environmental Resources" category is greatly affected by climate change. There was a decrease in this category in 2019, whereas all other years have an average annual increase rate of over 6%. The number increased from 60.3 in 2017 to 81.3 in 2022. In general, there has been an improvement in "Environmental Resources" over this time period.

Consumption & Emissions

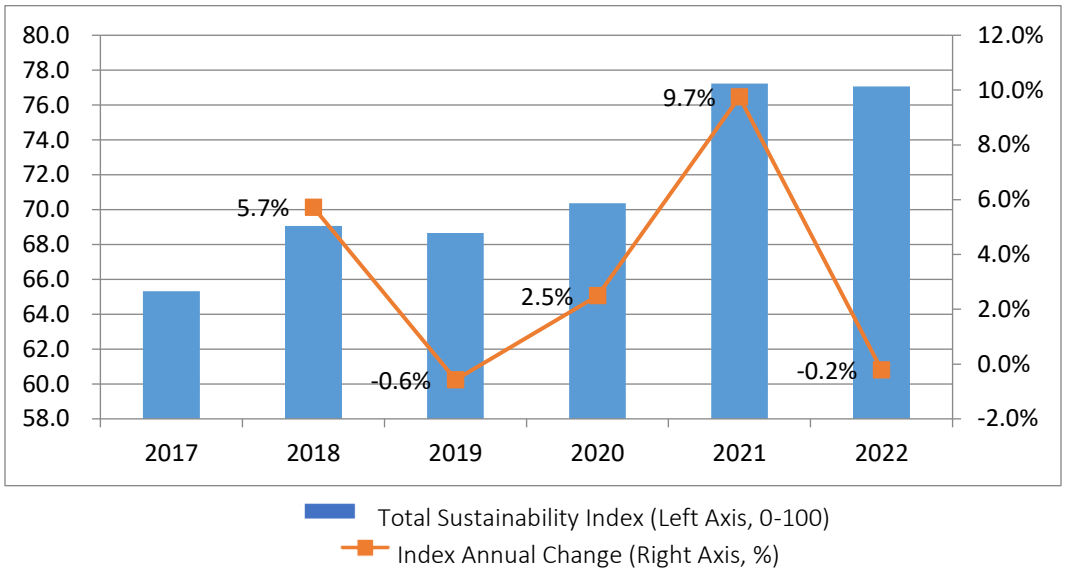
Graph 6: China's "Consumption & Emissions" from 2017 to 2022



The performance of "Consumption and Emissions" has continuously improved from 2017 to 2022. The Total Sustainability Index for this category increased from 53.3 to 88.3 during this period. The average annual increase rate is over 10%. However, this increase has also been slowing down since 2018, as indicated by the dwindling annual changes, with the most recent year scoring only 6.7% 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 2022



The Total Sustainability Index for "Environmental Management" increased from 65.3 in 2017 to 77.1 in 2022. The average annual rate increase is less than 4%, which is lower than the other indicator categories, but does show a general increase apart from a slight decrease in 2019 and 2022. In general, there has been stable development of environmental management in China, and with more policies on controlling pollution expanding throughout the country, 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). The top ten are Beijing, Shanghai, Zhejiang, Guangdong, Chongqing, Fujian, Tianjin, Jiangsu, Yunnan, and Hainan. All four centrally-administered municipalities rank in this top ten list, and eight of the top ten are coastal provinces in the east. Two provinces in the western part of China rank in the top ten list: Chongqing and Yunnan. Chongqing improved from #9 in 2021 to #5 this year, while Yunnan rose from #17 in 2021 to the #9 spot on this year's list. No provinces in the northeast or central part of China rank in the top ten. Provinces that lack behind are mainly provinces in the northwestern and northeastern part of China, such as Ningxia, Xinjiang, Inner Mongolia, Heilongjiang, and Liaoning.

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 2022, the top ten provinces in economic development are: Beijing, Shanghai, Guangdong, Tianjin, Jiangsu, Zhejiang, Fujian, Chongqing, Anhui, and Shandong. Provinces that rank towards the end are Xinjiang, Guangxi, and Guizhou.

Beijing, Shanghai, and Guangdong continue to be the top three centrally-administered municipalities and provinces in the economic development ranking. Beijing has been pushing a structural change in its economic development, focusing on transforming to a high-technological development municipality. It ranks high on "R&D Expenditure as a % of GDP," "Intellectual Property per 10,000 People," "High-Technology Industry Revenue to Added Value Ratio" and more. At the same time, as one of the largest international cities, Shanghai continued to develop its free-trade zone, ranking top on "Intellectual Property per 10,000 People", and on its development and openness. In addition, Guangdong focuses its attention on innovation and technology, stable development, and institutional optimization.

Social Welfare & Livelihood

In 2022, the top ten provinces in social welfare and livelihood are: Beijing, Qinghai, Jilin, Heilongjiang, Tianjin, Shanghai, Gansu, Jiangxi, Liaoning, and Ningxia.

This year, the whole country has been working on improving the poverty rate, and various policies suggest more focus on improving education and living quality in suburban and rural areas. China as a whole has developed its social welfare, and most provinces have improved from the previous year on indicators such as education and hospital expansion. Beijing ranks high on "Average Education Level of Working Population," "Basic Social Security Coverage," "Governance Health per Capital" and more. Qinghai ranks high on "Government Health Expenditure per Capita," and Heilongjiang ranks high in "Health Technicians per 10,000 People."

Environmental Resources

In 2022, the top ten provinces in environmental resources are: Qinghai, Guizhou, Guangxi, Fujian, Jiangxi, Yunnan, Hainan, Gansu, Sichuan, and Heilongjiang. Provinces that rank towards the end are Hebei, Shandong, and Tianjin.

Natural and environmental resources have always been considered important elements of the country. With the idea of green and ecological development spread across China, more and more provinces are working to improve different types of environmental resources. Almost all provinces improved air quality in 2022, with 15 provinces at 90% of good air quality days throughout the year. Beijing improved its number of good air quality days from 65.8% to 75.4%.

The average "Water Resources per Capita" improved among all provinces, whereas the "Arable Land per Capita" and "Wetland per Capita" dropped in 2022. Qinghai ranks high on "Water Resource per Capita" and "Grassland Area per Capita." Guizhou ranks top in "Forest Area per Capita." Some provinces that rank towards the end lack environmental resources because of their location inside and still need to improve their air quality and other environmental management strategies.

Consumption & Emissions

In 2022, the top ten provinces in consumption and emissions are: Beijing, Fujian, Guangdong, Zhejiang, Sichuan, Chongqing, Yunnan, Shaanxi, Henan, and Tianjin. Provinces that rank towards the end are Ningxia, Heilongjiang, 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 technology. Most provinces improved their emissions levels in 2022 and set higher standards on future consumption and emissions goals.

Beijing ranks high on "Water Consumption per Unit of Industrial Added Value," "Energy Consumption per Unity of Industrial Added Value," and more. Fujian ranks high on "Added Value of Secondary and Tertiary Industries per Unit of Built Area." Provinces like Ningxia, Heilongjiang, and Xinjiang still need to improve on aspects such as "Water Consumption per Unit of Industrial Added Value" and "Energy Consumption per Unity of Industrial Added Value."

Environmental Management

In 2022, the top ten provinces in environmental management are: Shanxi, Shanghai, Shandong, Hainan, Hebei, Zhejiang, Guangdong, Tianjin, Henan, and Jiangsu. Provinces that rank towards the end are Sichuan, Inner Mongolia, and Qinghai.

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. Shanxi ranks high on "Urban Sewage Treatment Rate." Beijing ranks high on "Environmental Protection Expenditure as a % of GDP." 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, may not be able to obtain a higher level of environmental management.

CSDIS City Data Analysis

City Ranking

In the 2022 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 previous three years, and it is the first time Hangzhou has been the top-ranked city. As the most developed regions in China, cities in the Pearl River Delta and Yangtze River Delta regions, as well as the capital city Beijing, all rank high in the CSDIS.

Table 5 shows the city ranking in 2022. In previous years, the CSDIS has ranked 100 cities for the city level analysis. This year, the team added the 101th city, Ordos. Ordos is a city located in the Inner Mongolia, representing the sustainable development for the central and northern part of China. Compared to last year's ranking, Hangzhou has risen three places, becoming the top 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

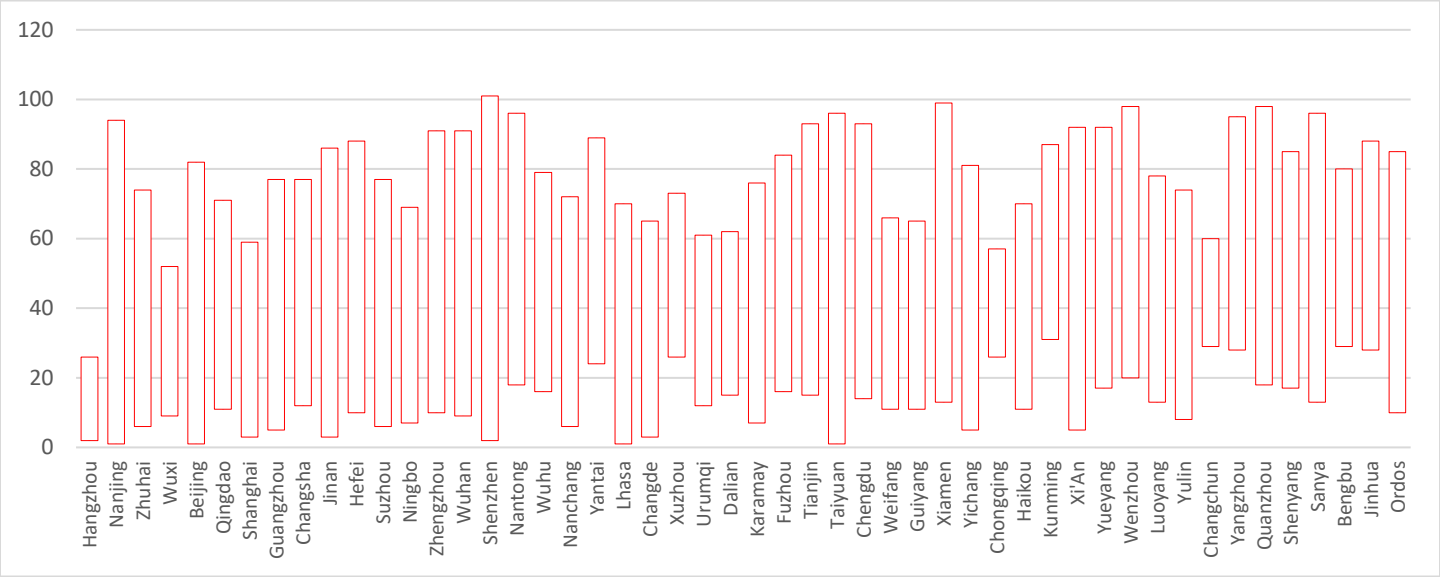
2022 Ranking	City	2022 Ranking	City
1	Hangzhou	52	Tongren
2	Nanjing	53	Mianyang
3	Zhuhai	54	Xining
4	Wuxi	55	Baotou
5	Beijing	56	Jiujiang
6	Qingdao	57	Nanning
7	Shanghai	58	Guyuan
8	Guangzhou	59	Shaoguan
9	Changsha	60	Huaihua
10	Jinan	61	Beihai
11	Hefei	62	Binzhou
12	Suzhou	63	Xiangyang
13	Ningbo	64	Yibin
14	Zhengzhou	65	Tangshan
15	Wuhan	66	Huizhou
16	Shenzhen	67	Jining
17	Nantong	68	Lanzhou
18	Wuhu	69	Ganzhou
19	Nanchang	70	Luzhou
20	Yantai	71	Xuchang
21	Lhasa	72	Zunyi
22	Changde	73	Huangshi
23	Xuzhou	74	Hohhot
24	Urumqi	75	Mudanjiang
25	Dalian	76	Qinhuangdao
26	Karamay	77	Harbin
27	Fuzhou	78	Linyi
28	Tianjin	79	Datong
29	Taiyuan	80	Nanchong

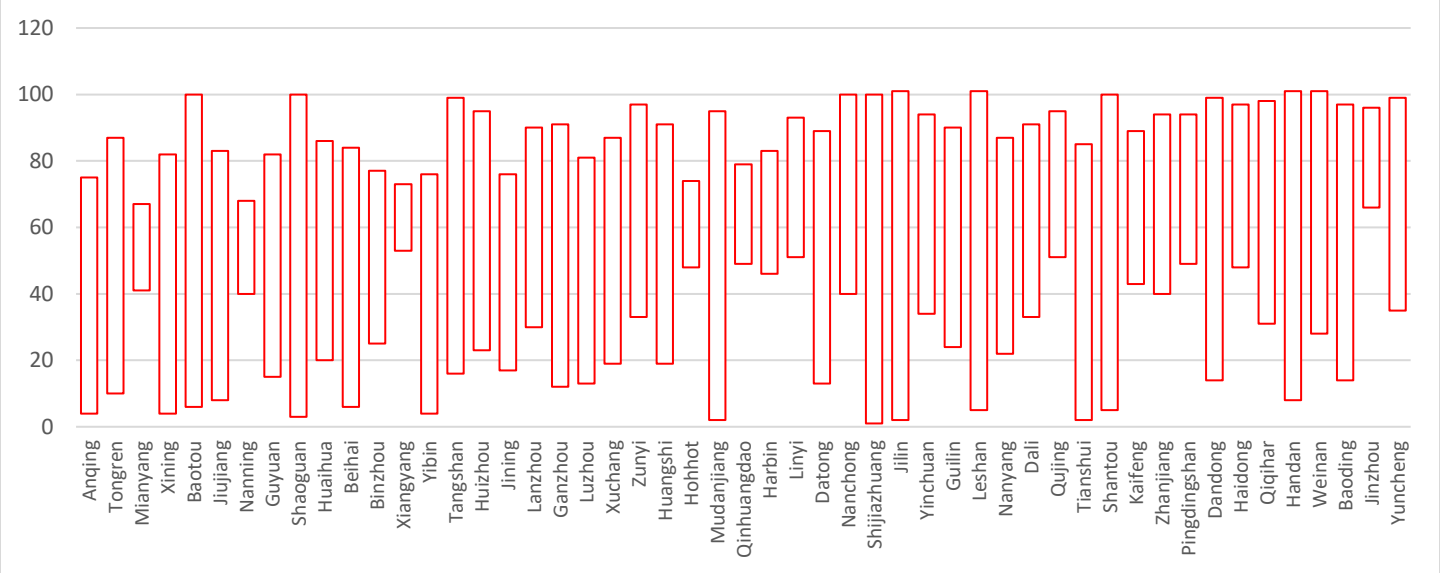
30	Chengdu	81	Shijiazhuang
31	Weifang	82	Jilin
32	Guiyang	83	Yinchuan
33	Xiamen	84	Guilin
34	Yichang	85	Leshan
35	Chongqing	86	Nanyang
36	Haikou	87	Dali
37	Kunming	88	Qujing
38	Xi'An	89	Tianshui
39	Yueyang	90	Shantou
40	Wenzhou	91	Kaifeng
41	Luoyang	92	Zhanjiang
42	Yulin	93	Pingdingshan
43	Changchun	94	Dandong
44	Yangzhou	95	Haidong
45	Quanzhou	96	Qiqihar
46	Shenyang	97	Handan
47	Sanya	98	Weinan
48	Bengbu	99	Baoding
49	Jinhua	100	Jinzhou
50	Ordos	101	Yuncheng
51	Anqing		

City-Level Sustainable Development Balance

Looking at the five main sustainable development categories, similar to the provincial ranking, city rankings also exhibit an imbalanced development with regards to the various aspects of sustainability. In Graph 8, each bar illustrates the range between the highest and lowest ranking for each city across the five main categories. The lengths of the bars in the graph—longer representing more imbalance—show that most cities still have a long way to go for achieving a more balanced sustainable development. Hangzhou ranks the first in the overall CSDIS city ranking and is the most balanced among the top 10 cities; the difference between its highest ranked category and lowest ranked category is 24 positions. Nanjing, on the other hand, ranks #2 among all the cities and places first in Economic Development, but lags in environmental management at #94, and is the least balanced city in the top ten. Zhuhai performs well on Consumption and Emissions (#6), Economic Development (#7), and Environmental Resources (#7); however, it lags in Social Welfare & Livelihood (#74) and Environmental Management (#55). The most imbalanced cities among all 101 cities are Shenzhen (#16), Shijiazhuang (#81), and Jilin (#82), with a difference between minimum and maximum category rankings of 99 positions. The most balanced city among all 101 cities is Xiangyang (#63), with the difference of 20 positions between its highest and lowest ranked categories.

Graph 8: CSDIS City Development Balance Graph





City Ranking by Major Component of Sustainable Development

Economic Development

The 2022 city rankings in economic development are similar to that of 2021. Nanjing ranks #1 in economic development and has improved its ranking over the last two years. Hangzhou ranks #2, as it lags in "GDP Growth" this year. The capital city of Beijing ranks high in "Service Sector Added Value" and "Science and Technology Expenditure." Major cities along the eastern coast of China are performing the best on economic development. Jinan and Hefei appeared on this top 10 list for the first time. Even though the pandemic hurt the economic development of China in a short period of time, the 101 cities still performed well getting back track in this category.

City	Ranking
Nanjing	1
Hangzhou	2
Beijing	3
Shenzhen	4
Guangzhou	5
Suzhou	6
Zhuhai	7
Jinan	8
Wuxi	9
Hefei	10

Social Welfare & Livelihood

In 2022, the top cities in social welfare and livelihood are mostly inland cities. Besides Jinan, 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 an imbalanced development on economy and social welfare for different cities. Taiyuan still ranks #1 in social welfare & livelihood. Jilin rose to the top 10 in this category for the first time, ranking #2 and improving 28 places from last year. This is the first year that the team included Ordos City in the city analysis, and it ranks #10 in social welfare & livelihood.

City	Ranking
Taiyuan	1
Jilin	2
Jinan	3
Xining	4
Yichang	5
Baotou	6
Karamay	7
Yulin	8
Wuhan	9
Ordos City	10

Environmental Resources

Consistent with popular perception, cities with rich resources and better environmental performance are mainly concentrated in Guangdong, Guizhou, and other cities in southern China. These cities generally have better ecological environments and rich natural landscapes, and they all rank high in "Air Quality" and "Urban Green Space." Lhasa has been the #1 city in environmental resources for the past three years. Zhuhai ranks high in "Urban Green Space." Mudanjiang, Shaoguan, and Jiujiang all rank high on "Water Resources per Capita." Anqing and Karamay improved 21 and 25 places in environmental resources compared to last year. Most cities have greatly improved in environmental resources in the past year; however, more attention is needed as it is not synchronized with economic development.

City	Ranking
Lhasa	1
Mudanjiang	2
Shaoguan	3
Anqing	4
Leshan	5
Beihai	6
Zhuhai	7
Jiujiang	8
Karamay	9
Tongren	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 and Shenzhen continue to rank #1 and #2 in the consumption & emissions category. Shanghai improved two places in the list from last year. Zhengzhou performs well in "Water Consumption per Unit of GDP" and "Energy Consumption per Unit of GDP." Most cities have improved in this category, with many establishing new goals to eliminate emissions.

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

Environmental Management

The 2022 top ranked cities in environmental management have changed drastically from last year's rankings. Tianshui, Shantou, Nanchang, and Shaoguan have jumped into the top ten in this category, whereas Zhengzhou, Zhuhai, Jinan, and Tianjin have dropped out of this list. Shijiazhuang performs well in "Centralized Treatment Rate of Sewage Plant;" it also improved in other aspects under environmental management, which leads it ranking #1 in environmental management this year. Cities such as Yibin, Shangtou, Nanchang, Shenzhen, and Jiujiang are all well balanced in environmental management. Most cities greatly improved in environmental management in 2022, and they are planning on achieving higher goals in the next couple of years as well.

City	Ranking
Shijiazhuang	1
Tianshui	2
Changde	3
Yibin	4
Shantou	5
Nanchang	6
Shenzhen	7
Handan	8
Shaoguan	9
Jiujiang	10

International City Comparison

International City Comparison Analysis

We compared both the top CSDIS ranked city, Hangzhou, and the other 100 Chinese cities with seven international cities--New York, São Paulo, Paris, Barcelona, Singapore, Eindhoven (Netherlands), and Hong Kong—on individual indicators from each category for which there was available data.

Figures 1 and 2 below compare only the top-ranked Chinese city for the CSDIS, Hangzhou, with the seven international cities. The figures show that Hangzhou outperforms international cities in two economic development indicators, while international cities rank higher in indicators for the four other categories.

Figure 1: International City Comparison Map

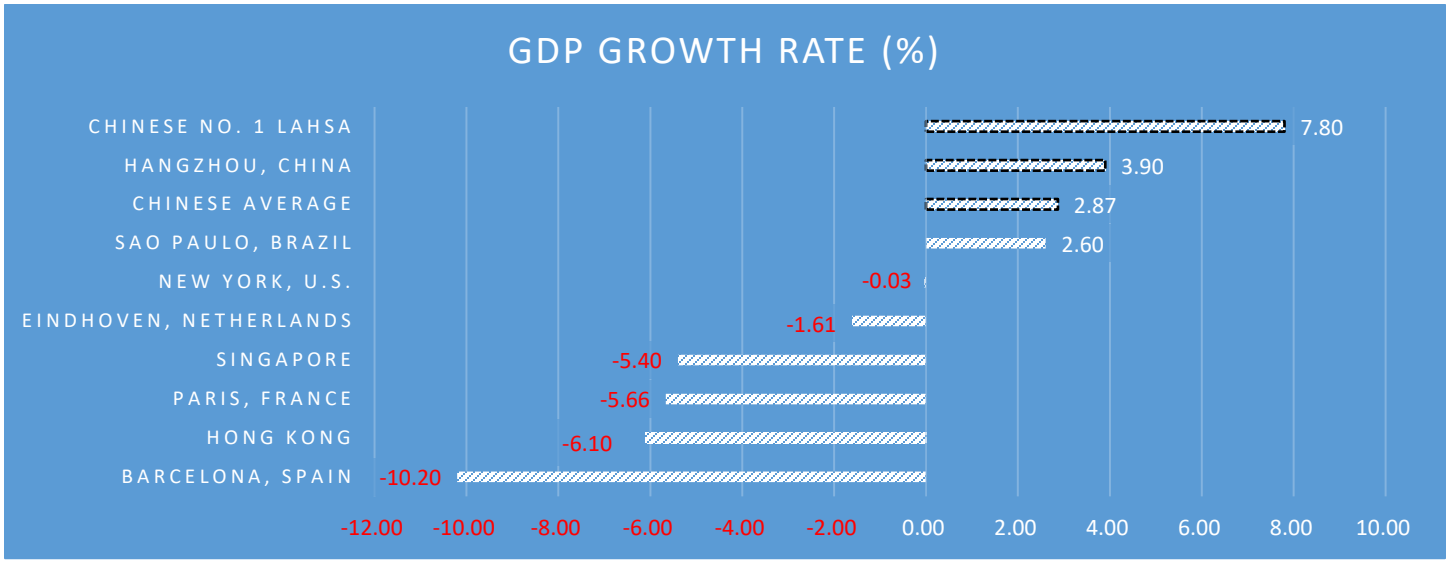
Figure 2: Leading Cities in Major Components of Sustainable Development

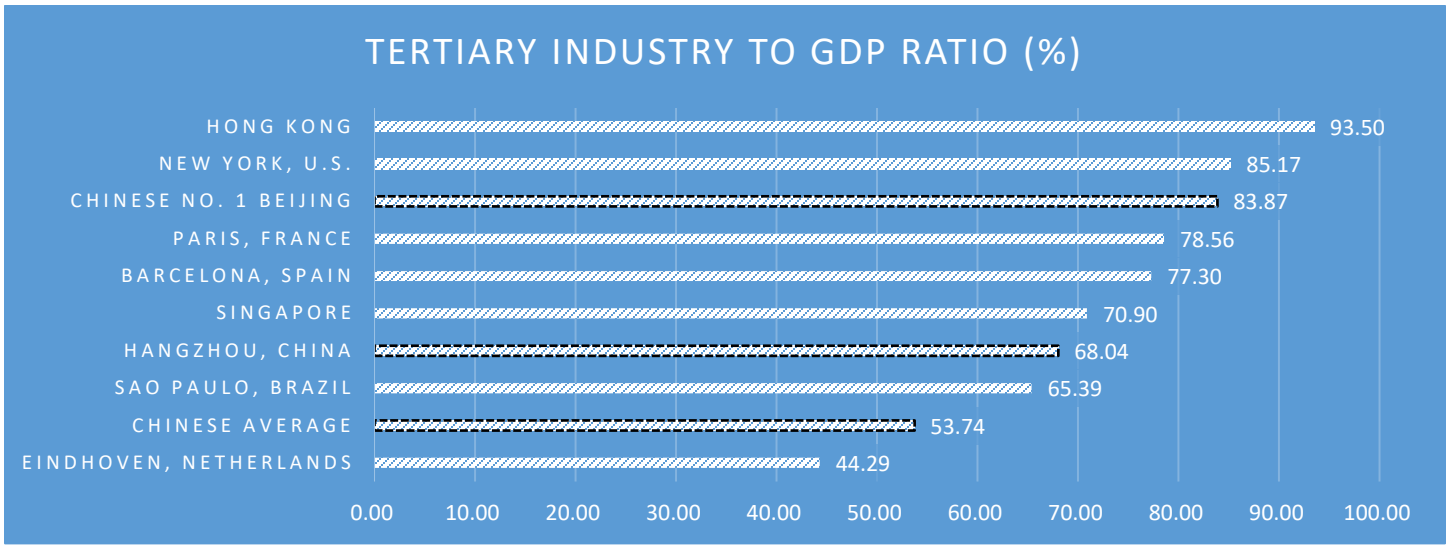
Economic Development	Social Welfare & Livelihood	Environmental Resources	Consumption & Emissions	Environmental Management
• **GDP Growth Rate** **#1:** Hangzhou • **Tertiary Industry to GDP Ratio** **#1:** Hong Kong • **Unemployment Rate in Rural Areas** **#1:** Hangzhou	• **Urban Road Area per Capita** **#1:** Paris • **Housing-to-Income Ratio** **#1:** New York • **Teacher to Student Ratio in Middle and Elementary School** **#1:** Singapore	• **Urban Green Space per 10,000 People** **#1:** Hong Kong • **Air Quality** **#1:** New York	• **Water Consumption per Unit of GDP** **#1:** Singapore • **Energy Consumption per Unit of GDP** **#1:** Barcelona	• **Centralized Treatment Rate of Sewage Treatment** **#1:** Barcelona, Paris, New York • **Harmless Treatment Rate of Domestic Waste:** Most cities have reached 100%

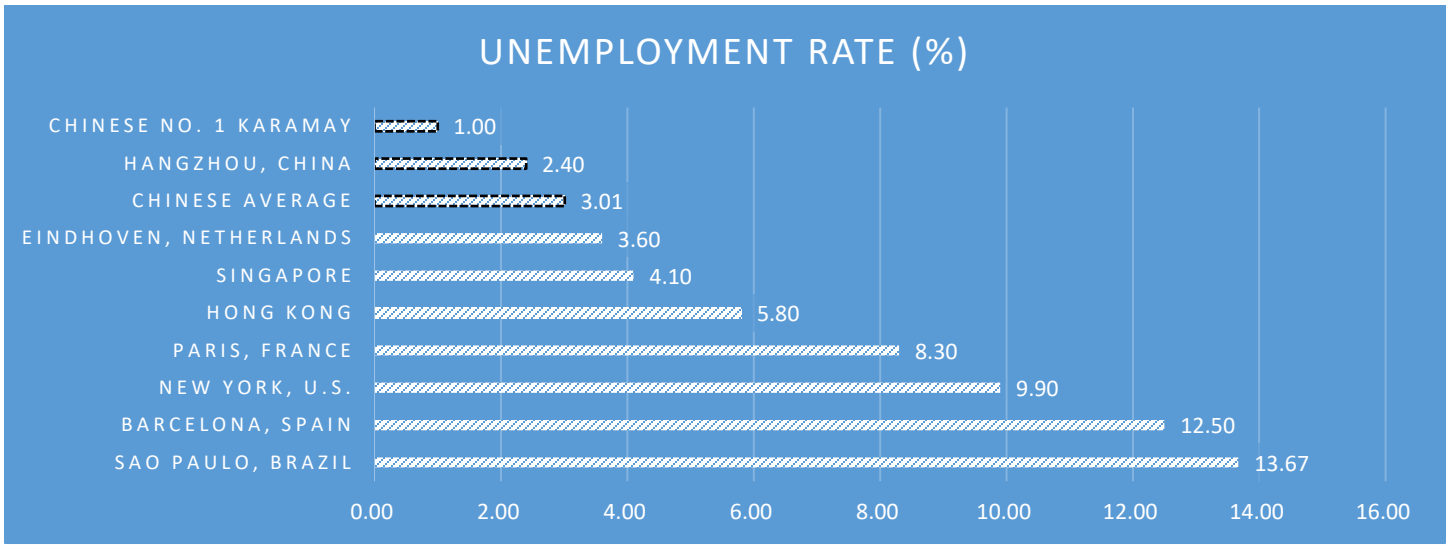
Categorical Comparison

The following graphs show the seven international cities ranked against both the top-ranked CSDIS city, Hangzhou, and the top-ranked Chinese city for each indicator. In general, Chinese cities perform well in economic development, whereas the seven 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 and livelihood.

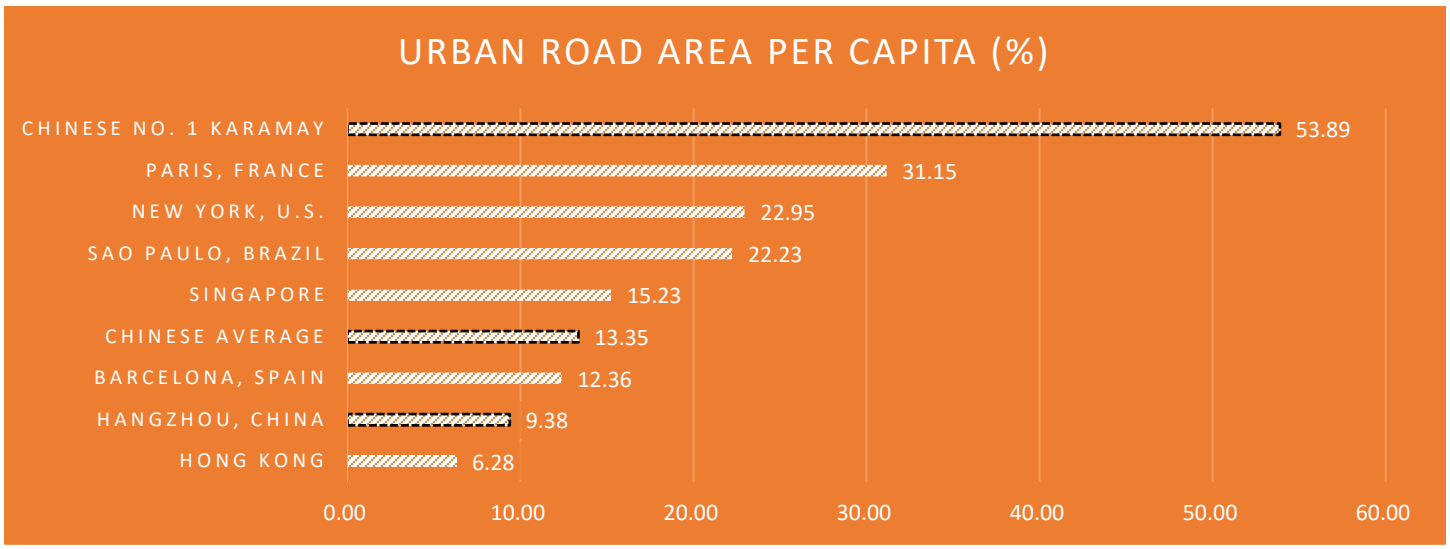
Economic Development

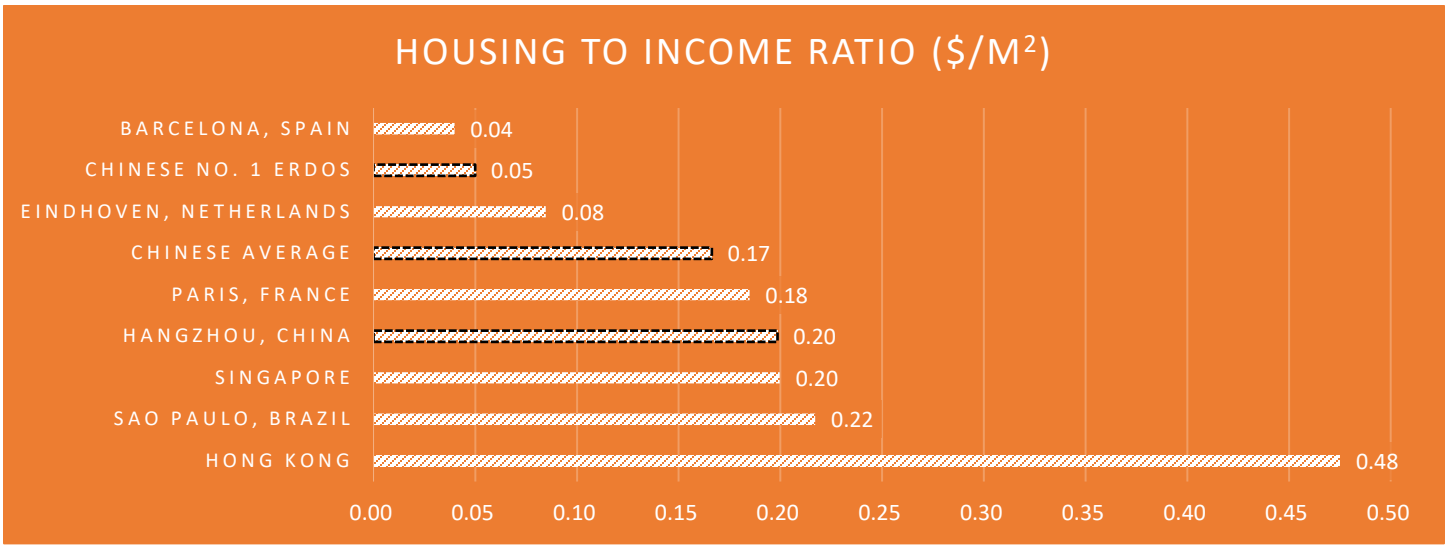


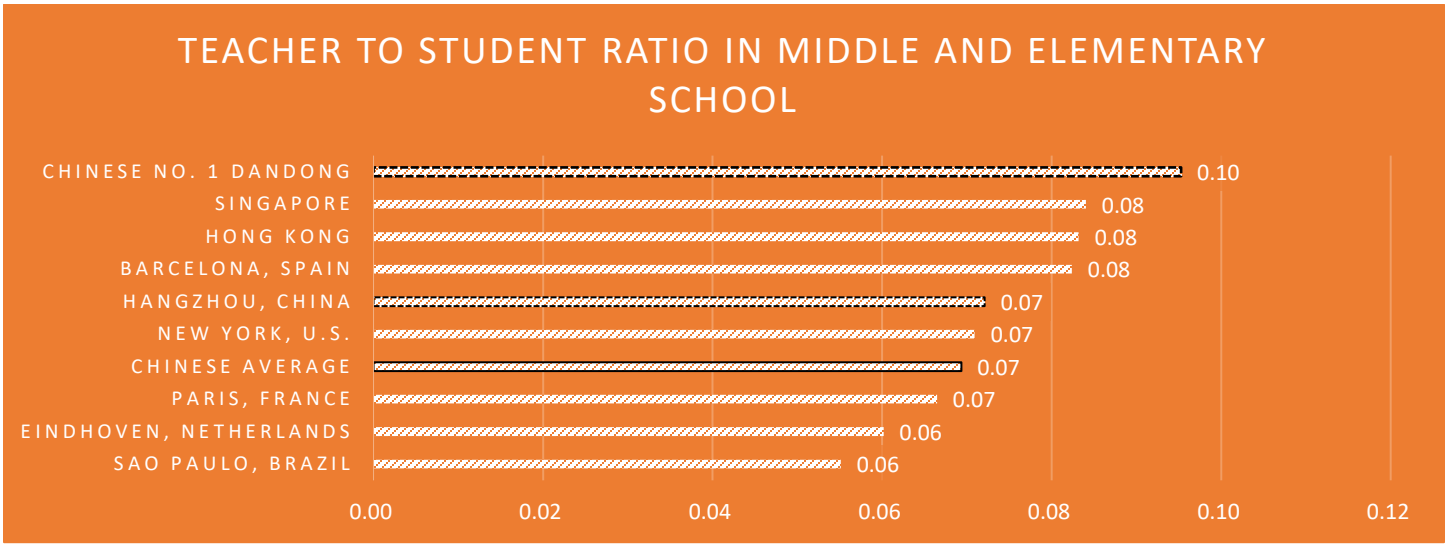




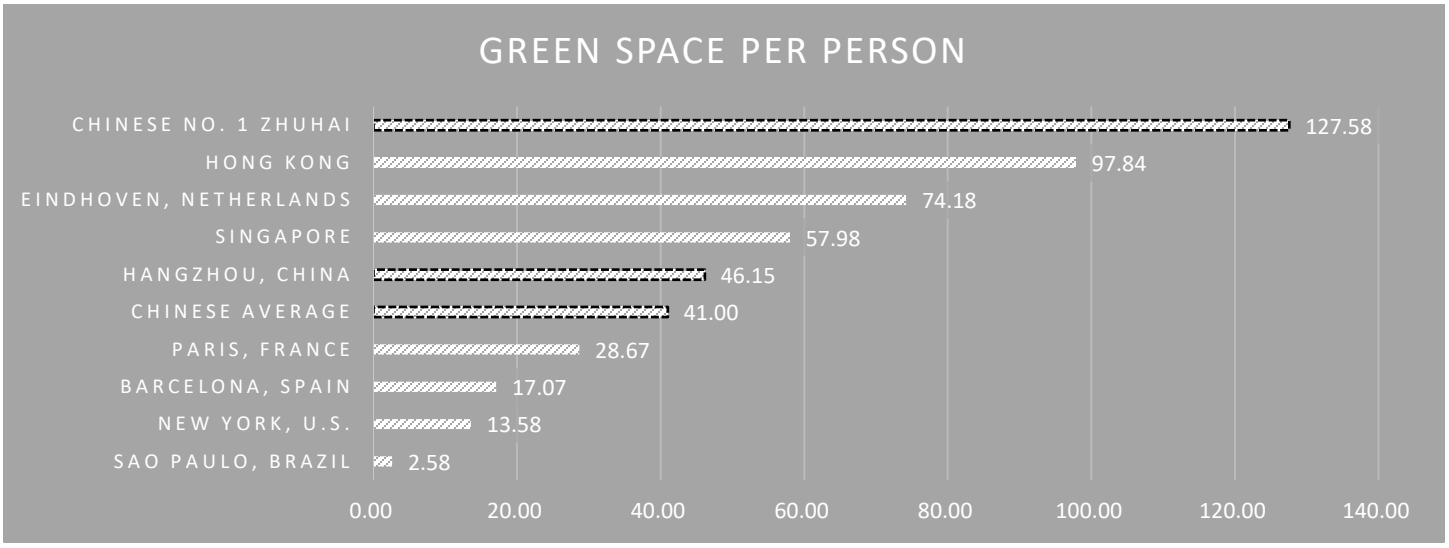
Social Welfare & Livelihood

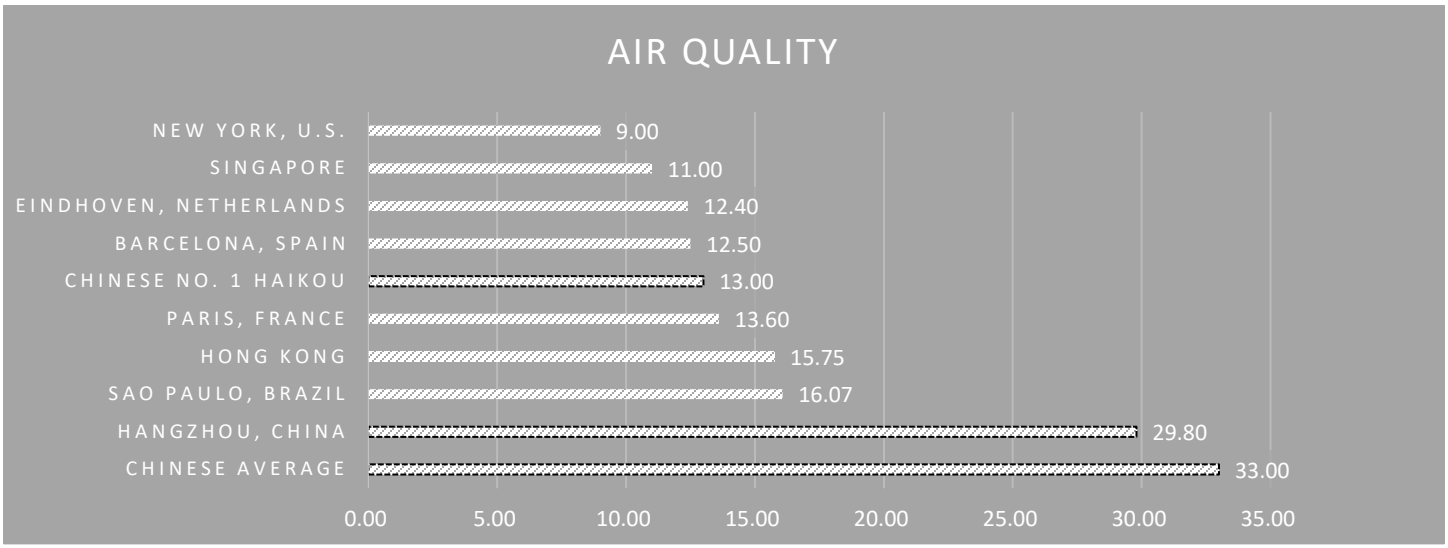




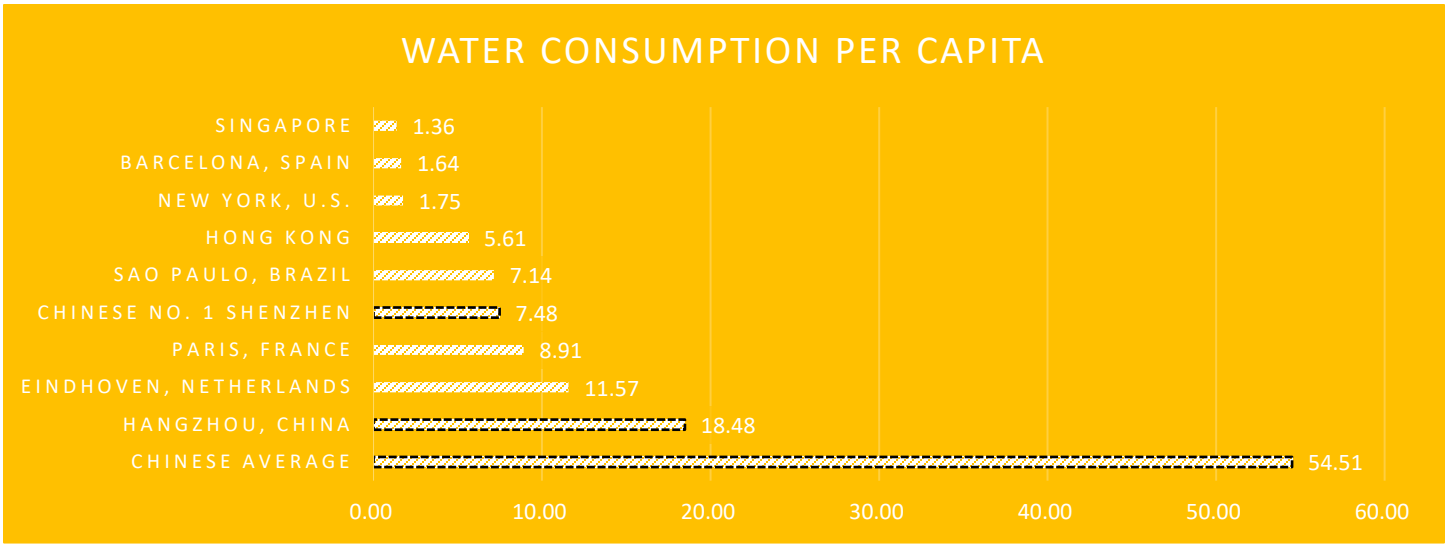


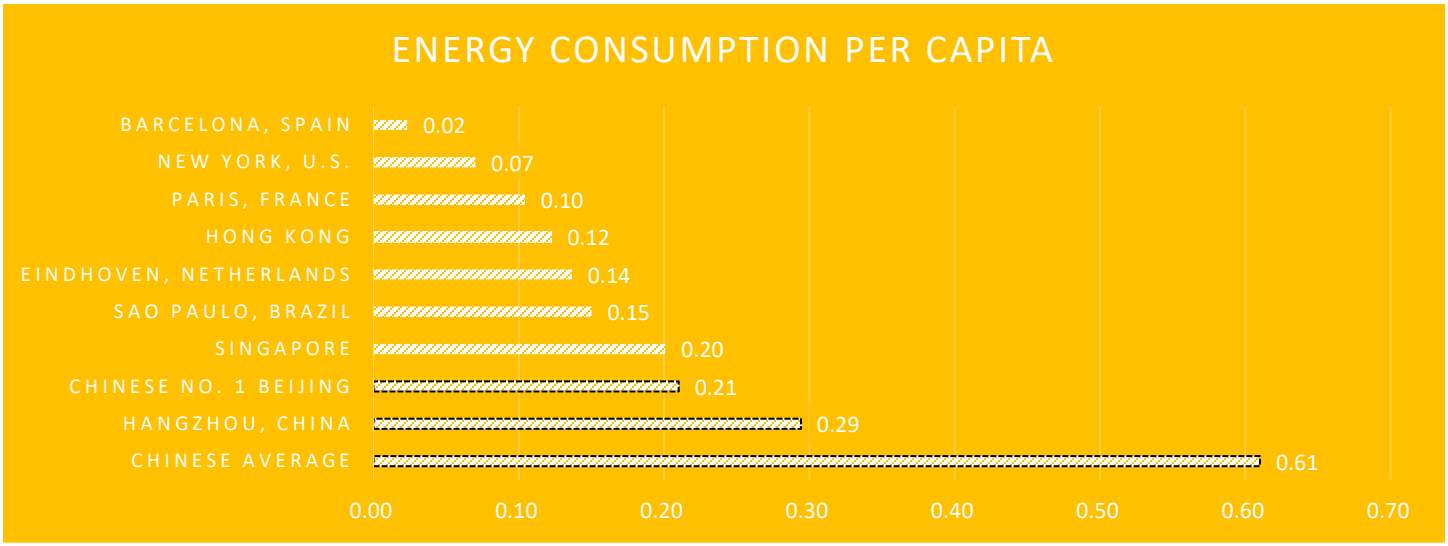
Environmental Resources

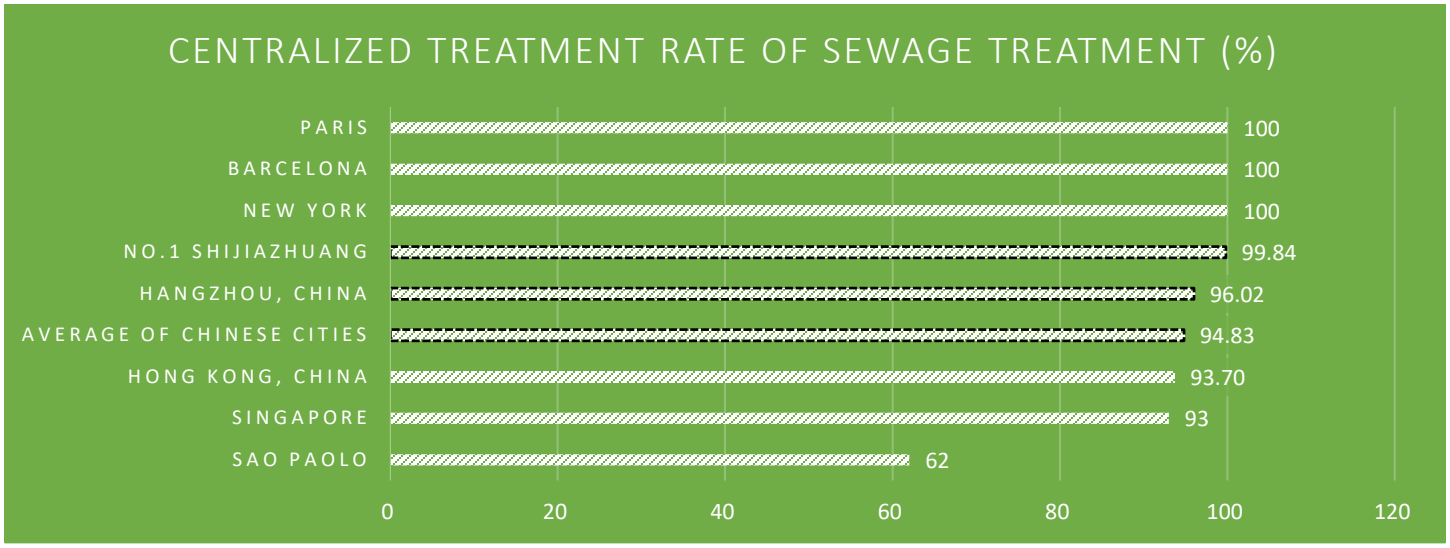


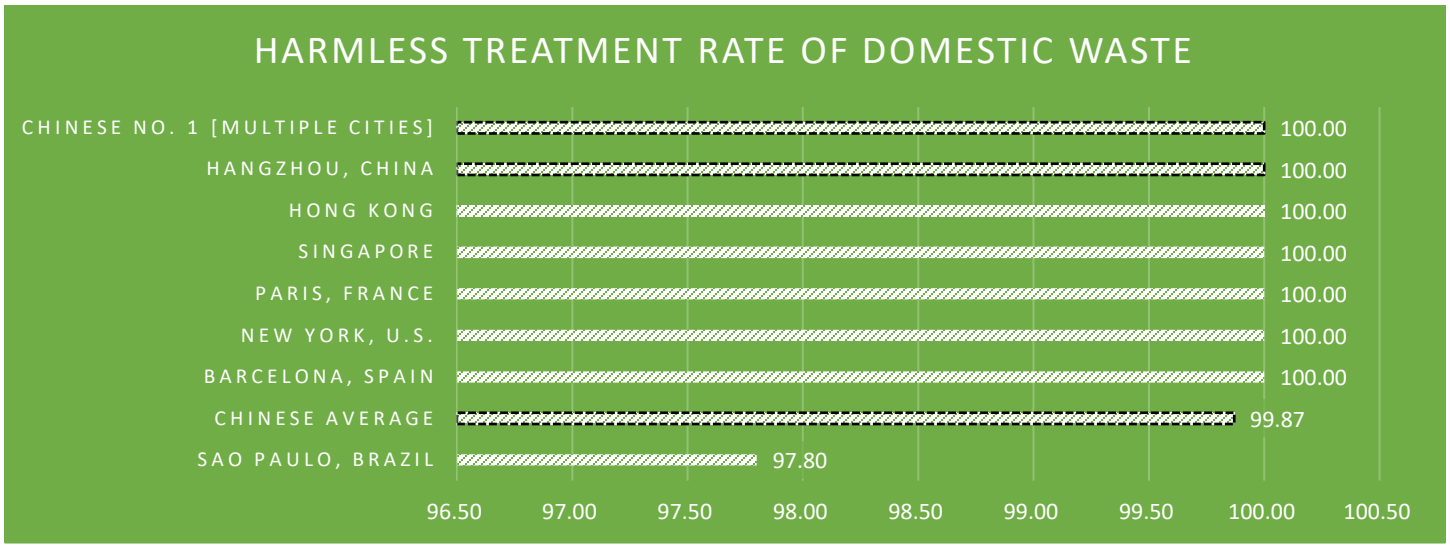


Consumption & Emissions






CENTRALIZED TREATMENT RATE OF SEWAGE TREATMENT (%)
PARIS
BARCELONA
NEW YORK
NO.1 SHIJIAZHUANG
HANGZHOU, CHINA
AVERAGE OF CHINESE CITIES
HONG KONG, CHINA
SINGAPORE
SAO PAOLO
100
100
100
99.84
96.02
94.83
93.70
93
62
0
20
40
60
80
100
120


HARMLESS TREATMENT RATE OF DOMESTIC WASTE
CHINESE NO. 1 [MULTIPLE CITIES]
HANGZHOU, CHINA
HONG KONG
SINGAPORE
PARIS, FRANCE
NEW YORK, U.S.
BARCELONA, SPAIN
CHINESE AVERAGE
SAO PAULO, BRAZIL
100.00
100.00
100.00
100.00
100.00
100.00
100.00
99.87
97.80
96.50
97.00
97.50
98.00
98.50
99.00
99.50
100.00
100.50

Conclusion

This publication has presented our China Sustainable Development Indicator System (CSDIS) and 2022 ranking results for 101 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.