

The China Urban Sustainability Index 2013

April 2014







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Preface

The China Urban Sustainability Index is an annual research project undertaken by the McKinsey Global Institute (MGI) and the Urban China Initiative (UCI). UCI is a think tank co-founded by McKinsey & Company, Columbia University, and Tsinghua University in 2010. UCI's mission is to convene leaders from the public and private sectors to promote sustainable urbanization and economic growth in China.

UCI has three goals:

Provide solutions: Develop the latest and best solutions for urban development in China.

Train talent: Create a professional platform to convene domestic and international experts in urban development

Organize dialogues: Organize urbanization discussions at national, provincial and municipal levels.

UCI has been an active contributor to China's research in urbanization and academic discussions for several years. UCI offers insights and tools for national and local policy makers who shape China's urbanization path. The China Urban Sustainability Index 2013 is the latest research built on the achievements of *A New Tool to Measure Urbanization in China*, issued in 2010, and *The Urban Sustainability Index 2011*.

USI 2013 evaluates the level and potential of China's urban sustainability development. It does this by analyzing key factors influencing sustainable urban development, identifying bottlenecks restricting sustainable development for different types of cities, finding the gap between Chinese cities and advanced cities in the developed world using international benchmarking and sharing experience from city case studies.

Led by Jonathan Woetzel (a Director of McKinsey & Co. and co-Chair of the Urban China Initiative), *USI 2013* is a research collaboration between UCI and a team of McKinsey experts, including Gengtian Zhang, Xiujun Li, Xiaopeng Li and Yingjie Zhang.

Many provincial and municipal government leaders generously assisted us in the development of detailed case studies in the report. We would like to thank the following individuals:

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Executive summary

The Urban Sustainable Index (USI) 2013 builds upon the work carried out in USI 2011. USI 2013 has expanded and upgraded the indicators used in USI 2011. The analysis deploys 23 metrics, which cover four categories: economy, society, resources and environment. We ranked 185 cities, of varying sizes and at different stages of development, by their level of sustainability from 2005 to 2011. To ensure data was available, as well as to reflect the full landscape of Chinese cities, our sample includes all levels of cities from municipalities directly under the central government, to county-level cities with populations ranging from 200,000 to 20 million.

Our study also benchmarks sample Chinese cities against advanced global cities. We studied the basic principles affecting the development of urban sustainability in order to identify closely-related features. Our aim is to understand how China's sustainability drive is evolving, and to provide an international reference for Chinese cities during this process.

The indicator system serves as a quantifiable scoring tool to evaluate cities urban development. With this tool, Chinese cities can identify models for urban development both within China and abroad, based on their own stage of development. Depending on how they scored in each category and their overall score, Chinese cities can also identify their advantages and disadvantages, craft development strategies, and evaluate the potential impact and effectiveness of development policies.

Key findings of the research include the following:

1. **Most of China's cities have improved their level of sustainability in recent years, primarily in the social and environment sub-categories.** This reflects both strong underlying progress driven by healthy economic growth and a renewed emphasis on delivering social and environmental benefits.
2. **The top 10 cities with best overall sustainability performance are located mostly in the coastal or eastern regions.** Cities in the east showed the strongest level of overall sustainability, followed by cities in central and western China. The same is true of city performance in the economic, social and environmental sub-categories studied. From 2008 to 2011, the gap between western and central cities was somewhat widened, with central cities gradually catching up with eastern cities. Situated in geographic locations favorable to trade and investment opportunities, Eastern cities were early beneficiaries of China's economic liberalization policies. However, since each city is at a different stage of economic development, the strongest economic performers are not necessarily those cities with the fastest improvement in sustainability.
3. In the long term, **the sustainability of China's cities is positively correlated to economic strength, population size, and density, FDI, and migration. However, our sample cities show there are clear turning points at which a city's sustainability potentially slows down, or stalls.** This becomes especially evident when a city with a population size of more than 4.5 million, population density of more than 8000 people per square kilometer, FDI of more than USD 3 billion, or with a more than 30% share of migrants. Most developed Chinese cities are positioned at such sustainability turning points: Shanghai, Beijing, Shenzhen, Guangzhou, Hangzhou, Tianjin, Chengdu, Nanjing, Shenyang, Wuhan and Chongqing.



4. **The gap with global benchmark cities is closing slowly.** Over the past few years, most Chinese cities are closing in on benchmark cities such as Tokyo, Seoul and London. But unlike the Chinese cities sampled, benchmark international cities are able to improve their levels of sustainability, whether or not they reach turning points in their development. Leading cities make better use of the economic advantages that high population density brings. They are able to deliver security, social stability and efficient allocation and utilization of resources at the same time. Many Chinese cities, especially those that have passed through the turning points, will have their potential for growth limited if they continue to follow existing models of development. A blind pursuit of economic growth, population expansion, and an increase in population density will prevent sustainable progress. Policy-makers in these cities must learn from leading international cities by seeking out new growth models. These include the construction of smart and low-carbon cities, a strategy that would strengthen the urban capacity of these cities. Policy-makers must also improve city planning, construction and management, in the hope that these cities will be able to leapfrog development.
5. **Bigger improvements in sustainability are possible for cities at earlier stages of economic development.** Increases in productivity (GDP per capita), the rise in scale (population and density), and external factors such as FDI and migration demonstrate a much bigger impact on sustainability for cities at earlier stages of economic development, than when they are at a more mature stage of development.
6. **Cities can determine their own future;** their fate is not determined by GDP, population size or density. **Cities can, at any time in their development, make improvements by leveraging inherent strengths, comparative natural advantage or policy instruments.** No uniform laws were identified, from our sample of 185 cities, to interpret short-term changes in a city's sustainability using only changes in macro variables.
7. **When a city's economy reaches a certain level of maturity, imbalance emerges between the economy and the social and environmental aspects.** Some rich and large cities are developing at the cost of social and environmental deterioration. Population and economic size expansion cannot help them further without social and environmental sacrifice as they lack advanced city management capabilities.
8. During the transformation from small cities to large ones, **small cities should better integrate with cluster cities.** This would enable them to leverage the advantages of the cluster while contributing their strengths to the entire cluster.

Introduction to the China Urban Sustainability Index 2013

Three years ago, the Urban China Initiative published the Urban Sustainability Index (USI), which provided a comprehensive analysis of the sustainability shifts taking place across cities in China. Since then, the USI has been refined and updated. USI is comprised of a group of indicators that provide a comprehensive assessment of a city's sustainability performance across four categories: economy, society, resources and environment. USI also accounts for the relationships between sub-categories. USI data provides a rich source for academic research, and serves as a point of reference for China's policymakers as they evaluate the country's sustainable development efforts and craft urban development policy.

Deepening reforms

Under the guise of China's new reforms, more than half the nation's counties and county-level cities will phase out GDP evaluation. Yang Weimin, Vice Director of the Central Financial Leading Group Office, made this promise at the annual forum of the Urban China Initiative on November 28, 2013. The forum followed the landmark Third Plenary Session of the 18th CPC Central Committee earlier in the month. Two weeks later, CPC's Organizational Department issued *A Notice to Improving the Performance Evaluation of Local Party and Government Leading Bodies and Leading Cadres*. The notice asked Communist Party officials to look beyond GDP and other growth rates as main performance indicators, refrain from ranking local GDP and growth rates, or assess the performance of leading cadres based solely on GDP.

This represented a sea change in the evaluation of urban performance. It showed a calculated and deliberate decision by the new leadership to assess China's achievements over the past ten years, and transform its growth model for the future. Economic development as the center of reform has undoubtedly brought prosperity and development to China. However, if priority continues to be placed on maximizing the size and growth rate of the economy, tensions between economic growth, social development, resource utilization, and protection of the environment will worsen, rendering China's economy development unsustainable.

Under the government's new growth strategy, we expect to see major changes in economic development strategies, with a much greater emphasis on pursuing a more balanced and sustainable set of development metrics.

New urbanization strategy

The *Decision* reached at the Third Plenary Session of the 18th CPC Central Committee proposed "a new path of urbanization with Chinese characteristics."

At the urbanization working conference (following the Third Plenary Session), the Central government emphasized that a national effort was underway to improve the quality and level of urbanization. This would involve making better use of land, managing population concentration, upgrading energy efficiency, reducing energy consumption and CO₂ emissions, prioritizing environmental security, and increasing forest, lake and wetland conservation. Efforts would also focus on boosting water conservation, reducing discharge of major pollutants, slowing development in some areas, and enhancing the prevention and mitigation of natural disasters.

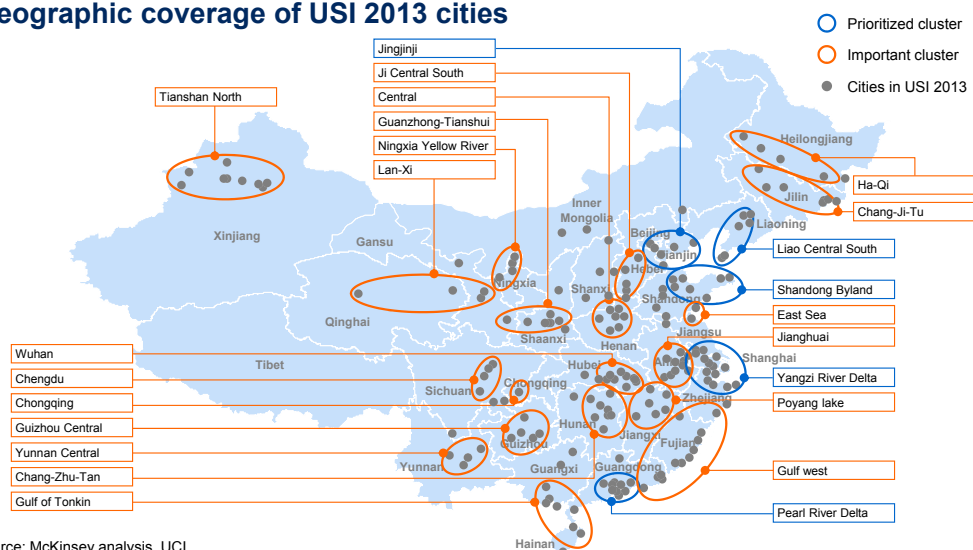
Given this turn of events, China's urbanization effort will focus more on economic sustainability, social development, resource preservation and environmental protection.

The forthcoming national urbanization plan will drive this new urbanization strategy, and serve as a guide to sustainable urban development.

Research scope

USI 2013 covers a longer period of time and studies more cities than USI 2011. Raw data was drawn from a **seven-year period: 2005-2011**; with the most recent data in most cities dating as of 2011. Raw data in USI 2011 was assembled from a four-year period: 2005-2009. Our research covers all **185** Tier 1 and Tier 2 cities, some county-level cities, as well as prioritized clusters and important clusters as designated in the *National Main Functional Cluster Plan* (Figure 1). These cities were considered for study because the government recognized them as urbanized areas with population settlement and economic activity. The report includes more key prefecture cities and county cities than the 112 cities analyzed in USI 2011.

Figure 1
Geographic coverage of USI 2013 cities



Source: McKinsey analysis. UCI

Cities included in 2013 index

| Anhui | Guangdong | Hebei | Hunan | Jilin | Shandong | Xinjiang |
|--------------|------------------|-----------------|----------------|----------------|---------------|--------------|
| 1 Hefei | 23 Shenzhen | 52 Tangshan | 84 Xiangtan | 112 Changchun | 139 Rizhao | 165 Urumqi |
| 2 Ma'anshan | 24 Guangzhou | 53 Baoding | 85 Changsha | 113 Jilin | 140 Qingdao | 166 Karamay |
| 3 Wuhu | 25 Zuhai | 54 Shijiazhuang | 86 Yueyang | 114 Songyuan | 141 Weihai | 167 Changji |
| 4 Anqing | 26 Zhanjiang | 55 Qinhuangdao | 87 Zhangjiagie | 115 Yanji | 142 Jinan | 168 Shihezi |
| 5 Chizhou | 27 Shantou | 56 Handan | 88 Zhuzhou | 116 Longjing | 143 Yantai | 169 Kuitun |
| 6 Tongling | 28 Foshan | 57 Langfang | 89 Changde | 117 Tumen | 144 Zibo | 170 Wusu |
| 7 Chaoiu | 29 Zhongshan | 58 Huanghua | 90 Hengyang | 118 Hunchun | 145 Tai'an | 171 Bole |
| 8 Chuzhou | 30 Shaoguan | 59 Xingtai | 91 Yiyang | | 146 Zaozhuang | 172 Yining |
| 9 Xuancheng | 31 Dongguan | | 92 Loudi | Liaoning | 147 Jining | 173 Fukang |
| | 32 Huizhou | Heilongjiang | | 119 Dalian | 148 Weifang | |
| Beijing | 33 Jiangmen | | Inner Mongolia | 120 Benxi | 149 Dongying | Yunnan |
| 10 Beijing | 34 Zhaoqing | 60 Daqing | 93 Hohhot | 121 Shenyang | 150 Binzhou | |
| Chongqing | 35 Jieyang | 61 Harbin | 94 Baotou | 122 Anshan | | 174 Kunming |
| | 36 Chaozhou | 62 Mudanjiang | 95 Chifeng | 123 Fushun | | 175 Qujing |
| 11 Chongqing | 37 Shanwei | 63 Qiqihar | | 124 Jinzhou | Shanghai | 176 Yuxi |
| | | 64 Suifenhe | Jiangsu | | 151 Shanghai | 177 Chuxiong |
| | | | 96 Nanjing | Ningxia | Shanxi | Zhejiang |
| Fujian | Guangxi | Henan | 97 Nantong | 125 Yinchuan | 152 Taiyuan | |
| 12 Putian | 38 Liuzhou | 65 Zhengzhou | 98 Suzhou | 126 Shizuishan | 153 Changzhi | 178 Hangzhou |
| 13 Xiamen | 39 Beihai | 66 Luoyang | 99 Lianyungang | 127 Wuzhong | 154 Linfen | 179 Ningbo |
| 14 Quanzhou | 40 Guilin | 67 Anyang | 100 Wuxi | 128 Zhongwei | 155 Yangquan | 180 Wenzhou |
| 15 Fuzhou | 41 Nanning | 68 Jiaozuo | 101 Changzhou | | 156 Datong | 181 Jiaxing |
| 16 Zhangzhou | 42 Qinzhou | 69 Kaifeng | 102 Yangzhou | | | 182 Shaoxing |
| 17 Ningde | 43 Fanggangcheng | 70 Pingdingshan | 103 Xuzhou | Qinghai | Sichuan | 183 Taizhou |
| 18 Wuyishan | | 71 Xuchang | 104 Zhenjiang | 129 Xining | | 184 Huzhou |
| | Guizhou | 72 Xinxiang | 105 Taizhou | 130 Geermu | | 185 Zhoushan |
| Gansu | 44 Guiyang | Hubei | | Shanxi | | |
| 19 Lanzhou | 45 Zunyi | 73 Wuhan | Jiangxi | 131 Tongchuan | 157 Chengdu | |
| 20 Jinchang | 46 Anshun | 74 Jingzhou | 106 Nanchang | 132 Xi'an | 158 Mianyang | |
| 21 Tianshui | 47 Duyun | 75 Yichang | 107 Jiujiang | 133 Xianyang | 159 Panzhihua | |
| 22 Baiyin | 48 Kaili | 76 Huangshi | 108 Jingdezhen | 134 Yan'an | 160 Luzhou | |
| | | 77 Huanggang | 109 Yingtan | 135 Baoji | 161 Yibin | |
| | Hainan | 78 Ezhou | 110 Xinyu | 136 Weinan | 162 Deyang | |
| | 49 Haikou | 79 Xiaogan | 111 Fuzhou | 137 Shangluo | 163 Leshan | |
| | 50 Sanya | 80 Xianning | | | | Tianjin |
| | 51 Wenchang | 81 Xiantao | | | | 164 Tianjin |
| | | 82 Qianjiang | | | | |
| | | 83 Tianmen | | | | |

Index selection

We used the same index system framework for USI 2013, as we used for USI 2011. The evaluation was done by breaking down the issues into four categories for analysis: economy, society, resources and the environment, (including cleanliness and the built environment). We selected 23 indicators for the index to quantify the level of sustainability (Figure 2). This took into consideration the 17 indicators in USI 2011 and the 34 indicators proposed in the *China Urbanization Index* by UCI and the NDRC in 2012. To bolster the emphasis **on quality of life compared to USI 2011, USI 2013 has replaced or added** indicators such as per capita disposable income, employment rate, number of doctors per capita, pension and healthcare coverage rates, air quality, water supply coverage, internet access and water usage efficiency.

Figure 2
23 indicators are included in four categories with emphasis on Society and Environment

Bold = indicator not in USI 2011

| Category (weight = 100%) | | Components (weight within category = 100%) | Indicators |
|-----------------------------|--------------------------------------|---|--|
| Society (33%) | Social welfare (33%) | Employment (25%) | Urban employment rate (%) |
| | | Doctor resource (25%) | Number of doctors per capita (per thousand persons) |
| | | Education (25%) | Middle school students in young population (%) |
| | | Pension (13%) | Pension security coverage (%) |
| | | Healthcare (13%) | Health care security coverage (%) |
| Environment (33%) | Cleanliness (17%) | Air pollution (11%) | Concentration of SO ₂ , NO ₂ , PM ₁₀ (mg per cubic meter) |
| | | Industrial pollution (11%) | Industrial SO ₂ discharged per unit GDP (tons per bn RMB) |
| | | Air qualified days (11%) | Days of air qualified equal or above level II¹(%) |
| | | Waste water treatment (11%) | Wastewater treatment rate (%) |
| | | Household waste management (5%) | Domestic waste treated (%) |
| | Built environment (17%) | Urban density (11%) | Persons per square kilometer of urban area |
| | | Mass transit usage (11%) | Passengers using public transit (per capita) |
| | | Public green space (11%) | Area of public green space (%) |
| | | Public water supply (5%) | Public water supply coverage (%) |
| | | Internet access (11%) | Household access to Internet (%) |
| Economy (17%) | Economic development (17%) | Income level (33%) | Disposable income per capita |
| | | Reliance on heavy industry (33%) | GDP from service industry (%) |
| | | Capacity investment (33%) | Government investment in R&D (per capita) |
| Resources (17%) | Resource utilization (17%) | Energy consumption (33%) | Total energy consumption (SCE per unit GDP) |
| | | Power efficiency (33%) | Residential power consumption (kwh per capita) |
| | | Water efficiency² (33%) | Total water consumption (liters per unit GDP) |

1 Air qualified days defined as days qualified equal or above Air Pollution Index level II. There are six levels by API. Level II means air quality is general acceptable to public, except for specially sensitive population.

2 Cities are classified by water resource and then are scored within their own group to minimize distortion by natural water resource

SOURCE: McKinsey analysis, UCI

Research methodology

To calculate scores, we standardized all indicators' dimensions so that they could be added to, or compared with each other. The calculated mean of the year before and after, or the average growth rate of nearby years, was used to fill the data gaps for some years.

In USI 2011, we assigned equal importance to the four sub-categories. In USI 2013 society and environment are given more weight – each is worth 1/3 of the whole – than economic and resources, each of which is worth 1/6 of the whole.

In addition to the analysis of the traditional set of key drivers, USI 2013 made additional breakthroughs in three areas:

Firstly, we focus more on growth analysis than on static level analysis. We not only ranked cities by their current sustainability scores, but also calculated the compound annual growth rate of each indicator, gave them the same weight as in the original system, and calculated the growth rate of sustainability. As a result, we are able to deduce which cities, albeit at different stages of economic development, grow fastest. Consequently, this allows us to study the drivers of growth.

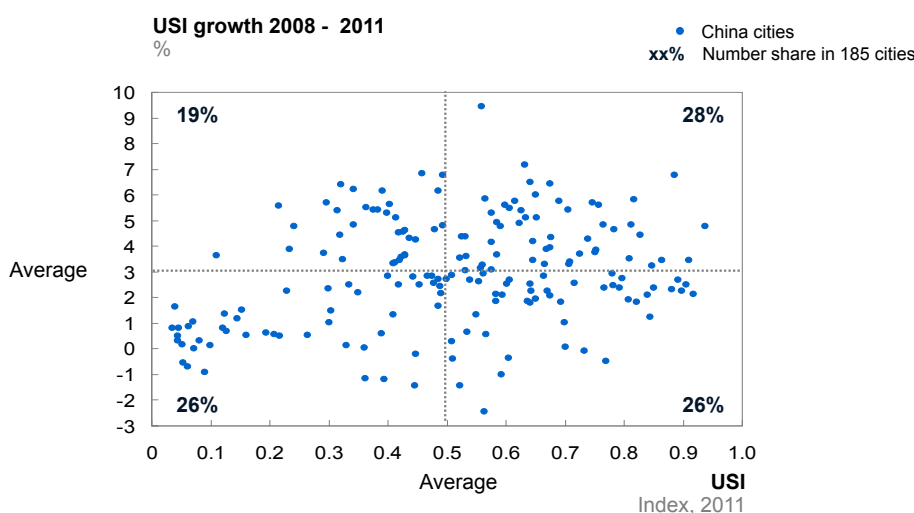
Second, to identify examples of outstanding development in cities, and to help encourage their further development, **we benchmarked domestic cities with 11 international cities**, including London, Berlin, Paris, Prague, Warsaw, Stockholm, Copenhagen, New York, Tokyo, Hong Kong and Seoul.

Third, we **summarized city growth strategies through quantitative analysis**, and conducted **9 case city studies** to understand the characteristics of different cities, including their advantages and disadvantages, and identify relevant growth strategies.

Changes in urban sustainability from 2008 to 2011

On the whole, **most Chinese cities have seen a gradual improvement in sustainability in recent years** (Figure 3). Average growth rate of sustainability from 2008 to 2011 is around 3%. Some cities experience high growth of 7-9%, while about 10 cities experience negative growth. **Social and environmental changes primarily lead this type of change.** Compared with 2011, social and environmental indicators in sub-category indicators were quite different from 2008 (Figure 4). Small cities (GDP below USD 5 billion at 2008) show larger changes in social indicators than medium (GDP between USD 5 billion and 20 billion at 2008) and large cities (GDP larger than 20 billion at 2008). However, in economic and environmental indicators medium/large cities have bigger improvements than small cities. Medium cities exhibit the largest changes in built environmental-related indicators.

Figure 3
Most Chinese cities have gradual growth in sustainability in the past years



SOURCE: McKinsey analysis; UCI

As shown by Figure 4, Chinese cities experienced the most significant changes in urban healthcare and pension insurance coverage, waste water management and industrial air pollution, internet access coverage and mass-transit utilization.

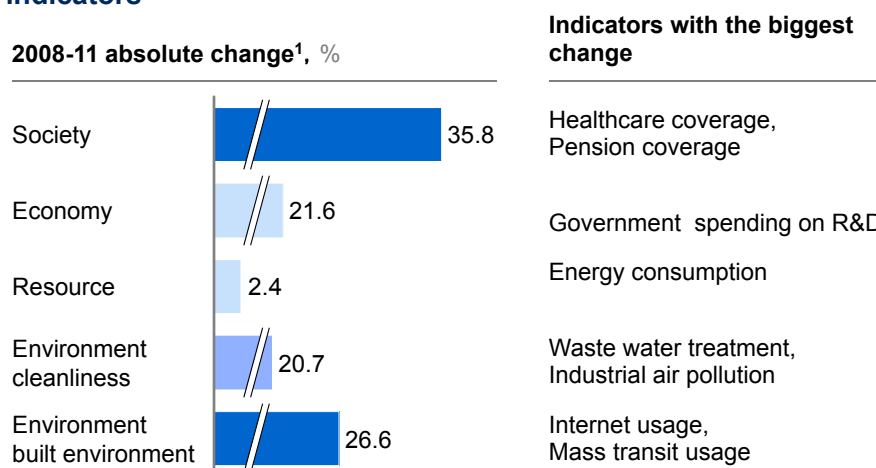
Top overall performers in 2011 were Zhuhai, Shenzhen, Hangzhou, Xiamen, Guangzhou, Dalian, Fuzhou, Beijing, Changsha and Yantai (Figure 5). Except for Changsha, all top 10 cities are in eastern China. Except for Changsha and Beijing, 8 out of 10 are located in coastal clusters, such as the Pearl River Delta, Yangzi River Delta, Gulf West, Shandong Byland, etc. Three cities are in the Pearl River Delta cluster in Guangdong Province, namely Zhuhai, Shenzhen and Guangzhou. **This suggests coastal clusters are enjoying the fruits of earlier economic openness, and with their superior geographic access, are currently the most successful and sustainable areas in China.**

These top 10 cities constitute around 1% of China's urban population and 16% of its urban GDP. Except for the mega-cities of Shenzhen, Guangzhou and Beijing, most of the top 10 performers are medium-sized cities with urban population of 1.5-6.5 million; with 6 out of 10 cities home to a 2-4 million population. All of them have a population density of 7,000-

10,000 people per square kilometer, with the exception of Beijing, which is more densely populated, with around 14000 people per square kilometer. All top performers have a GDP per capita level of 90-100,000 RMB, and can be compared with other top GDP performers in China, where GDP per capita reaches 200,000 RMB. The comparisons indicate that, **in terms of their population and economic size, the winners are well-managed in their economic development.** We will explore these characteristics in greater depth later in the report.

Figure 4

Overall sustainability change mainly comes from society and environment related indicators



¹ Category change is calculated by taking the average of indicators' absolute change between 2011 and 2008, i.e. indicator change = absolute change of (2011 value – 2008 value) / 2008 value

SOURCE: McKinsey analysis; UCI

Figure 5

Top 10 cities in sustainability¹

| Rank | Overall score | Society | Environment | Economy | Resource |
|------|---------------|-----------|-------------|----------|-----------|
| 1 | Zhuhai | Karamay | Shenzhen | Beijing | Ningde |
| 2 | Shenzhen | Zhuhai | Zhuhai | Shanghai | Beijing |
| 3 | Hangzhou | Yangquan | Xiamen | Shaoxing | Zhangzhou |
| 4 | Xiamen | Beijing | Haikou | Shenzhen | Shangluo |
| 5 | Guangzhou | Shaoguan | Fuzhou | Hangzhou | Zhongshan |
| 6 | Dalian | Zhaoqing | Qingdao | Suzhou | Putian |
| 7 | Fuzhou | Guangzhou | Hangzhou | Wuxi | Foshan |
| 8 | Beijing | Panzhuhua | Changzhou | Ningbo | Hangzhou |
| 9 | Changsha | Daqing | Karamay | Jiaying | Zhanjiang |
| 10 | Yantai | Hangzhou | Dalian | Changsha | Nantong |

¹ The ranks are based on data in 2011

Source: McKinsey analysis; UCI

Current top performers are not necessarily the same as those cities which have demonstrated the biggest improvements in sustainability. Chinese cities develop differently depending on GDP size (Figure 6). In the group of cities with the largest GDP (GDP greater than USD 20 billion), Xi'an, Changzhou, Zhongshan, show the largest improvements in sustainability, with around 5% annual growth from 2008 to 2011. In the group of cities with medium-sized GDP (GDP between USD 5 billion and 20 billion), Xinyu, Fuzhou and Zhanjiang, have roughly 7% growth. The cities of Jieyang, Sanya and Shanwei, all in the group with small-sized GDP (GDP size smaller than USD 5 billion), show high growth rates of 7-9%. Most of the cities in the top 5 in each group are from the eastern and coastal areas of China.

Figure 6

Top 10 cities with the biggest sustainability improvement at each economic stage

2008-2011 USI growth

| Rank | Large GDP (>\$20 bn ¹) | Medium GDP (between \$5 and \$20 bn) | Small GDP (>\$5 bn) |
|------|------------------------------------|--------------------------------------|---------------------|
| 1 | Xi'an 5% | Fuzhou 7% | Jieyang 9% |
| 2 | Changzhou 5% | Zhanjiang 6% | Sanya 7% |
| 3 | Zhongshan 4% | Benxi 6% | Shanwei 7% |
| 4 | Foshan 4% | Yangzhou 6% | Xinyu 7% |
| 5 | Daqing 4% | Ma'anshan 6% | Tongling 6% |
| 6 | Nanjing 4% | Kunming 6% | Zunyi 6% |
| 7 | Tianjin 4% | Wuhu 6% | Fuzhou 6% |
| 8 | Chongqing 3% | Hefei 6% | Mudanjiang 6% |
| 9 | Hangzhou 3% | huizhou 5% | Chizhou 6% |
| 10 | Changsha 3% | Jinzhou 5% | Jiaozuo 6% |

¹ By 2008 GDP size

Source: McKinsey analysis; UCI

Geographic patterns

Are cities in different regions across China at clearly different levels of sustainability? In 2011, there was a distinct correlation between a city's level of sustainability and its geographic location. In eastern China, 72 cities performed in the top quintile of sustainability, with a high percentage of cities performing very well. They were followed by 61 cities in central China – most of them in the upper middle section of the rankings. 52 western cities came last, with a majority of poor performers dragging the overall result down.

We have been able to observe huge differences in every region based on an in-depth study of the economy, society, resources and the environment. Eastern cities scored the highest in resources, but the lowest in social development. Central cities scored the highest in resources, but the lowest in economy. Western cities performed best in social development, but the worst in resources. Despite a low overall score, central China and western China were relatively close in social development performance to those in eastern China (Figure 7).

Moreover, the central region improved the most, while the western region demonstrated the least improvement. These results were arrived at by comparing regional changes during the period 2008-2011: despite the fact that the three regions retained the same ranking, the central region slowly caught up with the eastern region, and the gap between the western and central regions widened.

Of the 24 clusters studied, Pearl River Delta, Yangzi River Delta and Shandong Byland emerged with a clear advantage over all the others in 2011. These top-performers scored around 75, while the others scored 60 or below. Despite the size of their economy, Jianghuai, Poyang Lake and Ha-Qi improved more than the other clusters over the period 2008-2011. Their rate of sustainable growth rose at a rate of approximately 5%, while the other clusters climbed at a rate of 4%, or lower. Five clusters are listed in the top 10 in both overall sustainability level and improvement rankings, namely Pearl River Delta, Chengdu, Poyang Lake, Jianghuai and Ha-Qi (Figure 8).

Figure 7
The east outperformed the central and the west in all categories at 2011 with the gap enlarging in the past years

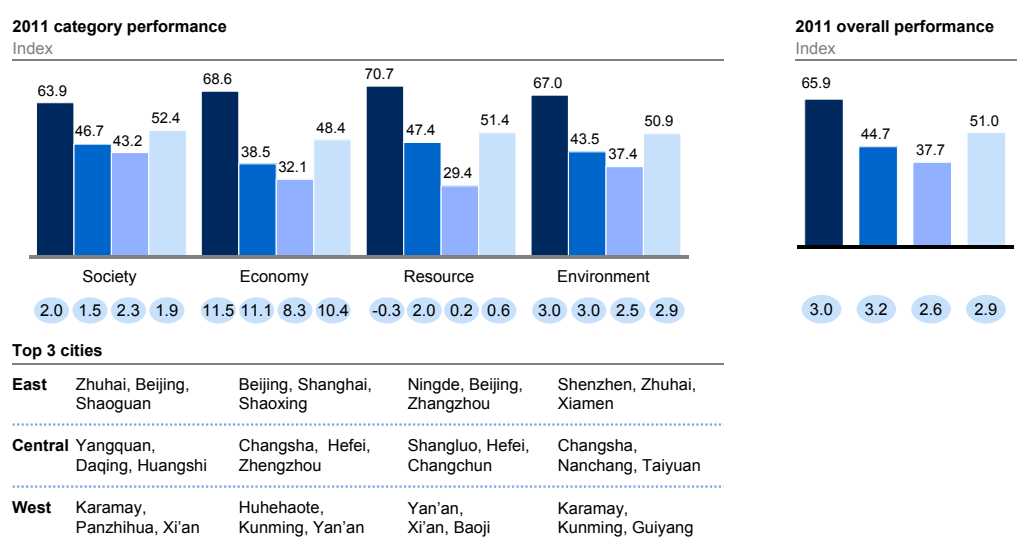
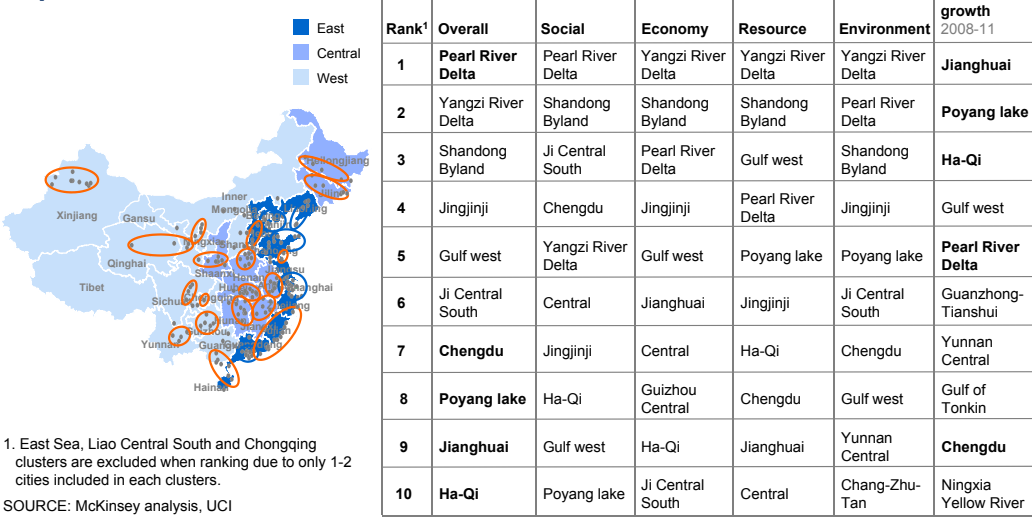


Figure 8
Top 10 clusters at 2011



Gap with global benchmarks

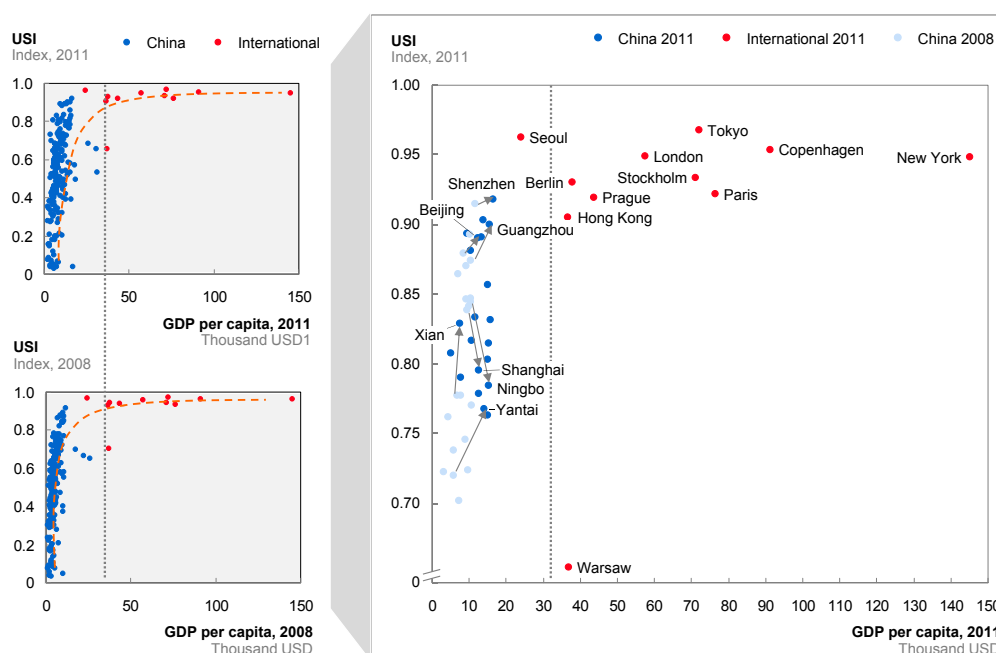
We selected 11 global cities as benchmarks including Tokyo, Seoul, Hong Kong, Copenhagen, London, Berlin, Stockholm, Prague, Paris, New York and Warsaw. Broadly speaking, most Chinese cities, such as Shenzhen, Guangzhou and Changsha, are catching up with our benchmark global cities, while several cities, including Shanghai, Ningbo and Dalian, have been gradually falling behind in recent years (Figure 9). **Chinese cities are slowly narrowing the gap with the global benchmark cities.** The pace at which they are catching-up increased from 0.4% to around 1% during 2008-2011.

The main gaps between Chinese cities and their international counterparts are in social, economic and environmental categories (Figure 10), and **more specifically in social and environmental cleanliness categories**, such as urban employment, per capita doctor numbers, industrial air pollution, air qualified days, and waste water treatment. We arrived at this conclusion by comparing each indicator of the sub-categories. Meanwhile, a comparison of category indicators shows that our global benchmark cities perform better in all society indicators than our leading Chinese cities.

For example, international cities have 4.5 doctors per thousand people, whereas our leading Chinese cities have 2.6 doctors per thousand people. The 11 global cities in our study also perform better in income per capita and in the strength of their service sectors than Chinese cities. Cities in which the service sector comprises 80% of GDP enjoy stronger economic growth and employment, as well as cleaner environments.

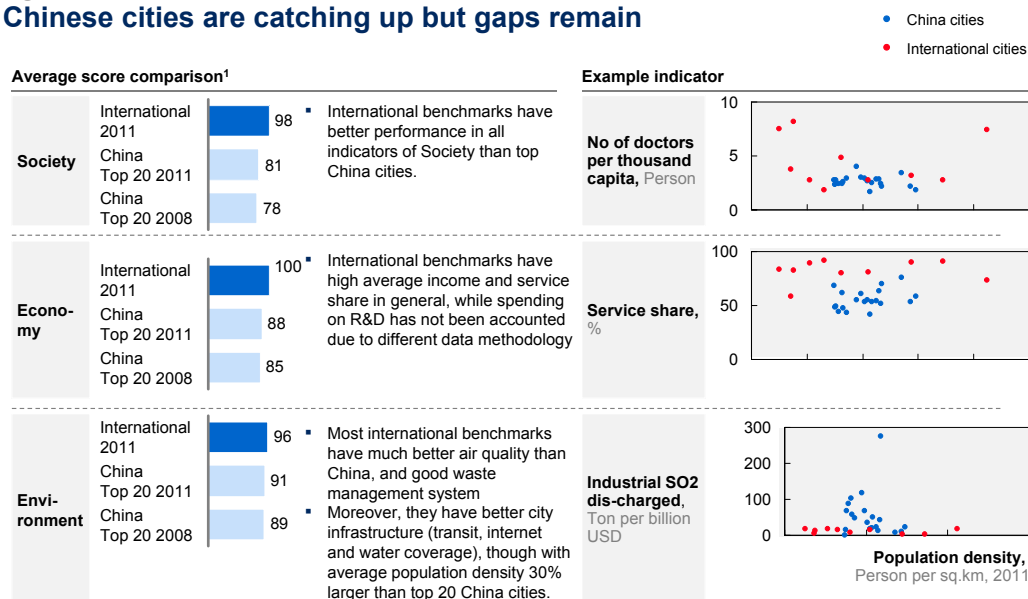
The gap in environmental indicators is very large. Leading global cities have much better air quality, as well as waste management. The concentration of air pollutants such as NO₂, SO₂ and PM₁₀, in international cities we studied is far lower than in Chinese cities. Emissions of industrial SO₂ are just 1/20th the level measured in Mainland Chinese cities. We carried out a limited comparison of resource indicators, due to differences in statistical standards between global and Chinese cities.

Figure 9
Although sustainability in China is improving in recent years, it still has a long way to close the gap with international standards for most of the cities



Source: McKinsey analysis; UCI

Figure 10
Chinese cities are catching up but gaps remain



¹ Warsaw is not included due to poor data quality

SOURCE: McKinsey analysis; UCI

The principles impacting city sustainability

To understand the basic principles that influence sustainability in China's cities sustainability, we conducted a correlation analysis between the level of sustainability and various factors.

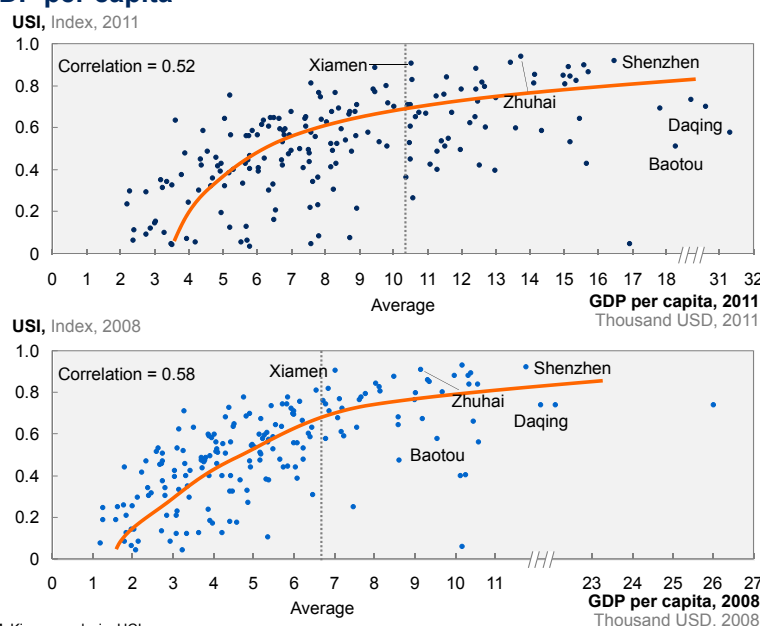
Economic development is the key

To identify the common principles underlying long-term sustainability drivers, we conducted a correlation analysis for all cities in the same year. As cities are at different development stages, their current performance can be used to represent the long term evolution of Chinese cities. Our results show that **the long-term sustainability of Chinese cities is closely correlated to the economy, population size and density**. Cities in China that demonstrate an outstanding performance in sustainability share the same characteristics of cities in well-developed economies. These include population size and density, as well as foreign direct investment (FDI), all of which appear to be correlated to sustainability.

In general, **there is a positive correlation between a city's sustainability and its GDP per capita** (Figure 11). Most economically advanced cities, such as Shenzhen, Guangzhou and Zhuhai, have higher levels of sustainability than poorer ones. The economic impact on sustainability is, however, diminished once GDP per capita reaches a certain level. Some economically advanced cities are ranked lower in terms of sustainability than other cities with less advanced economies. For example, Xuzhou's GDP per capita is higher than that of Xiamen, but Xuzhou has a lower sustainability ranking than Xiamen. There is also a gradual weakening of the correlation between sustainability and the level of economic development of a city over different periods of time. This suggests that it would be difficult to improve a city's sustainability by improving its GDP per capita alone, particularly once the city has reached a certain level of economic development. Economically advanced cities in China should focus more attention on social development, environmental protection and resource efficiency.

Figure 11

In general, there is positive correlation between a city's sustainability and its GDP per capita

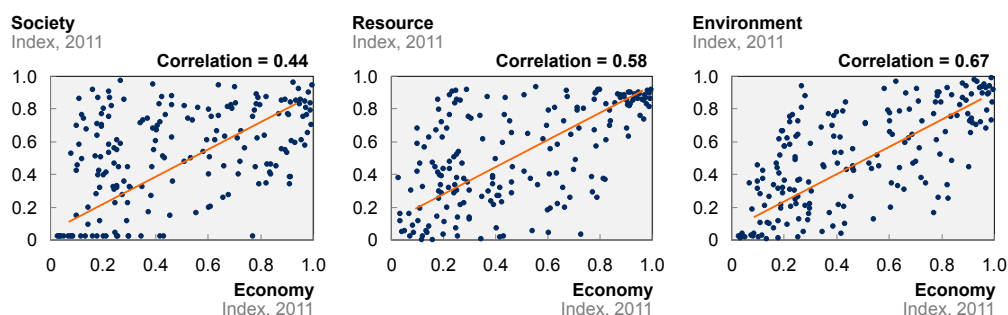


Source: McKinsey analysis; UCI

We identified similar relationships among the sub-categories of sustainability. There is a high correlation between the economy and the other three categories: society, environment and resources. This suggests that if a city's economy is strong, then it will usually perform well in at least two of the other three areas: society, resources and/or environment. The conclusion here is that **cities can and should develop their economies, as well as their society, resources and environment, at the same time** (Figure 12).

Figure 12

Among sub-categories, there are also positive correlations between Economy and Society or Resource or Environment



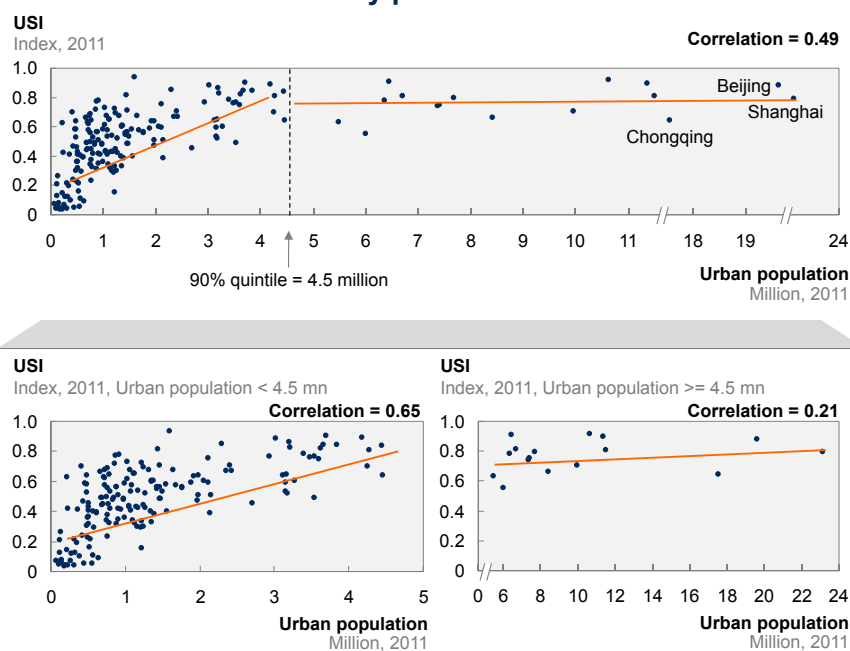
Source: McKinsey analysis, UCI

Critical decision-making points to enable a transformation

We found that there is a positive correlation between the level of sustainability and population size as well. This relationship is evident only when a population is smaller than 4.5 million (correlation 0.65). For cities with a population of more than 4.5 million, the correlation drops to 0.21. The turning point is shown clearly in Figure 13. This means that the expansion of a population will help improve a city's sustainability, but only up to the 4.5 million mark. Beyond 4.5 million, population expansion will no longer drive improvement in a city's level of sustainability. The urban populations we used in this report are based on the 2010 Census. From this perspective, we believe that **Chinese cities, based on our sample analysis, should recognize the need to transform their growth models when their populations reach the critical turning point of 4.5 million.**

Figure 13

Inflection on population track – cities with urban population higher than ~4.5 mn have similar sustainability performance

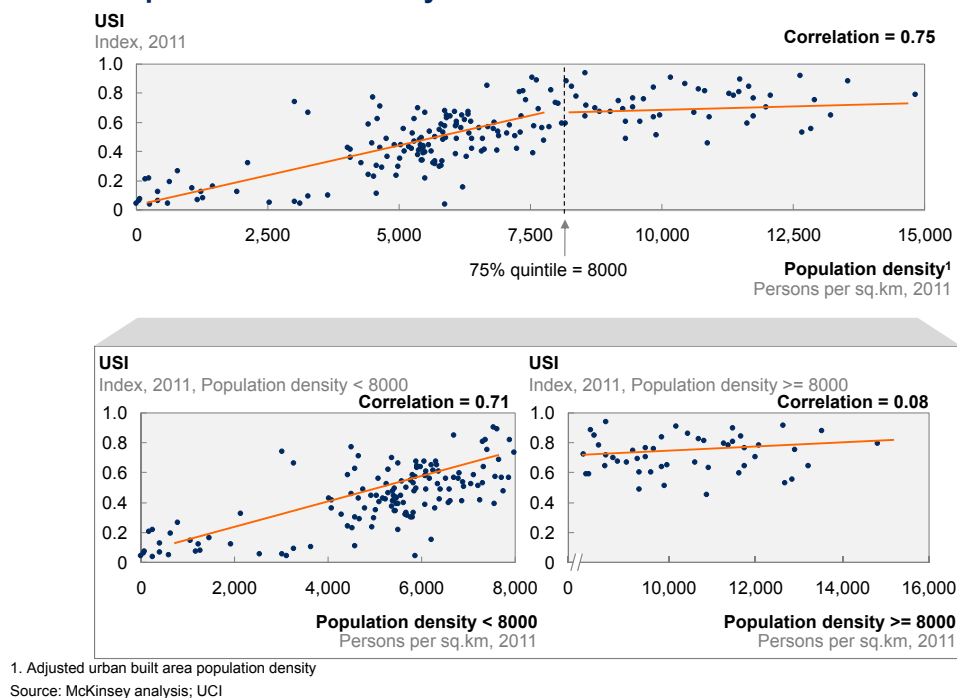


Source: McKinsey analysis; UCI

A similar turning point also appears when we study the correlation between population density (in urban built areas) and the level of sustainability. When population density is below **8000 people per square kilometer**, the correlation is 0.71. The correlation virtually disappears (dropping to 0.08) when population density exceeds **8000 people per square kilometer** (Figure 14). We also noticed the same trend in the sub-categories. **A second critical point in the sustainable development of Chinese cities is evident at 8000 people per square kilometer.** Cities with more than 8000 people per square kilometer exhibit only incremental improvement in sustainability.

Figure 14

Inflection on population density track – ~8000 people per s.km is an inflection point of sustainability in China

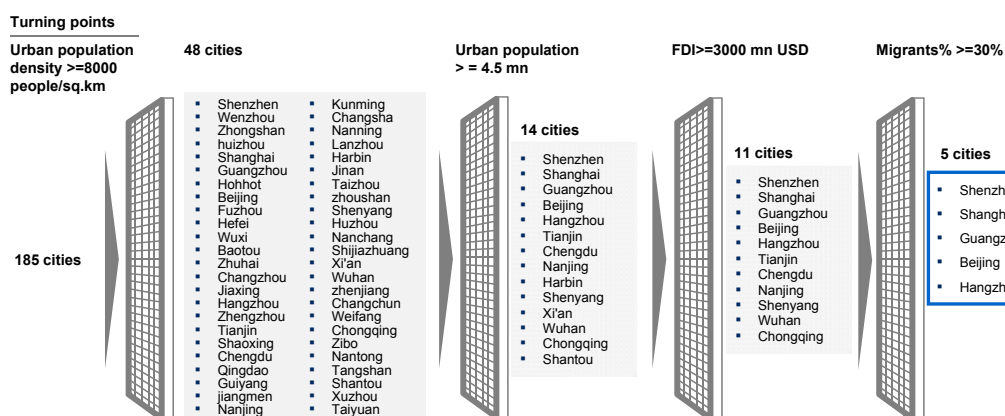


Foreign direct investment and migration are also positively correlated with the level of sustainability. **FDI is positively correlated with the level of sustainability in a city up until it reaches \$3 billion**, after which the correlation between the two drops to nearly zero. A similar turning point occurs when the share of migrants in a city's population reaches 30%.

More than 70 million people facing sustainability challenges

Five cities, with approximately 70 million people, or 10% of China's total urban population, have crossed our four turning points – Shanghai, Beijing, Shenzhen, Guangzhou and Hangzhou (Figure 15). In addition to these five cities, there are another six cities which have crossed the turning points of population size, density and FDI – Tianjin, Chengdu, Nanjing, Shenyang, Wuhan and Chongqing. **These eleven cities are home to around 155 million people, or 21% of China's total urban population.** Although most of these cities already have a high level of sustainability, additional improvements in sustainability as a result of growing population or higher GDP will be very limited. Since they represent such a large share of China's population, we call for an urgent transformation of current growth models. This would solve the contradiction between the pressures wrought by these cities' huge population and their limited carrying capacity, and would represent a step in the right direction towards improving their levels of sustainability.

Figure 15
5 cities representing 10% of urban population crossed all turning points



SOURCE: McKinsey analysis; UCI

Example of leading global cities and density turning points

From the analysis above, we would conclude that Chinese cities experience obvious turning points in sustainability upon reaching certain levels of income, population (4.5 million) and population density (8000 people per square kilometer). Does this relationship hold for other cities around the world? If not, what are the reasons for this? The answers could serve as useful reference for Chinese cities trying to break through sustainability bottlenecks.

Looking at density as a case in point, a direct link between population density and level of sustainability in global cities is not evident. The population densities in our sample of 11 international cities range from 2,500 - 22,000 people per square kilometer. They are all considered solidly sustainable, regardless of their concentration of population.

Top Chinese performers, such as Xiamen, Dalian, Ningbo and Jiaozuo, are positioned today at a sustainability crossroad. They currently display levels of sustainability and density very similar to our global benchmark cities like Copenhagen. Beyond this density turning point, only a few Chinese cities are able to maintain high performance (such as Shenzhen, Guangzhou and Hangzhou). The majority experience a decline in sustainability as population density rises, like Harbin, Lanzhou and Zhengzhou, which all have around 11,000 people per square kilometer. In sharp contrast, global benchmark cities like New York (11,000 per square kilometer), Tokyo (14,400 per square kilometer) and Seoul (17,000 per square kilometer) maintain a solid level of sustainability (Figure 16). It suggests that global benchmark cities, despite their high population density, have strong management capabilities that enable them to skillfully leverage their scale, and manage to absorb the pressures of urbanization while maintaining a higher standard of living, social stability and efficiency of resource allocation.

Tokyo's sustainability success

The population density in the main urban area of Tokyo is around 14400 people per square kilometer, equal to our Tier-1 Chinese cities (Shanghai, Shenzhen, Guangzhou and Beijing). Meanwhile, Tokyo's GDP per capita and GDP density are about \$70,000 and \$1,000 per square kilometer respectively, much higher than those of its Chinese counterparts. Despite population pressure and limited resources, Tokyo ranks No. 1 among its international counterparts in sustainability indexes, higher than any Tier-1 Chinese cities. Tokyo's outstanding performance in sustainability indices, especially in the social and environmental indicators, is a result of the Japanese government's persistent efforts to maintain social stability, protect the environment, produce robust economic growth and efficiently manage energy use (Figure 17).

Figure 16
High population density does not defer international cities to have high sustainability performance

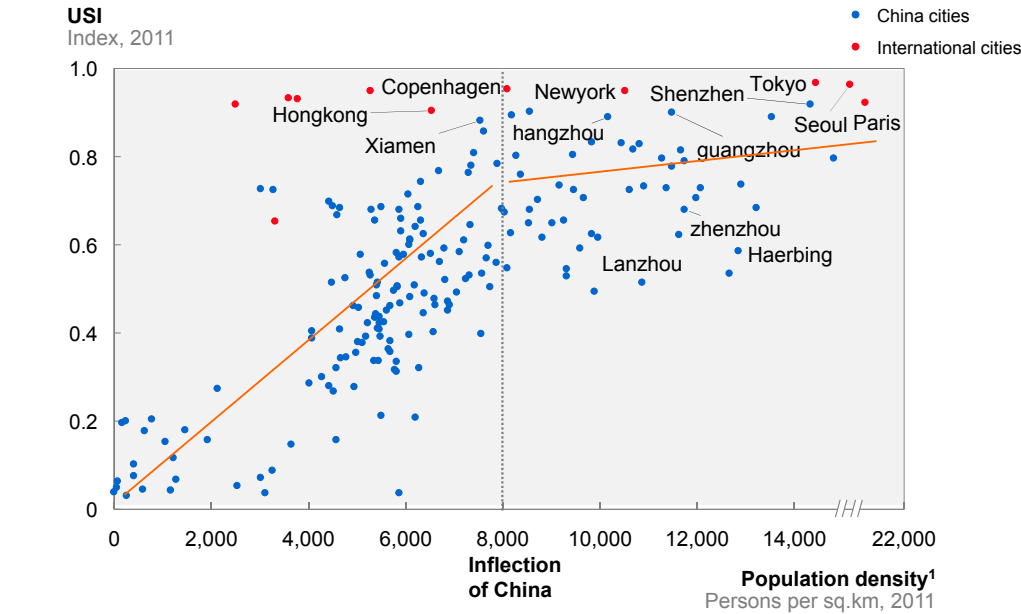
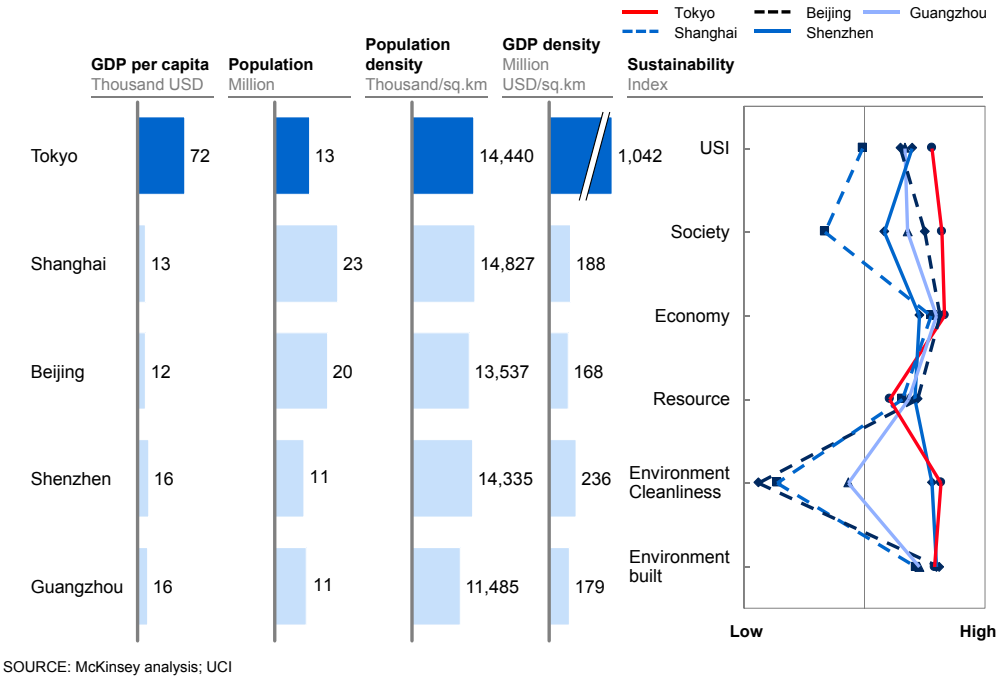


Figure 17
Tokyo with ~15,000 population density significantly surpasses major China cities in most sustainability categories



Tokyo takes the top spot among Asian cities in social security. It provides 100% coverage in basic pension and medical insurance. In addition to basic social security, Tokyo’s government also provides a social security net for children and the elderly. The Japanese capital has a well-designed daycare system for children. By 2020, it aims to provide day care services to more than 70,000 children. To accommodate its aging population, Tokyo also provides employment opportunities to senior citizens and assisted living centers for the elderly.

Tokyo's experience in environmental management, especially in waste gas pollution disposal, is also worth noting. In 2010, Tokyo took the lead in carbon emission reduction when it launched a carbon trading program in Asia. The program required enterprises to reduce CO₂ emissions by 6% by 2014, with the aim of reducing total CO₂ emissions by 25% between 2000 and 2020. Tokyo also banned the use of diesel vehicles in 2005 and required all taxis to be powered by liquefied natural gas. In waste management, Tokyo has actively promoted the 3R concept (reduce, reuse, and recycle); including the recycling of paper from waste paper. The city deploys a fee-based system for garbage disposal, with revenues collected used to pay waste management firms.

Tokyo's efficient mass-transit system – one of the world's most advanced - and its greening strategy, make it a very livable city. Tokyo has 2.5 times railway traffic mileage than Beijing. To increase the use of public transport, the Tokyo government has lowered bus fares, and imposed high parking charges for private cars, two strategies that have produced positive results. Furthermore, appropriate layouts, well-designed routes and integrated construction around bus stops have gradually made Tokyo residents more reliant on bus travel, which helps lower emissions and eases the flow of people around the city.

Tokyo's greening policies have also had a very positive impact. In its City Planning Act, the Tokyo government mandated that a park must lie within a 250-meter radius of any point in the city. The city has been carrying out a green building program since 2002, with city authorities empowered to order new buildings to be built with grassland and roof greening. City authorities are also empowered to develop fixed indicators for green coverage, which has to account for more than 20% of a building's total area. This measure addresses the challenge of incorporating green coverage despite severe space constraints.

Tokyo does not perform as strongly in terms of its economy as it does in the other categories of sustainability (society and environment). Nonetheless, it's worth noting a number of strengths exhibited by Tokyo on the economic front. Its services sector as a share of GDP exceeds 90%, a level that is twice that of the Chinese cities in our sample. To revitalize local industries, the Japanese government established the "Cool Japan" fund in 2013. Co-financed by the government and the corporate sector, the fund has a mission to promote Japanese cuisine, fashion, music and animation as important components driving economic the nation's economic growth.

Shaping strategies for cities

So what is a city leader to do? We wanted to identify how cities actually make changes in short-term sustainability.

Big improvements happen early in a city's economic development

As a start we factored in growth rate in sub-category indicators for each city during the period 2008-2011, then applied the same weights for each sub-category, and calculated the compound growth rate of sustainability in each city.

Our first observation is, as shown in Figure 6 in the previous section, the maximum growth in sustainability is 5% in cities with a very large-sized GDP, 7% in those with a medium-sized GDP, and 9% in cities with a small-sized GDP. A simple principle illustrated here is that **bigger improvements in sustainability are possible for cities at earlier stages of economic development**. Increases in productivity (GDP per capita), the rise in scale (population and density), and the attractiveness to external factors such as FDI and migration demonstrate a much bigger impact on sustainability for cities at earlier stages of economic development, than when they are at a more mature stage of development.

As a typical early stage city, Jieyang's USI ranking rose from 129th in 2008, to 86th in 2011. Jieyang's sustainability was primarily driven by development in the categories of society and resources. Jieyang's growth in sustainability is greater than its level of economic growth. Compared with other small-sized cities, Jieyang experienced the fastest growth (9%). From 2008 to 2011, Jieyang made sustainability progress in medical security, which delivered a breakthrough in a national system for basic drugs. The medical and health system was improved at the grassroots level and basic public healthcare was made available to more people. The city also invested more to protect its land and water resources, developed its forestry and marine ecological systems, and harnessed its resources and environmental protection mechanisms more effectively. These developments created a solid basis for Jieyang's sustainable development.

Up to cities to determine their own destiny

We also conducted a correlation analysis between the growth of sustainability and various macro factors. Our analysis shows there is no significant correlation between the growth in sustainability and the growth in macro indicators, including GDP, GDP per capita, population and population density (Figure 18). This is good news, meaning **cities can determine their own future**; their fate is not determined by GDP, population size or density. **Cities can, at any time in their development, make improvements by leveraging inherent strengths, comparative natural advantage or policy instruments.**

We also conducted a stage-based correlation analysis to take into account the growth differences during different stages of economic development. These differences stem from a variety of natural conditions and economic factors. With three development stages for 185 cities determined by GDP (2008), no significant correlation was identified between GDP growth and improvements in sustainability (Figure 19). The same is true for stage-based analysis of other macro indicators such as GDP per capita, income per capita, total population and population density. Therefore, no uniform laws were identified, from our

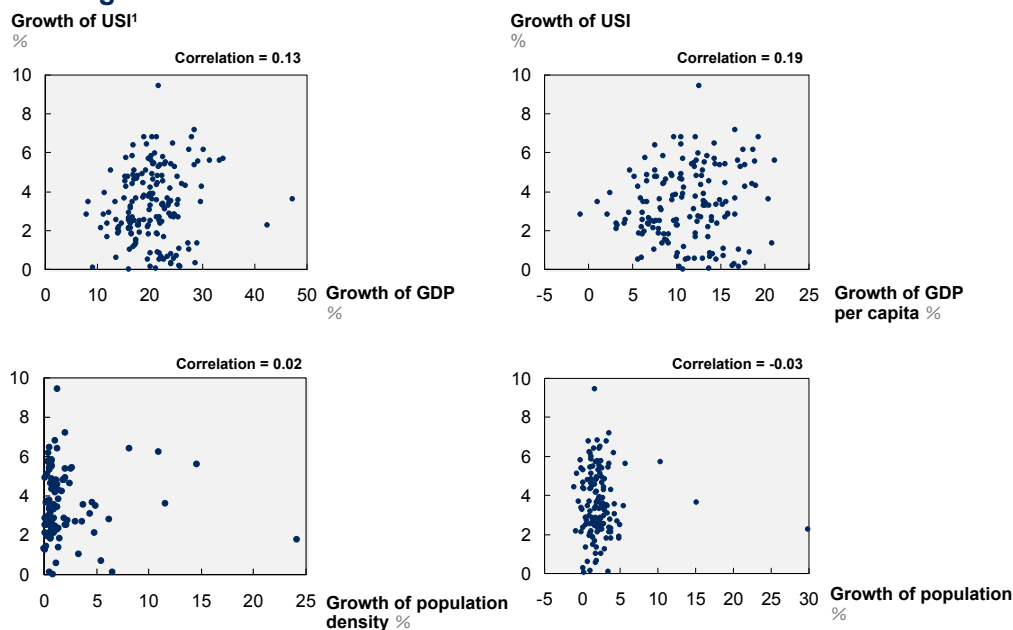
sample of 185 cities, to interpret short-term changes in a city's sustainability using only changes in macro variables. Again, it is up to cities to decide their own destiny.

We conducted case studies of 9 cities to understand how they made changes given their own development features. Please refer to the last section of this report containing a summary of key findings and the appendix in the electronic version of the report containing the case studies.

Figure 18

The growth of sustainability has no significant correlation with the growth of macro indicators

2008-2011

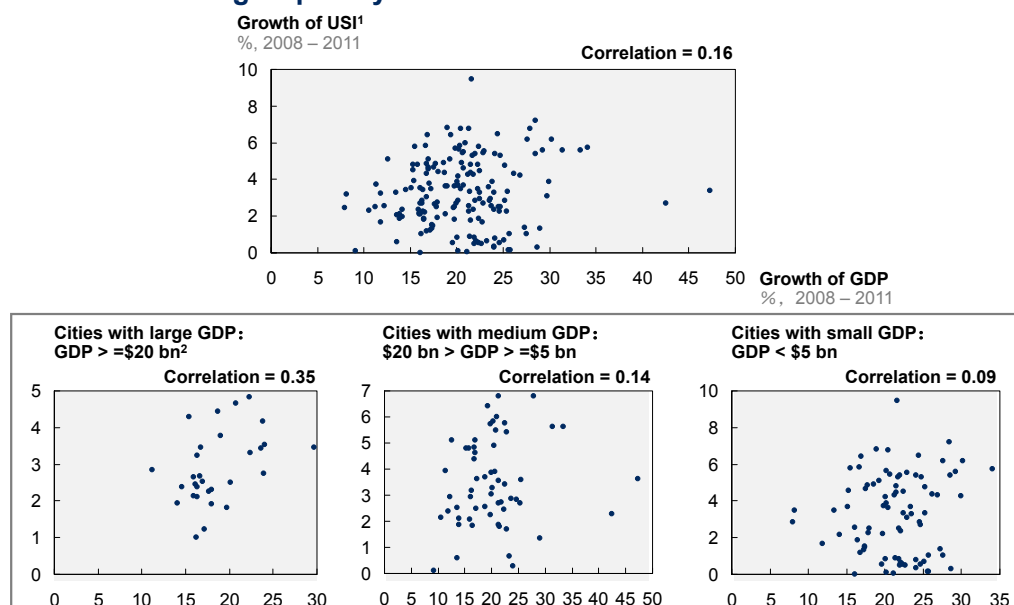


1 A few cities with negative growth have been excluded

Source: McKinsey analysis, UCI

Figure 19

The growth of sustainability has no significant correlation with the growth of GDP for cities grouped by GDP size



1 A few cities with negative growth have been excluded

2 Cities grouped by 2008 GDP

Source: McKinsey analysis, UCI

Rebalance towards society and the environment

As discussed in the previous section (Figure 4), changes in social and environmental categories lead overall changes to sustainability. Further, our correlation analysis between sub-categories shows that, for a number of cities that have a higher than average USI score (USI at 51), which are relatively developed with medium-large size (53% of sample cities with 82% of sample population), economic performance is negatively correlated with social performance (correlation at -0.1) and is not correlated with environmental cleanliness (correlation at 0.1). This finding confirms that **when a city's economy reaches a certain level of maturity, imbalance emerges between the economy and the social and environmental aspects.**

Rich and large cities are developing at the cost of social and environmental deterioration. The key growth strategy suggested here would be for these cities to promote productivity – to make the best use of the resources in place instead of hoping that continuous growth in inputs will deliver better results. Population and economic size expansion by themselves cannot deliver a better quality of life as they lack advanced city management capabilities. Productivity growth on the other hand enhances efficiency to enable cities to economically develop while delivering social and environmental benefits.

Having scored high in USI overall and across most sub-categories, Xi'an is a typical, large city, but with environmental cleanliness as its obvious weakness. However, from 2008 to 2011, the city's environmental cleanliness improved rapidly; its environmental ranking increased from 145 to 108. Together with huge progress along other aspects, Xi'an's USI ranking went from 36th in 2008, to 17th in 2011. With an annual growth rate of 5%, Xi'an is the fastest-growing city among all large-sized city economies.

Xi'an's ranking rose sharply due to a number of factors: the rising income of its residents; strong industrial development; success in building and operating world class High Tech-Clusters to promote R&D and productivity; wider coverage and better implementation of its social security network; increased employment support and unemployment benefits; a better educational system; and better management of its energy efficiency and pollution and emissions reduction thanks to improvements in its waste water treatment mechanism.

Eco-friendliness was a key consideration that was factored into the build out of Xi'an's infrastructure. These encompassed several projects, including the QinLin Eco-environment Protection Zone, the Weihe River City Section, the Hanchenghu Lake Treatment Initiative, and a three-year tree-planting effort. These programs significantly improved the living conditions in dry cities in China's west. See appendix for detailed analysis.

Small cities should work with larger cities in a cluster

Cities with a lower than average USI score are generally small cities with an average population of 0.8 million (comprising 47% of sample cities in our study, with 18% of total sample population). Their economic performance is the worst among all four categories (average score of 27, compared to a score of 67 for medium-large cities). As there is no significant positive correlation found between the economy and other categories in these cities, we believe their poor economic base is unable to support the development in the three other categories.

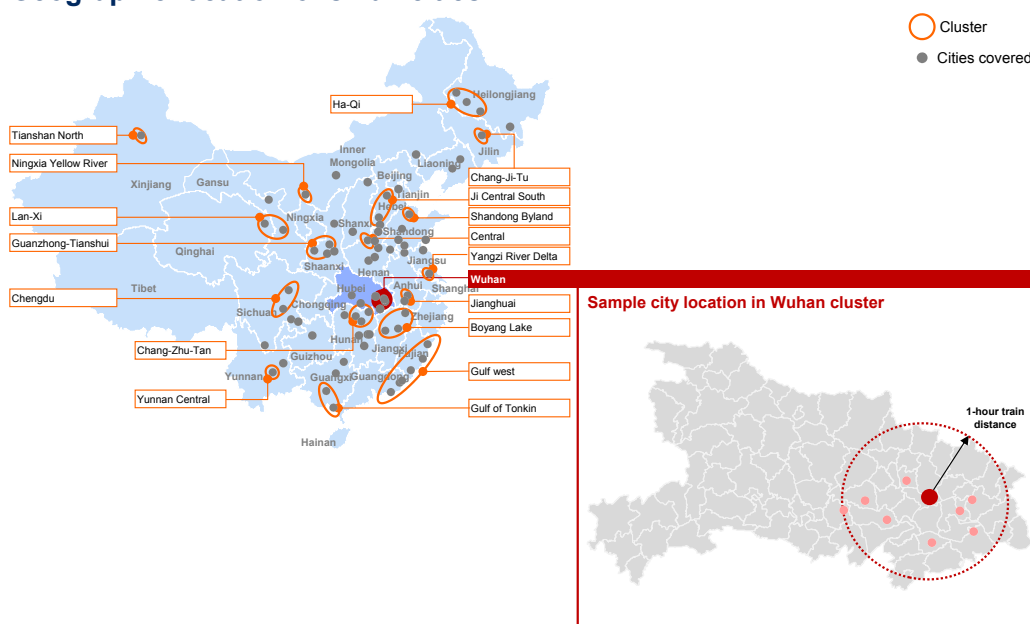
Therefore, during the transformation from small cities to large ones, **these cities should better integrate with cluster cities. This would enable them to leverage the economic advantages of the cluster while contributing their strengths to the entire cluster.** For example, in Wuhan cluster (Figure 20), Wuhan is the only large city (population of about 10 million and GDP of USD105 billion). The other sample 8 cities in the cluster are all small with urban populations equal to or less than 1 million. All of them

are located in the “1 hour economic circle” near Wuhan, 5 of these cities are located within a very short distance from Wuhan – less than 100 km - while the others are connected with Wuhan by a 1-hour high-speed train ride. **The short distance and transportation network makes economic integration easy for smaller cities, and enables them to leverage Wuhan’s strengths in technology and supply chain.**

Geographic and economic integration are also conducive to the expanded provision by Wuhan of social benefits and environmental management oversight and expertise, critical pillars of the continued improvement in sustainability of the smaller cities within the cluster.

Figure 20

Geographic location of small cities



Source: McKinsey analysis; UCI

Summary of best practices

We have conducted a deep-dive analysis of 9 cities at different stages of economic development, including Shanghai, Xi'an, Jinan, Yantai and Ningbo from the large-sized GDP group, Yangzhou from the medium-sized GDP, Zunyi, Jieyang and Fangchenggang from the small-sized GDP. Some of them ranked high in sustainability, while some have exhibited substantial changes in recent years. We conducted interviews and collected information directly from local governments to understand the distinctive drivers of their sustainability performance, as well as any major changes they've undergone. The following is a brief summary of some of the findings from this analysis. For more details regarding each city, please see the appendix in the electronic version of this report.

Economic development

Shanghai, Ningbo, Yangzhou, Jinan, Yantai and Xi'an have reached a high level of economic development. From 2008 to 2011, most of these cities, with the notable exceptions of Shanghai and Ningbo, improved their sustainability while pursuing stable economic growth. Their rise up the economic ladder was a result of sustained investment in economic growth over the years. Smaller cities such as Zunyi, Jieyang and Fangchenggang, have also experienced a marginal increase in their position along the USI ranking of economy despite their relatively weak economic base. A summary of the development pathways of these cities points to the following lessons:

1. Vigorously promote technological innovation.

Cities with significant economic growth have invested substantially in technological innovation and R&D, with local governments playing a steering role. For example, Yantai has pioneered an innovative cooperation model that connects government with the private sector. They've accomplished this by providing special funding for technology projects; through the implementation of the "six tens" projects that aims to build Yantai into an innovative city; and finally, by stressing the protection of intellectual property rights and gradually improving the integration of production with teaching and research.

Shanghai focuses its innovation efforts on strategic emerging industries such as civil aviation; cutting-edge equipment and new materials using the fruits of technology programs such as super-large IC manufacturing equipment; and the roll-out of a next-generation wireless broadband mobile communications network.

Unlike Yantai and Shanghai, Yangzhou focuses on attracting investment in technology and stages high-profile events such as an investment promotion fair. A marketing and communications campaign known as "Innovative Yangzhou" has been launched with the goal of raising awareness and understanding of the benefits of technological innovation. To support R&D, the Yangzhou government has also implemented the "Yangzhou R&D service program", and created a Smart City research institute.

Xi'an has also invested significantly in technological innovation, through the development of a high-tech zone aimed at housing a world-class technology park, and developing an industrial base that will support the aviation sector. Zunyi has increased funds for R&D in clean energy, promoted clean tech applications, and promoted the use of new materials and equipment among companies that are heavy users of energy. Yantai, Yangzhou, Xi'an and

Zunyi have all risen by at least 10 places in economic rankings, a climb that is an outcome of their enormous efforts and investments in technology and innovation.

2. Develop economies based on local characteristics

The development of a city's economy should harness its natural and human resources, unique geographic location, and other advantages of the local environment. The coastal city of Yantai has launched an initiative that seeks to promote the integrated development of its marine and land-based resources. The Yantai government has facilitated plans to construct the Shandong Peninsula Blue Economic Zone, the Yellow River Ecological Economic Zone, and the Jiaodong Peninsula High-end Industrial Cluster. Yantai is also pursuing the “four districts, one island” initiative, investing more than RMB 500 billion in current and future marine projects to drive the city's economy.

Despite its less-advanced economic base, Fangchenggang is revitalizing itself by focusing on harnessing the advantages of its port infrastructure to support economic growth. In addition to opening its port to international shipping routes, the city is developing itself as an ecological harbor city, and investing in the promotion of coastal tourism.

Xi'an is developing its tourism industry by leveraging local cultural attractions, a strategy which has led to the boom of tertiary industries. The development of an economy with “local characteristics” has been a driving force behind the economic advancement of several Chinese cities.

Social development

An analysis of these selected cities shows Yantai, Yangzhou, Jinan, Jieyang and Xi'an have risen significantly in the social rankings in USI, while Ningbo, Fangchenggang and Shanghai have fallen. Ningbo dropped sharply, while Fangchenggang stayed flat. The rise and fall in the social rankings of our Index are driven by improvements and challenges these cities face in social security, employment and education. The following is a summary of some of the lessons to be drawn from their experience:

1. Improve social security in rural and urban areas, and medical and endowment insurance.

Social security is critical to the sustainable development of any society. Yantai is distinctive in terms of the scale and degree of its health services. First, Yantai has made great strides in the expansion of its health insurance coverage. As part of the new national rural endowment pilot program, this insurance covers counties, county-level cities and districts.

Second, Yantai has upgraded its healthcare program to ensure the quality of medical security in urban and rural areas. Yangzhou focuses on rural and urban integration and a fair allocation of social security. Yangzhou offers social endowment insurance for rural residents who have had their land requisitioned, and combines the new rural social endowment insurance with the one for urban residents.

In addition, Yangzhou actively pushes migrant workers, especially those in manufacturing and building, to join the employment injury insurance program. The city is continuing to expand its coverage of social insurance. Like Yantai and Yangzhou, Xi'an and Jinan focus on expanding insurance coverage and improving the quality of social security.

The small city of Jieyang was able to rise significantly in the social rankings in our Index between 2008 and 2011, with the city becoming a leader in its group as a result. The city has built a basic medical security system, implemented national basic drug program and improved its basic health service program.

Ningbo, however, dropped places in the social ranking because of its weak social security system, which was dragged down by poor performance in healthcare. Ningbo's challenges stem from an insufficient supply of high-quality health resources, and inefficient delivery in this area. This has resulted in imbalances between rural and urban areas, as well as between different regions and various departments. To compound the situation, Ningbo's government has failed to effectively coordinate and allocate these resources. The quality and level of health services found in Ningbo need further improvement. Local authorities appear to lack a plan to bring different departments together under one administrative umbrella.

2. The role of education in a city's social development.

Education is fundamental to social sustainability. Cities which have risen significantly in social rankings are testament to the importance of a strong education system. Yantai is an example of a city that is undertaking a comprehensive set of measures to modernize its education system. In order to improve its education quality, Yantai seeks to share high-quality educational resources among various education providers, such as to vocational institutions. Yantai has stepped up the construction of technology and culture libraries, folk art museums, and county-level museums. Yantai provides free public access to these sites.

Xi'an is also working to build a positive cultural and educational environment by using tourism and other cultural attractions. It established the Epang National Archaeological Site Park, which draws on the city's rich historical and cultural resources. Xi'an is also supporting the development of private museums.

Other cities such as Shanghai and Ningbo, where the number of children of migrant workers is rising, face the challenge of providing adequate educational services. The numbers of migrant students attending public primary and secondary schools in Shanghai has soared, placing pressure on Shanghai's finances. Demand for school places has increased, making it difficult for local authorities to maintain small class sizes. The steady influx and mobility of migrant workers makes allocating resources and managing the education system particularly demanding.

3. Generate employment opportunities and cultivate talent

An emphasis on employment and the building of talent teams is of critical importance to maintaining a city's social sustainability. Yantai has managed to expand employment by creating public welfare positions, building career service centers, and by developing a College Student Venture Park to encourage college graduate entrepreneurship.

Yangzhou distinguishes itself through the successful cultivation of Chinese and multinational talent. Several city-sponsored programs foster international talent exchanges and cooperation. For example, "Talent city Dual-action Plan" targets to attract international talents, senior managers from multinational corporations, and talents in financial sector to enhance the city's human resource level.

Xi'an provides incentives for young technology talent and agricultural technology talent to start their own businesses.

However, some economically developed cities that attract a large amount of migrants are struggling with how to improve the quality of its employment. Firstly, the labor market is still a buyer's market, with no effective measures taken to adjust it; second, the increase in low-quality labor remains unchanged, and the labor market has been unable to reverse a vicious circle of continuously using low quality labor force with low compensation and forming low-end employment patterns.

Environmental governance

The quality of the environment has a direct impact on the quality of a city's development. In our sample of cities, Fangchenggang, Jinan, Yantai, Yangzhou and Jieyang have made progress in environmental management, while Shanghai and Ningbo have deteriorated. We find cities that have achieved significant environmental progress have been able to control both energy consumption and emissions by taking an integrated approach to urban and rural environmental management and ensuring a consistent and well-managed supply of services.

1. Energy savings and emissions reduction

Fangchenggang, Jinan and Yantai have risen in the environmental sustainability rankings in USI because of increased efforts in energy savings and emissions reduction. In addition to rigorously eliminating obsolete manufacturing capacity, these cities promote the deployment of energy-saving technologies in the iron and steel, power, chemicals, building materials, papermaking, alcohol and construction industries.. Several cities provide financial incentives to encourage companies to use energy-saving technologies. For example, Jinan has boosted fiscal and tax support for energy-saving projects. With a RMB 2.8 billion fund from the central and provincial governments for energy savings (via the 11th Five-Year Plan), the city has been able to deploy up to RMB 40 million to support 239 energy-saving projects. These projects have saved energy equivalent of 1.9 million tons of coal-fired.

Fangchenggang, Jinan and Yantai have reduced emissions and water pollution by building waste water disposal plants and implementing de-nitration projects for power plants. Xi'an has made further efforts to manage the sources of pollution and promote the use of clean energy.

2. Strike a balance between eco-friendly development in rural and urban areas

The integration of environmental development between rural and urban areas is crucial. Yantai and Yangzhou, for example, have developed mechanisms for promoting eco-friendly development in urban areas while implementing plans for improving the environment in rural areas. Special funds were provided for the creation of a sustainable ecological environment in urban and rural areas. They also built small towns featuring green and low-carbon economic development.

3. Tighten supervision of pollution and provide sufficient service

Jinan and Yangzhou have intensified supervision of environmental violations and have made substantial efforts to combat polluting behavior. They have adopted mechanisms such as multi-tier supervision. Jinan has exerted strict control over 115 primary polluting sources supervised by the government. Jinan has also put into practice a 3-tier online monitoring network and a 24/7 watch system to integrate pollutant management, supervision and monitoring.

Yangzhou sticks to getting involved at an earlier stage, setting up environmental pre-appraisal system, door-to-door service and express channels for green projects to improve its "green management". The city has created the Zhongdao project library for environmental approval. This project library introduced stringent standards for appraising the impact of high-emission and high-energy-consumption projects, particularly in sectors that already have significant overcapacity.

4. Tailor-made measures

Each city needs to find solutions that address its unique environmental situation, as it follows its journey toward sustainable economic and social development. Jinan is an

example of a city that stands out in this regard. To prevent serious dust pollution, Jinan stepped up patrol and inspection efforts on industrial factories, and circulated the results of the inspections to factories once a week. The city government launched a 24/7 campaign to monitor and eliminate the sources of dust, and worked with authorities (such as the municipal construction committee) to implement a pilot program that introduced environmental supervision of five construction sites.

Xi'an has made notable progress in removing illegal mining sites, establishing 5A-level scenic spots and appropriately leveraging the northern foot of the Qingling Mountains. Xi'an also expanded forest coverage and completed the forestation of Daming Palace National Heritage Park to act as an ecological corridor between separate urban clusters in the main urban area.

All these measures have contributed to the promotion of sustainable development in top-performing cities. Some cities have, however, suffered from environmental degradation, largely due to a lack of awareness and unsound methods of pollution reduction. Initiatives to advance the development of heavy industry could spark a long-term environmental challenge for any city. The failure to adopt appropriate measures to reduce pollution could result in worsening environmental degradation, such as waste gas pollution, dust and acid rain. A massive increase in its transient population could put pressure on public transport and the environment. Most important, the failure on the part of city authorities to address these challenges can hinder the sustainable development of its environment.

Resource efficiency

An abundance of natural resources not only lays the foundation for a city's existence, but also serves as a basis for its sustainable development. Natural resources are unevenly distributed across China's huge land mass. Cities with scarce natural resources have to take effective measures to protect existing resources, while proactively seeking out new drivers of economic development. Cities rich in natural resources, such as Yantai and Fangchenggang, have made notable progress in resource sustainability.

1. Comprehensive resource protection

With substantial water and maritime resources, the Port of Fangcheng is the largest port in Western China. Fangcheng has adopted a series of measures to protect its water resources, offshore ecological environment, and forests.

To strengthen the protection of water resources, the port has established an ecological area for water conservation that prioritizes the protection of water resources and safeguards water supply for industrial, agricultural and ecological use. To protect ecological resources in offshore areas, the port strengthened the protection of the Beilun River National Nature Reserve. The city took effective measures to protect mangrove forests and expand their area of coverage, and established a coastal wetland protection system to maintain its natural marine environment.

The port also implemented several projects for the protection and development of forest resources, including the Shiwanshan rare tree breeding program, the green channel project, and coastal and forest resource protection. These projects were aimed at developing biodiversity in the Shiwanshan area, and establishing water conservation zones.

In Xi'an, the municipal government implemented measures to protect the Qingling Mountains. This included stepping up the reduction of pollution in the Wei River, which entailed the creation of the Qingling Mountain protection system, supported by 14 national, provincial and municipal forest parks. Xi'an also developed an urban green land system – i.e., three green circles, eight green zones and ten green corridors.

Jieyang's land and water resource conservation initiatives yielded positive results. The city is developing itself into a green city by expanding urban forestry coverage and renewing its marine environment.

2. Prioritizing rational utilization of natural resources

The rational use of natural resources acts as a catalyst for urban development. By taking advantage of its marine resources and deep water harbor, the Port of Fangcheng stepped up efforts in port-building and made this a driving force of economic growth. The ultimate aim is to develop the site into the first Chinese port capable of accommodating five capsized vessels.

The Port has been built as an ecological city in the bay with a panoramic view of the sea, as well as a coastal tourist city. Culture and marine parks have been constructed in the Port area. The city has also held a series of cultural events such as the International Marine Dragon Boat Festival and the Hat Festival of the Jing Minority.

3. Appropriate conservation of resources

The conservation of resources is critical to achieving long-term sustainability, and Yantan has performed exceedingly well in this area. It has improved energy-saving regulations and carbon emission trading system, tightening up the management of energy use in key areas, and phasing out obsolete capacity. The city implemented a rigorous system for the management of water resources, in a bid to build a water-conserving society. Efforts were made to boost the development of energy-saving, low-carbon and new energy industries. A campaign was launched among enterprises for low-carbon and energy-saving economic development: two hundred enterprises were urged to implement clean production; parks were built to demonstrate how the circular economy worked; efforts were made to increase the energy efficiency of buildings and to implement energy-saving standards for public and residential buildings. The measures have had very positive results in fostering resource conservation.

The Shanghai government is promoting the use of water, energy, land, marine resources and waste via clean production and the optimization of renewable energy recycling systems. Its efforts have played an active role in promoting efficient use of production factors and brought about the cyclic use and sustainability of resources.

The city of Zunyi has closely monitored total energy consumption by establishing an energy consumption warning system to track and analyze total usage in a timely fashion.

Through its efforts to protect, use and conserve limited resources, the Port of Fangcheng, Yantan and Xi'an have risen by 28, 12 and 16 ranks respectively in our list of top-performing sustainable cities. Shanghai and Zunyi have risen by 8 and 16 places, respectively. Such dramatic progress underlines the importance for a city to have a well-designed plan for energy use based on the adequate supply and sustainability of resources.

Bearing in mind that resources are ultimately limited, it is imperative that municipal governments make efficient use of their own resources as they explore other, more sustainable, modes of development. It is unrealistic for cities to depend solely on existing resources in their pursuit of sustainable development.



Appendix:

City best practices

Based on our data, we selected nine cities for more in-depth analysis. These cities are at varying levels of development; some have made significant strides in their sustainability performance, while others have not. We also conducted interviews with local government officials to understand how they approached issues of sustainability and what factors affected their progress. Survey responses show that most officials agree that the evaluation made by USI is consistent with their own perceptions of their cities—a finding which vindicates the accuracy of USI.

Xi'an

City and sustainability overview

Xi'an, historically known as Chang'an, is the capital of Shaanxi province in central China. Well known as the home of the terra cotta soldiers, Xi'an is a gateway and transit hub linking the northwest to the rest of the China. The city has a built-up area of 343 square kilometers, with 5.7 million residents in city districts. Xi'an is a large-sized economy. From 2008 to 2011, Xi'an's GDP rose from RMB 162 billion to 246 billion, and recorded an above-average economic growth rate (15%)¹. In 2011, GDP per capita of Xi'an reached RMB 36,7 thousand. The State Council listed Xi'an as a "national historic and cultural base" and started to develop the city into an international metropolis.²

On both USI and its sub-category metrics, Xi'an has delivered significant improvement across the board socially, economically, environmentally, and in terms of resource use. Its USI ranking improved from the 36th in 2008 to 17th in 2011, the fastest rate of improvement (5%) recorded among cities of large economic size. Key contributors to the city's improvement in ranking include: 1) continuous improvement of its social security system, 2) higher disposable income; and 3) energy saving, carbon abatement, and waste reduction efforts.

Xi'an showed significant improvement in both economic sustainability and integrated resource utilization, and its momentum is strong. We believe its experience can therefore offer valuable lessons for other cities.

Key experiences and features

(1) Economic sustainability

Xi'an's economic ranking has improved from 65th place in 2008 to 45th in 2011. Here are some of the city's most important economic achievements:

Boosting income levels: The per-capita disposable income of urban residents increased from RMB 15,207 (US\$2,477) in 2008 to RMB 25,981 (\$4,232) in 2011; over the same period and per-capita net income of rural residents improved from RMB 3,808 (\$620) to RMB 9,788 (\$1,594) indicating a significant growth in the overall income level of the residents of Xi'an.

1 Land area and population numbers are 2011 data, referring to city built-up area and city district population respectively; same for the other cities of this paper.
2 GDP and per-capita GDP numbers are in real values at constant prices of 2005, referring to real urban GDP estimated by McKinsey Global Institute China model 2013 version; same for the other cities of this paper.

Increasing investment: The city has made big investments in social fixed assets, urban maintenance and construction projects, targeted industries, and civil engineering projects. Xi'an has also leveraged RMB 100 billion in loans to provide strong support its development programs.

Upgrading priority industries: Xi'an has five "pillar" industries including High-tech manufacturing, Equipment manufacturing, Tourism, modern Service and Culture; these represent almost half (47.8%) of the city's total GDP during 2008 to 2011. The number of medium-large industrial enterprises has increased by more than 100 with their industrial added value achieving RMB 70+ billion.

Developing city districts and development zones: The city is fully committed to the development of "4 zones, 1 harbor, and 2 bases. The city has pushed aggressively to build world-class high-tech industrial parks and invested RMB 100 billion to build advanced manufacturing bases.

(2) Social sustainability

The city's social sustainability ranking has improved from 30th place in 2008 to 11th in 2011. The following efforts have played a role in this success.

Improving the social security system: Between 2008 and 2012, Xi'an invested more than RMB 100 billion in civil projects, which accounted for about 70% of total spending. All registered residents of Xi'an now have basic pension and medical insurance. The city also launched social pension insurance for urban and rural residents to address the issue of integrating uninsured retirees from collectively-owned enterprises into the system. The city has completed the construction of 143,000 housing units for mid- and lower-income families, built 150 community health centers, renovated or expanded 101 rural health clinics, and established 3,117 village health clinics. All government-run grass-roots medical institutions are now under the National Essential Drug system, to manage and monitor appropriate drug usage, price and quality.

Strengthening employment support and unemployment relief: Xi'an actively encourages technology and other start-ups, providing both finance and advice. In 2009 alone, the city issued RMB 267 million worth of small secured loans. It has secured job placements for an additional 110,000 urban workers and job transfers for 650,000 rural workers.

Improving culture and education: Xi'an established a mechanism to provide guaranteed funding for compulsory education and rationalized the allocation of education resources. It has continued its campus safety projects for primary and middle schools; built or expanded 93 kindergartens; and provided additional bus services. For older students, the city is developing new model high schools, while working to improve quality at the regular ones; and it increased support for vocational and special education. In terms of culture, the city has accelerated the development of cultural industries, focusing on building Xi'an's distinctive traditions.

(3) Resource and Environmental sustainability

Xi'an has also been taking steps to develop and protect its resources; its resource ranking improved from 30th to 15th and its overall environmental ranking from 49th to 25th. Environmental cleanliness, the obvious shortage of Xi'an, has also been improved from the 145th place in 2008 to the 108th in 2011. Specific initiatives include:

Land: Strengthening the protection of ecological resources on the north side of Qinqing Mountain. The local government has cracked down on illegal mining and unplanned development projects to create high-quality scenic areas. Xi'an has completed urban forest development within the Daming Palace Ruins, and is developing ecological corridors.

Determined to ensure that “its mountain stays green and its 8 rivers never run dry” the city has therefore kicked off full-scale Qinling mountain eco-system protection program.

Water: Implementing integrated water management for the Wei River, including fully implementing the three-year pollution prevention action plan; minimizing flood risks downstream of the Heihe River; and supporting the Han-Wei water diversion program. The city is also working on the management of smaller rivers, focusing on the upstream areas of the Heihe, Laohe, and Bahe rivers. Till 2012, the city has built water surface of 30 square kilometers, a forestation area of 250 square kilometers, and added 10 square kilometers of urban green space. The Chanba Ecological Zone has also been designated as a national ecological zone.

Sewage and waste: A sixth sewage-treatment plant and further construction at two others have been completed. The city also set up sewage/drainage emergency mechanism to ensure the efficiency and quality of drainage and non-hazardous treatment of sewage. A garbage sorting program and strengthened rules regarding car exhaust, dust, and noise pollution are also at work.

Conservation and air quality: The city has implemented water-conservation regulations and shut down eight outdated cement production lines to reduce its greenhouse-gas emissions. These and other efforts have resulted in a 5.5% reduction of energy consumption per unit of GDP, and significant reductions in sulfur dioxide (21,500 tons). For four years in a row, the city has achieved second-grade air quality for more than 300 days.

Urban infrastructure: The city has completed the replacement of overhead cables with underground cables for some road sections and is gradually bringing store front signage into order and launched landscaping projects for the Train Station Plaza, New City Plaza, and Bell and Drum Towers Plaza. These efforts are also being extended to nearby villages; Xian is managing infrastructure construction and allocating funds to kick off the development of priority sites for building new rural villages. In terms of transport, Xi'an is constructing a metro system, while also expanding road coverage. Public transport is the priority, including a series of bus service lines and harbors.

Yangzhou

City and sustainability overview

Yangzhou is located in the center of Jiangsu Province. Yangzhou is adjacent to the Shanghai and Suzhou areas, and benefits from that city's economic attractiveness. The city is growing fast, and its 2.3 million people in city districts had a per capita GDP of RMB 61,000 in 2011. It is a mid-sized economy with GDP of RMB 87.4 billion in 2011, growing at a rate of 13% from 2008 to 2011.

Between 2008 and 2011, Yangzhou performed impressively in terms of all aspects of sustainability. Its USI ranking improved from 37th to 16th, with a sustainability growth rate of 6%. Such high growth rate led Yangzhou to a growth ranking of the 4th place in mid-sized economies.

Key experiences and features

(1) Economic and resource sustainability

On the economic front, Yangzhou's ranking has improved from 53rd in 2008 to 31st in 2011.

Economically, the most important reason for improvement is the increase in foreign direct investment (FDI). In 2011, 11 VC funds were launched, with total investment reaching RMB 2 billion. Equity funds such as Hudson Capital and CCB International have also invested RMB 3-5 billion. The second factor is that the city has developed several effective policies

and plans to encourage technology development and innovation, including an incubator and strategic research institute. Third, the technology service sector has achieved breakthrough growth, ringing up RMB 2.5 billion in revenues in 2011, 25% more than the year before. In 2011, Yangzhou approved 1,378 projects, with total investment reaching RMB 254 million. The projects were mostly dedicated to the city's emerging and pillar industries, including Zhongxian's Solar Energy Project and Zhongke Semiconductor's White LED Project.

(2) Social sustainability

The city's social sustainability ranking has improved from 80th place in 2008 to 44th in 2011. The main reason was that Yangzhou improved the social security system.

Reforming the pension system: Yangzhou's pension insurance coverage grew by 10% between 2008 and 2011. First, farmers whose lands were expropriated were incorporated into the social pension insurance network. A total of 60,677 people have joined the pension insurance, 47,941 of whom are former farmers. Second, Urban and Rural Residents Social Pension is launched to combine the New Rural Pension System and Urban Resident Pension Insurance, which are funded by both individuals and government subsidy. Third, the city has reformed the pension insurance system for municipal agencies and units. So the premium is calculated based on total wage instead of filed wage, and minimum premium is set as the average monthly wage of all non-public organizations for the previous year. Fourth, benefits of pension insurance have gradually improved in terms of increasing pension of corporate retirees.

Reforming the medical insurance system: The city established a balanced medical insurance system that strengthened coverage and improved benefits and quality. It also improved access for retirees and increased reimbursement rates for critical diseases. Maximum reimbursement for special materials and hospitalization expenses has also been raised, while the list of reimbursable drugs extended.

Promoting social insurance: Yangzhou introduced a series of social insurance projects, including one for maternity and another for work-related injuries, including for migrant worker. Corporate employee pension insurance, urban worker medical insurance and unemployment insurance have all seen their coverage expanded with premium payment increasing. Lastly, Yangzhou was the first city in China that implemented social insurance MIS. The system enables social insurance transfer, platform buildup, social insurance balancing and internal auditing to provide regulated, digitized and standardized insurance operation.

Improving human resources: Yangzhou launched an aggressive top management talent building program to meet development needs; this program reached almost 2,000 people in 2011. It also provided on-the-job training for corporate employees and matched new graduates with suitable jobs. On the education front, enrollment was almost universal from kindergarten through high school. Vocational schools recruited 24,500 students and the higher education enrollment rate was 46%.

(3) Environmental sustainability

On environment cleanliness, Yangzhou has improved its ranking from 34th place in 2008 to 21st in 2011. This success toward building an ecological city can be attributed to the following efforts:

The government made emissions reductions a target for all agencies, and tracked it monthly. It also brought several waste-water treatment plants online, while establishing a waste-water emission permit system and clean manufacturing assessment system. In terms of environmental regulation, Yangzhou initiated a series of projects on heavy metal, chemicals, and electroplating. In 2011, the city investigated 118 companies for violating environmental regulations and formalized a site investigation process. It also built new

capabilities, such as dust haze monitoring and remote sensing image interpretation and establishing an environmental project database. The city aggressively persuaded industrial parks to build greener; Weiyang Economic Zone is a showcase.

On built environment, Yangzhou improved from the 58th place in 2008 to the 51st place in 2011. Some example projects are the West Lake Underground Passage Project and Sanwan Park Project in 2011. It extended the Wenchang Road eastward, built Mangdao Bridge, constructed 328 Highway, rebuilt Yangling Road, expanded Jiangdu Road and re-engineered several major arteries to complete the city's traffic network. On an aesthetic level, the green landscape program and vegetation planning along the ancient canal have created attractive natural oases. The Great Urban-Rural Development Action Plan provided planning for rural environment improvement and funding for eco-environmental projects, aiming to build low-carbon towns. Lastly, buildings are being monitored for energy saving, with higher standards for new construction.

Jieyang

City and sustainability overview

Jieyang is located on the Chaoshan plain in Guangdong province in southeastern China. Its terrain tilts toward the east with hills and mountains on the northwest and southwest and an expansive and fertile Rong River and coastal alluvial plain in the central, southern, and southeastern parts of the city. Thanks to Rong River, Jieyang has long been seen as a “land of abundance.”

Jieyang with a city district area of only 58 square kilometers and district population of 0.7 million, has been growing fast; its GDP increased by 50%, to RMB 20.9 billion, between 2008 and 2011. Jieyang's USI ranking rose from 129th place to 86th.

Key experiences and features

Jieyang as a small-sized economy compared to others at the same level, is growing faster, due to actions it took to promote sustainability, including the effective use of resources and policies on environmental protection. Here we focus on understanding what Jieyang is doing, and how its progress can offer lessons to other small-sized cities.

(1) Social sustainability

From 2008 to 2011, Jieyang made remarkable progress, going from 92nd to 16th in social ranking. The most important reason is that Jieyang delivered improvements in five key medical-and-health areas.

Upgrade basic medical insurance system: Jieyang established an integrated management and service system to provide medical insurance for the entire population—employees, urban residents, and rural ones, through a rural cooperative. The number of urban residents enrolled in the basic medical insurance system rose from 4.4 million in 2008 to 5.4 million in 2011, for a participation rate of 98.6%. Jieyang increased the reimbursement for hospital expenses to up to 70%, and also lifted the cumulative payment cap to RMB 80,000 per year.

Breakthrough in the National Basic Drug system: Jieyang did two important things. First, it built a basic drug insurance system. It established Huilai County as the basic drug insurance program test county. Until April 30, 2011, 65 rural health clinics and 18 community health centers have implemented the National Basic Drug system by canceling medicine markup and following zero-profit policy for essential drug sales.

Second, it improved drug supervision, access, and safety. Jieyang improved oversight of drug production and circulation; on-site checks of production and prescription processes

are in place for 56 essential drug categories, and there is electronic supervision of companies that produce essential drugs. It also constructed rural pharmacy networks, as well as pharmacies for medical institutions. Till now, rural villages are 98.7% covered by the drug supply network and 100% by the drug supervision network.

Develop the grass-roots medical and health service system: Jieyang has made building grass-roots medical institutions its top priority and continuously improved its service network. Since 2009, 13 grass-roots medical institutions have been included in the subsidy program of National Development and Reform Commission. Three new community-based health service centers were established, bringing the total number of such operations to 18, thus making the vision of one community-based health service center per community possible. There are seven county-based general, 59 qualified rural health clinics, 12 qualified community-based health service centers, and 1,182 qualified village-based health rooms.

Jieyang is also exploring an integrated management model for towns and villages in which county-based hospitals support rural health clinics. Huilai County pioneered the experiment, setting up 50 “administrative villages” with rural health clinics. As of the end of December 2011, Huilai County government had invested RMB2.67 million in this effort and completed construction of 50 health stations in pilot villages. As a result of this pilot, Huilai County has accumulated valuable experience as the city considers how to roll out this model.

(2) Resources sustainability

In terms of resources, Jieyang ranked 50st in 2008 and 21th in 2011, reflecting its improved sustainability practices, particularly in land and water practices, forestry, and marine ecology.

Protect land and water resources: Jieyang has followed strictly the arable land protection policy. The city is developing a digital geospatial framework to improve surveying management and service levels. Meanwhile, Jieyang is accelerating the effort to improve counties’ capability of “mass prediction and mass prevention” of geological disasters. Water resources are managed in an integrated manner, and policies require protection for reservoirs and irrigation; pollution control in the Rong River, Lian River, and Long River basins has been improved. Pollution-emitting companies are required to comply with strict standards or are forced to shut down. Jieyang also forbids construction of sewage emission facilities or industrial wastewater discharge in protected areas where drinking water sources are.

Improve forest and marine ecological construction: Keen to build “a green city with green villages, green channels, and green shelters,” Jieyang aims to develop a broad and healthy ecosystem, including forests in mountain and coastal areas, and nature reserves. By 2015, Rongcheng area, Puning city, Huilai county will be built into ecological forest area.

In regard to marine ecology, Jieyang has carried out integrated resource management for near-shore areas, islands, and coastal zones. It enhanced marine resources and environment management and protection at the outlet of Rong River. Such ecological resources as shelter forest and mangroves are also prioritized for protection.

(3) Economic sustainability

Jieyang’s economic ranking rose slightly, from 138th in 2008 to 136th in 2011, primarily by fostering industrial development.

Jieyang has lowered industrial investment cost to encourage such investments. The approval procedures for new construction for industrial companies have been streamlined and improved, and their land-use rights clarified. The city also provides targeted policy support to new projects that invest at least RMB100 million, high-technology companies, corporate headquarters, manufacturing bases, and R&D centers. Industrial projects that

complete investment of more than RMB500 million in productive fixed assets within two years will also be heavily rewarded. Priority industrial companies are entitled to “green card” treatment where they get premium public services, such as licensing, tax, inspection and assessment, public security, land training.

In terms of easing day-to-day operations, a city-level industrial coordination meeting between corporates and government managing departments is held at least twice a year to help resolve difficult issues. Accountability is implemented for business and investment recruiting to ensure consistent ownership from business recruiting, execution, and tracking.

Zunyi

City and sustainability overview

Zunyi is the second-largest city in Guizhou province in southwestern China. It is a key area in the state plan for the Yangtze River upper stream and famous for its tobacco and liquor (as well as being the place where Mao Zedong was elected leader of the Communist Party). The city center built area covers a total land of almost 65 square kilometers, and has been growing fast - GDP growth rate of 10% a year between 2008 and 2011. Total GDP and per capita GDP, however, are still relatively low (RMB 25.4 billion and RMB 22,500 respectively). It is a small-sized economy.

Zunyi's performance in USI (159th to 149th) and all sub-indicators was steady but also revealed its weak foundation; there is considerable room for improvement. Basically, it improved its position in economic and resource terms, but stagnated in social terms. Its experience can provide lessons for cities in similar situations.

(1) Economic and resource sustainability

In 2011, Zunyi ranked 69th in economy, up from 91st in 2008.

Economics: As part of China's broader efforts to develop the west, Zunyi accelerated its economic development transformation through a series of policies on industrialization, urbanization, agricultural modernization and restructuring. The provincial government approved the Zunyi City Master Plan and the Zunyi Land Use Master Plan. The land coordination policy for the downtown area injected vitality to the land market. Construction of the Xinpu new district, the new train station area and the Guojiu new district were in full swing, in parallel to these undertakings were the old town renovation and key small town construction which lifted urbanization rate to 34.5%.

Industrial project construction increased significantly. New achievements to support industries were made in projects of “six bases”, “six signature projects” and “six multi-billion RMB industries (companies)”. Moutai Distillery added completed significant technological upgrades, Goupitan Power Station began operation, and Tongzi Coal Chemical Engineering and Zunbao Titanium kicked off pilot operations. Tongzi Thermal Power Plant and a number of coal mining projects were rolled out. Xichi district's oil and gas development was accelerated and the grid structure improved.

The city also boosted the development of service sectors. Tourism, for example, saw strong growth, bringing in RMB24 billion in revenues in 2011, and generated added value of RMB 47.7 billion, up 16.6% compared to 2008.

Resources: Zunyi ranked 153th in resource in 2011, up from 169th in 2008.

Zunyi has sought to make energy conservation a universal effort, to rein in consumption, and to improve related technical capabilities. It has increased R&D funding for energy conservation technology year after year, and supported companies to adopt energy-saving

materials and equipment and to evaluate its energy consumption. 16 model projects of energy conservation technology industrialization have been carried out.

To provide a sound factual basis for its policies, Zunyi conducts quarterly energy conservation trend analyses, and tracks the power consumption of energy-intensive industries; it makes sure that companies complete their energy-use reports, and evaluate SOEs and their subsidiaries on their energy conservation performance. Zunyi will also shut down operations with poor energy performance, and review fixed-assets investment projects; these assessments are a prerequisite for project approval. It collaborates with stakeholders to evaluate SOEs and their subsidiaries on energy conservation. Other conservation initiatives include encouraging environmentally-friendly buses and other forms of transport and improving lighting and air-conditioning systems.

(2) Social sustainability

Zunyi's social ranking improved slightly, from 158th in 2008 to 152nd by 2011. The major reason for this modest change was wider medical and social-security coverage; more than 150,000 people were lifted out of poverty.

Zunyi started relatively late in medical and health undertakings, making the first significant investments in 2010; financial support has continued since, and medical and health care experienced rapid growth. Specifically, 224 township clinics, six government community health service centers and village clinics implemented the National System for Essential Drugs. Moreover, traditional Chinese medicine hospitals; maternity and child health care centers; county-level hospitals; and village clinics and community health service centers all made progress; 65 new nursing homes were constructed. Food and drug regulation, disease control and prevention, health supervision, blood supply were all strengthened. In 2011, the basic medical insurance participation rate for urban residents and new rural cooperative medical service participation rate reached 86.9% and 95.4% respectively.

There was also substantive progress on the “Two Basic Efforts” — nine-year compulsory education and illiteracy elimination among young and middle-aged adults. Primary-, middle- and high school enrollment all rose, and nine provincial level model high schools were built. Higher education, vocational training, special education, and preschool education continued to prosper, as Zunyi increased its spending on education by more than 17% a year.

During the 11th five years, Zunyi's efforts were recognized when it was nominated for building a “National Model City” by The Central Commission for Guiding Cultural and Ethical Progress of the Communist Party of China.

(3) Environmental sustainability

In terms of building a clean environment, Zunyi's ranking improved slightly, from 164th in 2008 to 150th in 2011. The city focused on the following areas:

Control construction pollution: Zunyi enforced strict construction protocols, including mandatory energy conservation standards for new buildings. Existing buildings were subject to energy conservation by using new wall materials, fly ash bricks, industrial waste residue bricks and hollow bricks to prevent dust and other from causing environmental pollution.

Agriculture and rural area clean-ups: Some 5,500 rural households built methane tanks to replace coal. The city also made great efforts to promote the adoption of energy saving and environmentally friendly agricultural machinery and new technology. Garbage disposal was improved and waste water treatment and desulfurization facilities were built.

Land quality: Zunyi added 623 square kilometers of new forest area in 2011 alone; its forest coverage reached 48.6%. There were efforts to deal with desertification and soil erosion, and environmental improvement in these areas was very obvious.

