Chapter 16
Measurement and Analysis of the Support Degree of Government Policies

Junli Zhao, Xin Jiang and Tao Song

Green economic development has become the common choice of all countries to cope with global warming and climate changing realize sustainable development of humanity. For China, in particular, it is an important approach to practice the Scientific Concept of Development, transform the pattern of economic growth and coordinate the development of economy, society and environment in a sustainable way. As the policy orientation and implementation directly affect the level of green economic development in a region, the Index of Support Degree of Government Policies constitutes one of the three important sub-indexes under Green Development Index (GDI). Since 2009 was an important year of the *11th Five-Year Plan* period, governments at all levels had made efforts to save energy, reduce pollution, protect environment, build up ecological civilization, and guide the green development of socio-economy. These efforts were fruitful.

The Support Degree of Government Policies (SDGP) is a comprehensive evaluation of the participation of a government in local green development. In accordance with the measurement criterion of SDGP in China Province Green Development Index System (PGDIS) and China City Green Development Index System (CGDIS), basing on data of 2009, we measured the SDGP of 30 provinces (autonomous regions, and municipalities directly under the jurisdiction of the central government),[1] 34 large and mid-sized cities (including four municipalities directly under the jurisdiction of the central government, 25 provincial capital cities and five cities specifically designated cities in the state plan, except Lhasa and Urumqi) in China by analyzing three indicators: green investment, infrastructure and environmental control. Based on the results, we elaborated on the relationship between policy support and green economic development on a regional comparative basis and put forward policy suggestions for the government to act more effectively towards green development.

[1] For lack of key data, Tibet, Hong Kong and Chinese Taipei are excluded from the calculation.

X. Li and J. Pan (eds.), *China Green Development Index Report 2011*,
Current Chinese Economic Report Series, DOI: 10.1007/978-3-642-31597-8_16,

16.1 Calculated Results of SDGP

In order to fully reflect the characteristics of provinces and cities, we designed different Third-Level Indicators with different weights under SDGP in PGDIS and CGDIS. The calculated results of provinces and cities are as follows:

16.1.1 Calculated Results of Provincial SDGP

According to the measurement system and weight standards of PGDIS and CGDIS, we worked out the results of SDGP of 30 provinces (autonomous regions and municipalities directly under the jurisdiction of the central government) in China (See Table 16.1).

The results showed that these provinces varied little in SDGP, indicating that local governments are all making efforts (see Table 16.1). Beijing ranked first with a SDGP of 0.278, 28 % higher than the national average;The lowest was Gansu with −0.165, 17 % lower than the national average. The index values of 15, or half of the measured provinces (autonomous regions and municipalities directly under the jurisdiction of the central government) were above the national average. The top ten provinces were Beijing, Jiangsu, Shanghai, Zhejiang, Shandong, Ningxia, Guangdong, Fujian, Yunnan and Hebei (see Fig. 16.1). A deeper look into the three indicators showed that, in terms of green investment, the top ten provinces were Ningxia, Beijing, Qinghai, Shanxi, Chongqing, Shaanxi, Gansu, Guangxi, Hebei and Xinjiang; in terms of infrastructure, the top ten provinces were Shanghai, Beijing, Jiangsu, Zhejiang, Shandong, Guangdong, Fujian, Chongqing, Jiangxi and Hebei; in terms of environmental control, the top ten provinces were Beijing, Inner Mongolia, Yunnan, Guizhou, Anhui, Jiangsu, Shandong, Guangdong, Shanxi and Fujian.

In 2009, the SDGP of 30 provinces (autonomous regions and municipalities directly under the jurisdiction of the central government) in China had the following characteristics:

16.1.1.1 SDGPs in Economically Developed Provinces were Relatively Higher

The calculated results showed a slight inter-provincial disparity, but economically developed provinces did have a higher SDGP. Among the four major regions[2]

[2] The eastern provinces included Beijing, Tianjin, Hebei, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan; the central provinces included Shanxi, Anhui, Jiangxi, Henan, Hubei and Hunan; the western provinces included Inner Mongolia, Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang; the northeastern provinces included Liaoning, Jilin and Heilongjiang.

Table 16.1 Indexes of support degree of government policies and rankings of 30 provinces in China in 2009

Indicator	Support degree of government policies		Green investment indicators		Infrastructure indicators		Environmental control indicators	
Weight	100 %		25 %		45 %		30 %	
Province	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Beijing	0.278	1	0.052	2	0.137	2	0.089	1
Jiangsu	0.121	2	−0.018	20	0.11	3	0.029	6
Shanghai	0.107	3	−0.003	15	0.152	1	−0.043	26
Zhejiang	0.096	4	−0.003	16	0.1	4	0	15
Shandong	0.087	5	−0.022	22	0.083	5	0.027	7
Ningxia	0.081	6	0.068	1	0.019	12	−0.006	16
Guangdong	0.077	7	−0.028	26	0.081	6	0.024	8
Fujian	0.051	8	−0.034	28	0.065	7	0.019	10
Yunnan	0.049	9	0.001	13	−0.01	15	0.057	3
Hebei	0.043	10	0.01	9	0.025	10	0.007	12
Shanxi	0.036	11	0.038	4	−0.022	19	0.02	9
Chongqing	0.035	12	0.036	5	0.042	8	−0.044	28
Shaanxi	0.017	13	0.033	6	−0.008	14	−0.009	17
Jiangxi	0.01	14	−0.026	23	0.035	9	0.001	14
Anhui	0.004	15	−0.019	21	−0.014	18	0.037	5
Hubei	0	16	−0.008	19	0.019	13	−0.011	21
Tianjin	−0.009	17	−0.032	27	0.021	11	0.002	13
Guangxi	−0.03	18	0.015	8	−0.024	20	−0.021	24
Inner Mongolia	−0.03	19	0.003	12	−0.092	27	0.058	2
Hainan	−0.05	20	−0.002	14	−0.061	25	0.013	11
Liaoning	−0.061	21	−0.039	30	−0.012	17	−0.01	20
Xinjiang	−0.063	22	0.008	10	−0.01	16	−0.062	29
Sichuan	−0.074	23	−0.007	18	−0.048	22	−0.018	22
Hunan	−0.075	24	−0.004	17	−0.051	24	−0.02	23
Henan	−0.076	25	−0.027	25	−0.038	21	−0.01	19
Guizhou	−0.076	26	0.003	11	−0.127	29	0.048	4
Qinghai	−0.082	27	0.051	3	−0.05	23	−0.082	30
Heilongjiang	−0.147	28	−0.037	29	−0.101	28	−0.009	18
Jilin	−0.154	29	−0.027	24	−0.085	26	−0.042	25
Gansu	−0.165	30	0.017	7	−0.138	30	−0.044	27

Notes (1) Figures in this table are calculated based on data of each indicator for 2008 and 2009 in accordance with the indicator system of SDGP embedded in the Province Measurement System (2) Index of each province in this table is ranked in descending order

Sources China Statistical Yearbook 2010*, Annual Statistical Report on Environment in China* 2009*, China Environmental Statistical Yearbook* 2010*, China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

(eastern, central, western and northeastern), the eastern provinces had the highest SDGP. Eight of the ten eastern provinces ranked among the top ten in the country, including Beijing (No.1), Jiangsu (No. 2), Shanghai (No. 3), Zhejiang (No. 4),

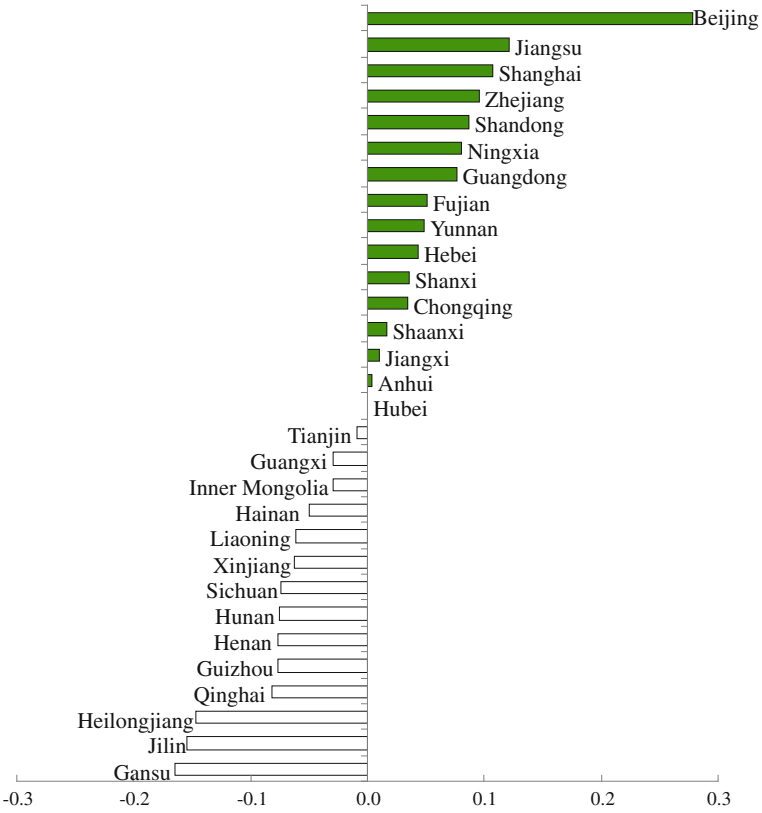

Fig. 16.1 Inter-provincial comparison of SDGP rankings

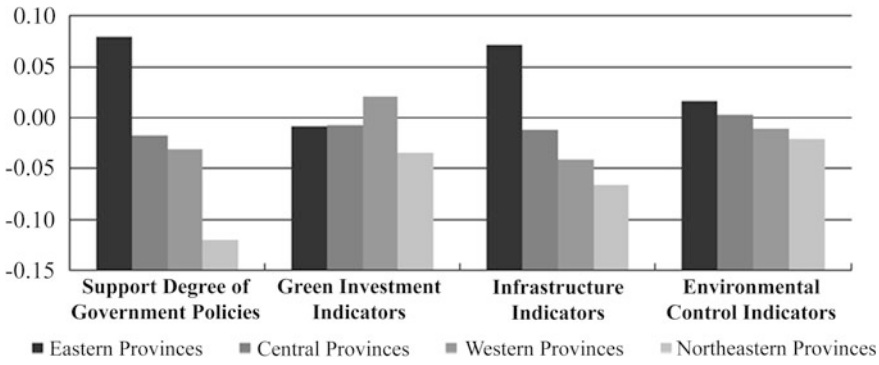

Fig. 16.2 Comparison of SDGP among 4 Major Areas in China. *Notes* Figures in the chart are the arithmetic mean of provinces within each of four major areas in China

Shandong (No. 5), Guangdong (No. 7), Fujian (No. 8), and Hebei (No.10). Only Tianjin and Hainan were slightly lower, ranking 17 and 20th. The central provinces had the second highest SDGP in general. Of the six central provinces, four ranked among No. 11 ~20. They were Shanxi (No. 11), Jiangxi (No. 14), Anhui (No. 15) and Hubei (No. 16); Hunan and Henan were slightly lower, ranking 24 and 25th. As to the western provinces, half were high, half were not. Six of the 11 provinces had high SDGP: Ningxia, (No. 6), Yunnan (No. 9), Chongqing (No. 12), Shaanxi (No. 13), Guangxi (No. 18) and Inner Mongolia (No. 19). However, the other five provinces ranked among the national bottom ten. The SDGP of northeast provinces were much lower. Liaoning (No. 21), Heilongjiang (No. 28) and Jilin (No. 29), below the national average, lied among the bottom ten.

16.1.1.2 Green Development of Local Governments Among Different Regions was Distinctive

Given the different natural endowments and economic development levels, all local governments should tailor their own policies towards green development to their specific conditions and needs. In terms of the three indicators, the provinces differ most in infrastructure, next in green investment, and least in environmental control. This meant different policy orientations and priorities for each province in green development.

The eastern provinces had the finest infrastructure and relatively effective environmental control but insufficient green investment. The much better infrastructure (see Fig. 16.3) provided well-equipped hardware for the government to carry out more favorable policies. The environmental control was slightly above the national average and not so much an advantage. The green investment, slightly below the national average and equal to that of the central region, was far below that of the West, but higher than that of the Northeast. Thus, the eastern provinces should invest more in environmental protection and scientific research to match their economic strength.

The central provinces had high environmental control and green investment but poor infrastructure. The environmental control level approximated the national average, second to the East with a slight gap; the green investment identified with that of the East, slightly below the national average; the infrastructure was slightly below the national average but significantly lower than that of the East. Improved infrastructure was the necessary step towards greener development. Sandwiched by the East and West, Central China was confronted with double trouble in the underdeveloped economy and shortage of natural resources. Thus more policy support was needed for greener development.

The western region made the greatest green investment, compared with poor infrastructure and insufficient environmental control. Though rich in resources, the West was confronted with dual challenges in economic development and environmental protection. The provinces had trouble in energy conservation and emission reduction. The region's greatest efforts into green investment indicated

that policy support for Western Development was paying off. Yet the region needed to invest more in infrastructure and environmental control that were better than the Northeast but slightly below the national average.

The northeastern provinces were poor in all the three indicators that were significantly lower than the national average. Compared with other parts of China, the region was closest with them in environmental control and most distant in infrastructure. As the old industrial base of China, the region had no time to delay in transforming the economic development pattern. In this regard, policy support served as a strong backup Fig. 16.2.

16.1.1.3 Government Policy Support Offset Deficient Resources and Environment

By comparing the rankings of SDGP Index and GDI, we found 14, or half of provinces had changed their rankings by five places or less. Only seven provinces changed their rankings by ten places or more, namely Qinghai, Tianjin, Hainan, Guizhou, Heilongjiang, Ningxia and Shanxi (see Table 16.2).

Overall, the SDGP rankings of 18 provinces were higher than their GDI rankings. Of the top ten GDI provinces, seven ranked among the top ten SDGP ones (see Table 16.2), namely Beijing, Shanghai, Zhejiang, Yunnan, Fujian, Jiangsu and Guangdong. The eastern provinces lagged behind in terms of potential bearing capacity indexes of resources and environment, such as Beijing (No. 18), Shanghai (No. 24), Zhejiang (No. 19), Fujian (No. 14), Jiangsu (No. 30) and Guangdong (No. 23). Their strong policy support greatly pushed forward the green development. As was indicated, government policy support played an important role in offsetting the deficient resources and environment and safeguarding green development.

16.1.2 Calculated Results of City SDGP

Given the central role of cities in regional economy and the constantly improved urbanization in China, measuring urban SDGP was of great significance. The Third-Level Indicators of urban SDGP were different from those under the provincial measurement system, for they were more representative of the characteristics of urban socio-economic development. In this report, 13 Third-Level Indicators were selected and the results of SDGP in 34 cities were ranked as follows (see Table 16.3).

As can be seen from Table 16.3, the highest index value was that of Shenzhen, 0.319, 32 % higher than the average, while the lowest was that of Xining, −0.346, 35 % lower than the average. The index values of 18, or over half of the cities were above the average. The top ten SDGP cities were Shenzhen, Beijing, Xiamen, Guangzhou, Shijiazhuang, Ningbo, Nanjing, Qingdao, Dalian and Fuzhou

Table 16.2 Inter-provincial comparisons of ranking gap between GDI and SDGP

Province	Ranking of GDI (1)	Ranking of SDGP (2)	Ranking gap (1)–(2)	Province	Ranking of GDI (1)	Ranking of SDGP (2)	Ranking gap (1)–(2)
Beijing	1	1	0	Xinjiang	16	22	−6
Shanghai	2	3	−1	Jiangxi	17	14	3
Qinghai	3	27	−24	Hebei	18	10	8
Tianjin	4	17	−13	Sichuan	19	23	−4
Hainan	5	20	−15	Anhui	20	15	5
Zhejiang	6	4	2	Chongqing	21	12	9
Yunnan	7	9	−2	Hubei	22	16	6
Fujian	8	8	0	Jilin	23	29	−6
Jiangsu	9	2	7	Guangxi	24	18	6
Guangdong	10	7	3	Liaoning	25	21	4
Inner							

Note This table is derived from Table 16.1

(see Fig. 16.3). The top ten green investment cities were Shijiazhuang, Lanzhou, Fuzhou, Beijing, Harbin, Hangzhou, Yinchuan, Guangzhou, Shenzhen and Zhengzhou; the top ten infrastructure cities were Shenzhen, Beijing, Dalian, Xiamen, Qingdao, Nanjing, Hangzhou, Nanchang, Nanning, Shijiazhuang; and the top ten environmental control cities were Xiamen, Beijing, Ningbo, Guangzhou, Guiyang, Nanjing, Kunming, Taiyuan, Qingdao and Shanghai. The SDGP of all the cities was shown in Fig. 16.3.

To sum up, the inter-city SDGP in 2009 had the following characteristics:

16.1.2.1 There was a Significant Disparity Among Cities and Clear Advantages of the Eastern Cities

Deviation values of SDGP among cities were high, indicating a significant disparity of urban SDGP. The eastern cities[3] enjoyed greater support. Among the four regions in China, the eastern cities had the highest SDGP, higher than the average of the 34 cities and the SDGP of any city in the other three regions. Among the ten eastern cities, nine ranked among the top ten, namely Shenzhen (No. 1), Beijing (No. 2), Xiamen (No. 3), Guangzhou (No. 4), Shijiazhuang (No. 5), Ningbo (No. 6), Nanjing (No. 7), Qingdao (No. 8) and Fuzhou (No. 10). The SDGP of the central cities was relatively high, close to the city average. These cities were

[3] The eastern cities included Beijing, Tianjin, Shijiazhuang, Shanghai, Nanjing, Hangzhou, Ningbo, Fuzhou, Xiamen, Jinan, Qingdao, Guangzhou, Shenzhen and Haikou; the central cities included Taiyuan, Hefei, Nanchang, Zhengzhou, Wuhan and Changsha; the western cities included Hohhot, Nanning, Chongqing, Chengdu, Guiyang, Kunming, Xi'an, Lanzhou, Xining and Yinchuan; the northeastern cities included Shenyang, Dalian, Changchun and Harbin.

Table 16.3 Indexes of SDGP and rankings of 34 cities in China in 2009

City	Support degree of government policies		Green investment indicators		Infrastructure indicators		Environmental control indicators	
	100 %		25 %		45 %		30 %	
	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Shenzhen	0.319	1	0.015	9	0.29	1	0.017	18
Beijing	0.222	2	0.035	4	0.08	2	0.109	2
Xiamen	0.168	3	−0.019	26	0.07	4	0.12	1
Guangzhou	0.141	4	0.027	8	0.03	13	0.086	4
Shijiazhuang	0.133	5	0.072	1	0.04	9	0.019	16
Ningbo	0.11	6	0.002	14	0.02	16	0.089	3
Nanjing	0.099	7	−0.019	24	0.05	6	0.065	6
Qingdao	0.083	8	−0.012	23	0.06	5	0.034	9
Dalian	0.065	9	−0.026	31	0.07	3	0.018	17
Fuzhou	0.048	10	0.043	3	0.01	17	−0.01	21
Kunming	0.047	11	−0.026	30	0.02	14	0.049	7
Haikou	0.047	12	0.004	13	0.02	15	0.022	15
Hangzhou	0.041	13	0.029	6	0.05	7	−0.036	25
Shanghai	0.03	14	−0.01	21	0.01	19	0.031	10
Yinchuan	0.024	15	0.028	7	−0.02	25	0.014	20
Taiyuan	0.009	16	0.013	11	−0.05	28	0.047	8
Jinan	0.008	17	−0.007	18	−0.01	23	0.027	14
Hefei	0.008	18	−0.038	32	0.03	11	0.015	19
Changsha	−0.011	19	−0.009	20	0.01	18	−0.015	22
Nanning	−0.021	20	−0.007	17	0.04	10	−0.05	27
Zhengzhou	−0.027	21	0.013	10	0	21	−0.045	26
Shenyang	−0.034	22	0.007	12	0.03	12	−0.071	29
Nanchang	−0.045	23	−0.006	16	0.04	8	−0.084	32
Guiyang	−0.057	24	−0.009	19	−0.12	32	0.071	5
Wuhan	−0.059	25	−0.025	28	−0.01	24	−0.021	23
Xi'an	−0.094	26	−0.019	25	0	22	−0.08	31
Hohhot	−0.098	27	−0.039	34	−0.09	30	0.03	11
Tianjin	−0.099	28	−0.011	22	−0.05	29	−0.035	24
Chengdu	−0.102	29	−0.039	33	0.01	20	−0.072	30
Chongqing	−0.121	30	−0.026	29	−0.03	26	−0.068	28
Harbin	−0.135	31	0.029	5	−0.19	33	0.03	12
Changchun	−0.163	32	−0.005	15	−0.03	27	−0.127	33
Lanzhou	−0.184	33	0.06	2	−0.27	34	0.028	13
Xining	−0.346	34	−0.02	27	−0.12	31	−0.208	34

Notes (1) Figures in this table are calculated based on data of each indicator for 2008 and 2009 in accordance with the indicator system of SDGP embedded in the City Measurement System (2) Index of each province in this table is ranked in descending order

Sources China Statistical Yearbook 2010, *Annual Statistical Report on Environment in China* 2009, *China Environmental Statistical Yearbook* 2010, *China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

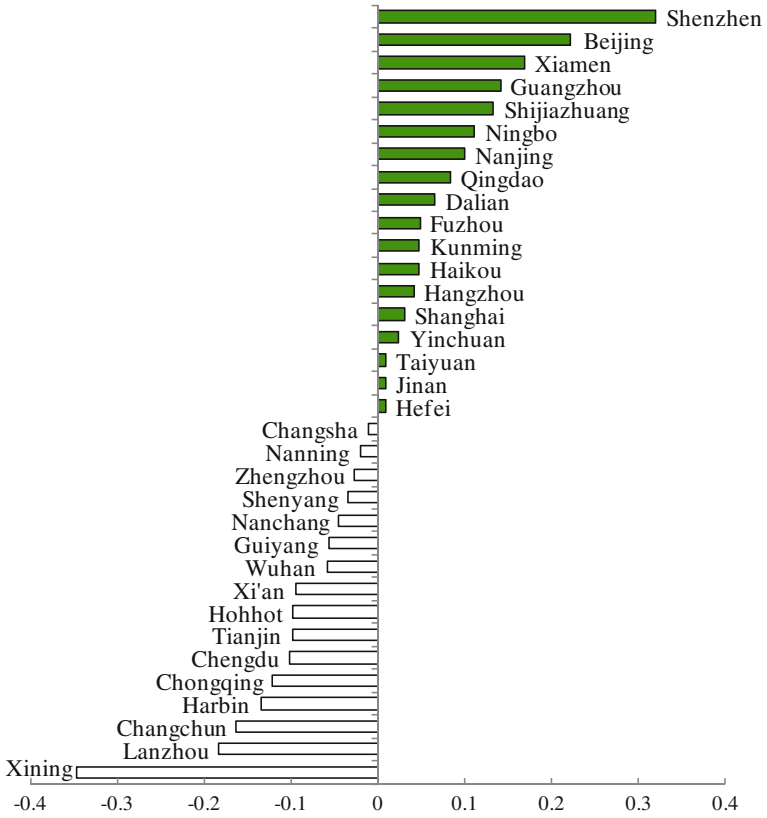

Fig. 16.3 Inter-city comparison of SDGP rankings

Taiyuan (No. 16), Hefei (No. 18), Changsha (No. 19), Zhengzhou (No. 21), Nanchang (No. 23), Wuhan (No. 25). The SDGP of the four northeastern cities were relatively low. They were Dalian (No. 9), Shenyang (No. 22), Harbin (No. 31) and Changchun (No. 32). The western cities had the lowest SDGP, for among the ten measured cities, eight were far below the national average except Kunming (No. 11) and Yinchuan (No. 15).

The measured results of cities differed slightly from those of provinces. On the provincial level, western provinces had higher SDGP than the northeastern ones, while on the city level, we got the reverse outcome.

16.1.2.2 Different Cities had Their Specific SDGPs

We measured the three indicators including Green Investment, Infrastructure and Environmental Control in order to measure SDGP under GDI. The results showed

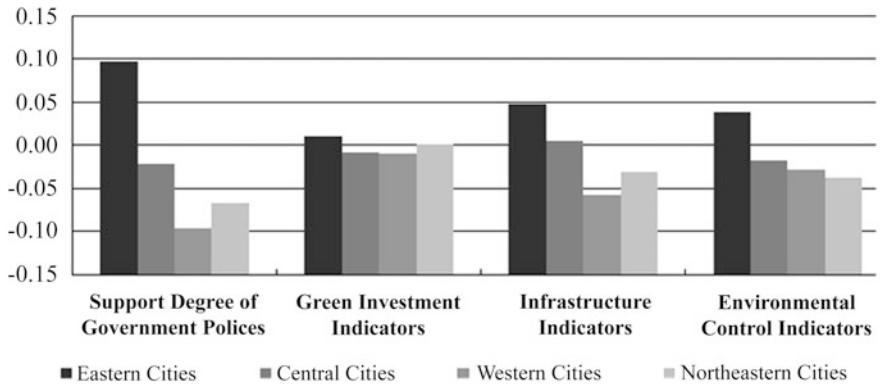

Fig. 16.4 Inter-city comparison of SDGP among 4 major areas in China. *Note* Figures in the chart are the arithmetic mean of provinces within each of four major areas in China

that different cities had different trends, priorities and extent of efforts in making and implementing policies on green development Fig. 16.4.

From the above table, among the four major regions, the cities in the eastern region had much higher green investment and infrastructure value and slightly higher environmental control value over the national average and cities in the other regions. On the one hand, eastern cities were highly developed in infrastructure, urban planning management and control of industrial pollutants. On the other hand, these cities made much heavier investment in environmental protection, science and technology and education than the underdeveloped regions.

The values of all indicators of central cities were far below those of eastern ones. In the central region, the infrastructure value was slightly above the national average and also higher than that of the West and Northeast. The environmental control value was above the West and Northeast, and the green investment value was equal to the West and slightly below the Northeast, but the value of both indicators were both lower than the national average. This revealed a solid hardware basis of Central China and greater input into environmental protection by provincial capitals and other major and mid-sized cities. As a result, the region was delivering a better environment for the people.

The three indicators of the western and northeastern cities were all low. However, the northeastern cities had more green investment and better infrastructure than the western cities. The green investment in the Northeast approached the city average and was second only to the East, but the region lagged far behind East and Central China in infrastructure. The western cities had better environmental control over the Northeast, but lagged behind the eastern and central cities. Mostly on the verge of resource exhaustion, the resource-relied western cities and the long-established industrial cities in Northeast China must transform their patterns of economic development. It was also imperative for local governments to make more preferential policies and implement the Scientific Approach to Development.

16.1.2.3 Government Policies Underpinned Urban Green Development

Policy Support from Government contributed to economic development. Among the top ten GDI cities, six were also among the top ten SDGP cities, namely Shenzhen (No. 1), Beijing (No. 2), Guangzhou (No. 4), Dalian (No. 9), Qingdao (No. 8), and Fuzhou (No. 10). Although Beijing, Guangzhou and Shanghai were poor in the potential carrying capacity of natural resources and environment, yet the robust local economy and strong policy support from government offset the disadvantage and enhanced green development. Among the last ten GDI cities, seven were also among the last ten SDGP cities, namely Tianjin (No. 28), Chongqing (No. 30), Xi'an (No. 26), Wuhan (No. 25), Chengdu (No. 29), Lanzhou (No. 33), and Xining (No. 34) (see Table 16.4).

Table 16.4 Inter-city comparison of ranking gap between GDI and SDGP

City	Ranking of GDI (1)	Ranking of SDGP (2)	Ranking gap (1)–(2)	City	Ranking of GDI (1)	Ranking of SDGP (2)	Ranking gap (1)–(2)
Shenzhen	1	1	0	Nanjing	18	7	11
Haikou	2	12	−10	Shanghai	19	14	5
Kunming	3	11	−8	Changchun	20	32	−12
Beijing	4	2	2	Jinan	21	17	4
Hefei	5	18	−13	Yinchuan	22	15	7
Guangzhou	6	4	2	Nanchang	23	23	0
Dalian	7	9	−2	Hohhot	24	27	−3
Qingdao	8	8	0	Zhengzhou	25	21	4
Changsha	9	19	−10	Guiyang	26	24	2
Fuzhou	10	10	0	Taiyuan	27	16	11
Xiamen	11	3	8	Tianjin	28	28	0
Nanning	12	20	−8	Chongqing	29	30	−1
Ningbo	13	6	7	Xi'an	30	26	4
Shenyang	14	22	−8	Wuhan	31	25	6
Harbin	15	31	−16	Chengdu	32	29	3
Shijiazhuang	16	5	11	Lanzhou	33	33	0
Hangzhou	17	13	4	Xining	34	34	0

Notes This table is derived from Tables 0.5 and 16.3

16.1.2.4 There was a Disparity in SDGP of a City and the Province Where it was Located in

Basing on a comparative analysis, we found that most cities had different SDGP rankings from those of the provinces they were located in (see Table 16.5 for details). The city rankings of four municipalities directly under the jurisdiction of the central government were lower than their provincial ranking. Beijing's city ranking was one place behind its provincial ranking, but the other three municipalities experienced a ranking gap by 11 ∼ 18 places. Such a ranking gap took

place among all provincial capitals and their corresponding provinces. 14, or half of the cities dropped by five or more places. The five cities specifically designated in the state plan were among the top ten cities, higher than the rankings of their corresponding provinces and the capitals.

Table 16.5 Comparison of ranking gap of SDGP between cities and their corresponding provinces

Indicator	Support degree of government policies		Indicator	Support degree of government policies		Ranking gap (1)–(2)
Province	Score	Ranking (1)	City	Score	Ranking (2)	
Beijing	0.278	1	Beijing	0.222	2	−1
Jiangsu	0.121	2	Nanjing	0.099	7	−5
Shanghai	0.107	3	Shanghai	0.03	14	−11
Zhejiang	0.096	4	Hangzhou	0.041	13	−9
			Ningbo	0.11	6	−2
Shandong	0.087	5	Qingdao	0.083	8	−3
			Jinan	0.008	17	−12
Ningxia	0.081	6	Yinchuan	0.024	15	−9
Guangdong	0.077	7	Guangzhou	0.141	4	3
			Shenzhen	0.319	1	6
Fujian	0.051	8	Fuzhou	0.048	10	−2
			Xiamen	0.168	3	5
Yunnan	0.049	9	Kunming	0.047	11	−2
Hebei	0.043	10	Shijiazhuang	0.133	5	5
Shanxi	0.036	11	Taiyuan	0.009	16	−5
Chongqing	0.035	12	Chongqing	−0.121	30	−18
Shaanxi	0.017	13	Xi'an	−0.094	26	−13
Jiangxi	0.01	14	Nanchang	−0.045	23	−9
Anhui	0.004	15	Hefei	0.008	18	−3
Hubei	0	16	Wuhan	−0.059	25	−9
Tianjin	−0.009	17	Tianjin	−0.099	28	−11
Guangxi	−0.03	18	Nanjing	−0.021	20	−2
Inner Mongolia	−0.03	19	Hohhot	−0.098	27	−8
Hainan	−0.05	20	Haikou	0.047	12	8
Liaoning	−0.061	21	Shenyang	−0.034	22	−1
Xinjiang	−0.063	22	Dalian	0.065	9	12
Sichuan	−0.074	23	Chengdu	−0.102	29	−6
Hunan	−0.075	24	Changsha	−0.011	19	5
Henan	−0.076	25	Zhengzhou	−0.027	21	4
Guizhou	−0.076	26	Guiyang	−0.057	24	2
Qinghai	−0.082	27	Xining	−0.346	34	−7
Heilongjiang	−0.147	28	Harbin	−0.135	31	−3
Jilin	−0.154	29	Changchun	−0.163	32	−3
Gansu	−0.165	30	Lanzhou	−0.184	33	−3

Note This table is derived from Tables 16.1 and 16.3

Table 16.6 Third-class indicators, their weights and attributes of inter-provincial green investment

Sequence number	Indicator	Weight (%)	Attribute
1	Ratio of environmental protection expenditures to government expenditures	1.50	Positively correlated
2	Ratio of investment in the control of environmental pollution to GRP	1.50	Positively correlated
3	Per capita investment of water sanitation and toilet improvement in rural areas	1.50	Positively correlated
4	Investment in converting cultivated land into forests and grassland per unit of area of cultivated land	1.50	Positively correlated
5	Ratio of expenditures for science and technology, education, culture, and medical and health care to government expenditures	1.50	Positively correlated

Note The contents in this table are determined by the task force after having conducted a lot of expert workshops

16.2 Comparison of Inter-Provincial SDGP

Weighing 30 % of GDI, Inter-provincial SDGP was made up of 19 Third-Level Indicators, including 18 positively correlated indicators and one negatively correlated indicator. Each positively correlated indicator weighted 1.50 % and the negatively correlated one 1.69 %.

16.2.1 Measurement and Analysis of the Green Investment Indicator on the Provincial Level

According to the perspectives of Western organizations and scholars, green investment was an investment model based on environmental norms, social norms and economic return norms. Taking the three bottom lines of economy, society and environment into account, it was also known as "triple surplus" investment.

Green Investment was an investment strategy that conformed with the Scientific Approach to Development and sustainable development. It was an integration of economic, social, environmental and other factors. It encouraged investors to take due responsibilities in line with the profits and brought both investors and the society sustainable development. Government played the leading role as green investment was policy oriented and worked for public good.

Table 16.7 Indexes of green investment indicators and rankings of 30 provinces in China in 2009

Indicator	Green investment indicators		Indicator	Green investment indicators	
Province	Score	Ranking	Province	Score	Ranking
Ningxia	0.068	1	Zhejiang	−0.003	16
Beijing	0.052	2	Hunan	−0.004	17
Qinghai	0.051	3	Sichuan	−0.007	18
Shanxi	0.038	4	Hubei	−0.008	19
Chongqing	0.036	5	Jiangsu	−0.018	20
Shaanxi	0.033	6	Anhui	−0.019	21
Gansu	0.017	7	Shandong	−0.022	22
Guangxi	0.015	8	Jiangxi	−0.026	23
Hebei	0.010	9	Jilin	−0.027	24
Xinjiang	0.008	10	Henan	−0.027	25
Guizhou	0.003	11	Guangdong	−0.028	26
Inner Mongolia	0.003	12	Tianjin	−0.032	27
Yunnan	0.001	13	Fujian	−0.034	28
Hainan	−0.002	14	Heilongjiang	−0.037	29
Shanghai	−0.003	15	Liaoning	−0.039	30

Sources China Statistical Yearbook 2010*, Annual Statistical Report on Environment in China* 2009*, China Environmental Statistical Yearbook* 2010*, China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

Weighing 25 % of SDGP, Green Investment Indicator (GII) consisted of five Third-Level Indicators, namely the ratio of environmental protection expenditures to government expenditures, ratio of investment in the control of environmental pollution to GRP, per capita investment of water sanitation and toilet improvement in rural areas, Investment in converting cultivated land into forests and grassland per unit of area of cultivated land, and the ratio of expenditures for science and technology, education, culture, and medical and health care to government expenditures. Those five indicators were currently the priorities of government green investment. Measuring them would be an objective and comprehensive evaluation of China's green investment. We adopted the averaging weight method (Table 16.6) and ranked the green investment levels of all provinces (see Table 16.7).

Calculated results showed a slight difference among the provincial GDI that ranged from 0.068 to −0.039. Ningxia ranked the first, 7 % higher than the national average; 13, or half of the provinces were above the national average level, which in descending order included Ningxia, Beijing, Qinghai, Shanxi, Chongqing, Shaanxi, Gansu, Guangxi, Hebei, Xinjiang, Guizhou, Inner Mongolia and Yunnan. The other provinces such as Hainan and Shanghai were below the average (Table 16.7).

From a regional perspective, West China had the highest GDI value, followed by equivalent East and Central China, and lastly Northeast China. Among the ten western provinces (see Fig. 16.6) that were above the national average, seven were among the national top ten, including Ningxia, Qinghai, Chongqing, Shaanxi,

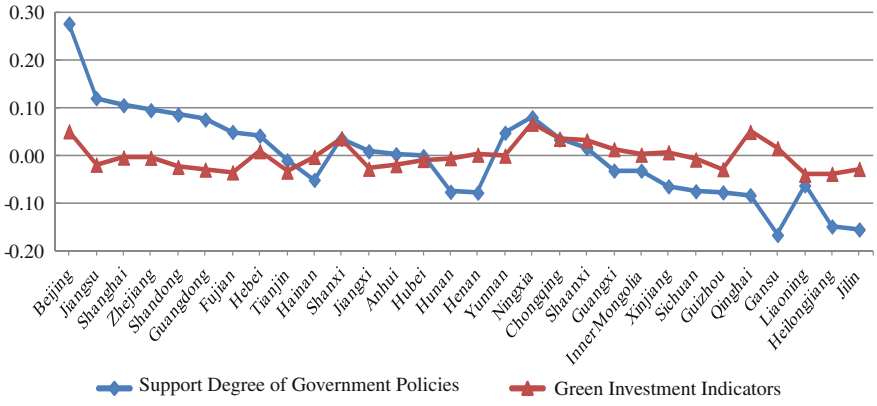

Fig. 16.5 Inter-provincial comparison of green investment index and SDGP index. *Notes* From the area division perspective of eastern, central, western and northeastern areas, this chart arranges these regions from *left–right* in terms of indexes of SDGP in descending order

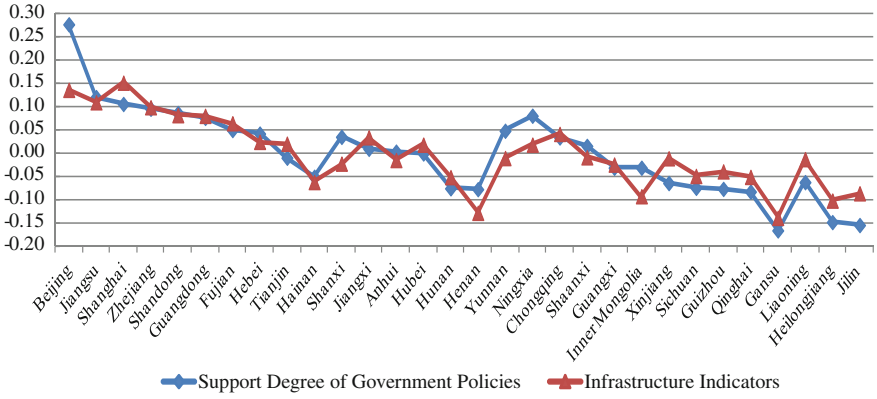

Fig. 16.6 Inter-provincial comparisons of infrastructure index and SDGP index. *Notes* From the area division perspective of eastern, central, western and northeastern areas, this chart arranges these regions from *left–right* in terms of indexes of SDGP in descending order

Gansu, Guangxi, Xinjiang, and the other three, namely Guizhou, Inner Mongolia and Yunnan respectively ranked 11th, 12th and 13th. Among the eastern provinces, only Beijing and Hebei ranked among the top ten, while Guizhou, Inner Mongolia, Yunnan, Zhejiang, Jiangsu were among the No. 11 $\sim$ 20. Shandong, Guangdong, Tianjin and Fujian were among the bottom ten, whose GDI did not match their economic strength. Among the central provinces, Shanxi was the only one among the top ten, Hubei and Hunan among No. 11 $\sim$ 20, and Anhui, Jiangxi and Henan among the bottom ten. Among the Northestern provinces, Jilin ranked 24th, and Heilongjiang 29th and Liaoning 30th.

Table 16.8 Third-class indicators, their weights and attributes of inter-provincial infrastructure

Sequence number	Indicator	Weight (%)	Attribute
6	Area of green land per capita in urban areas	1.69	Positively correlated
7	Coverage rate of urban population with access to tap water	1.69	Positively correlated
8	Treatment rate of urban waste water	1.69	Positively correlated
9	Ratio of urban consumption wastes treated	1.69	Positively correlated
10	Public transportation vehicles per 10000 urban population	1.69	Positively correlated
11	Per capita length of urban public transit operating routes	1.69	Positively correlated
12	Ratio of rural population benefiting from water improvement projects to total rural population	1.69	Positively correlated
13	Ratio of green covered area to completed urban area	1.69	Positively correlated

Notes The contents in this table are determined by the task force after having conducted a lot of expert workshops

On a comparison basis, we found that the eastern provinces had lower GDI compared with their SDGP; the central provinces had basically the same GDI and SDGP; the western and northeastern provinces had higher GDI compared with their SDGP.

16.2.2 Measurement and Analysis of the Infrastructure Indicator on the Provincial Level

Given the current situation of policy making and implementation in regard to infrastructure, we designated 45 % of weight to the Infrastructure Indicator in SDGP. Under the indicator were eight Third-Level Indicators, namely area of green land per capita in urban areas, coverage rate of urban population with access to tap water, treatment rate of urban waste water, ratio of urban consumption wastes treated, public transportation vehicles per 10,000 urban population, per capita length of urban public transit operating routes, ratio of rural population benefiting from water improvement projects to total rural population, and ratio of green covered area to completed urban area. The weights and indications of the Third-Level Indicators were shown in Table 16.8.

Calculated results (Table 16.9) showed that the value of provincial Infrastructure Indicator ranged from 0.152 to −0.138, with a larger disparity than green

Table 16.9 Indexes of infrastructure indicators and rankings of 30 provinces in China in 2009

Indicator	Infrastructure indicators		Indicator	Infrastructure indicators	
Province	Score	Ranking	Province	Score	Ranking
Shanghai	0.152	1	Xinjiang	−0.010	16
Beijing	0.137	2	Liaoning	−0.012	17
Jiangsu	0.110	3	Anhui	−0.014	18
Zhejiang	0.100	4	Shanxi	−0.022	19
Shandong	0.083	5	Guangxi	−0.024	20
Guangdong	0.081	6	Henan	−0.038	21
Fujian	0.065	7	Sichuan	−0.048	22
Chongqing	0.042	8	Qinghai	−0.050	23
Jiangxi	0.035	9	Hubei	−0.051	24
Hebei	0.025	10	Hainan	−0.061	25
Tianjin	0.021	11	Jilin	−0.085	26
Ningxia	0.019	12	Inner Mongolia	−0.092	27
Hubei	0.019	13	Heilongjiang	−0.101	28
Shaanxi	−0.008	14	Guizhou	−0.127	29
Yunnan	−0.010	15	Gansu	−0.138	30

Sources China Statistical Yearbook 2010*, Annual Statistical Report on Environment in China* 2009*, China Environmental Statistical Yearbook* 2010*, China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

investment. Shanghai ranked first and Gansu the last. 13 provinces were above the national average. In descending order, they were Shanghai, Beijing, Jiangsu, Zhejiang, Shandong, Guangdong, Fujian, Chongqing, Jiangxi, Hebei, Tianjin, Ningxia and Hubei. The other 17 provinces such as Shaanxi and Gansu were below the national average.

Among the four major regions (see Fig. 16.7), there was a significant disparity. East China had much higher Infrastructure value, followed by Central China, West China and Northeast China in order. SDGP highly depended upon the Infrastructure Indicator.

Most of the eastern provinces had higher Infrastructure value than the national average, except Hainan. Eight provinces were among the top ten, namely Shanghai, Beijing, Jiangsu, Zhejiang, Shandong, Guangdong, Fujian, and Hebei. Tianjin ranked 11th and Hainan 25th. Highly urbanized with great social progress and civilization, this region had perfect infrastructure and scientific urban planning and management guided by relevant philosophy.

However, other regions had much lower Infrastructure values. Most provinces from the other three regions were below the national average. As economic development improved and urbanization sped up, local governments would invest more in infrastructure and embrace more scientific philosophy of urban planning and management. Improved infrastructure would be a solid basis underpinning green development.

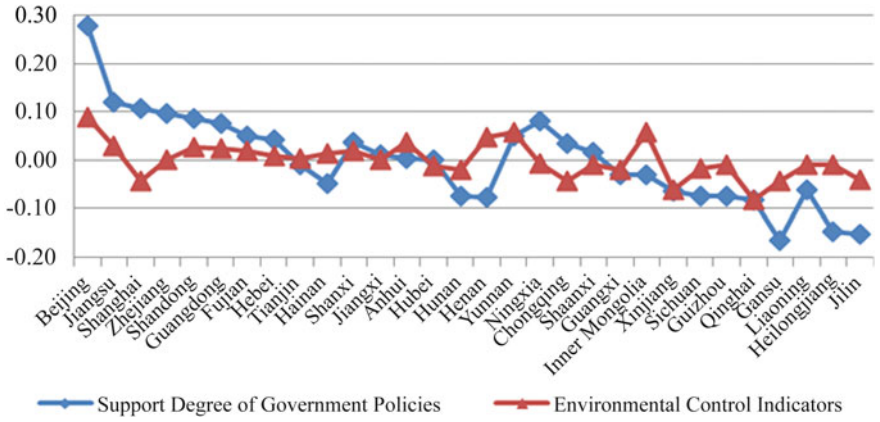

Fig. 16.7 Inter-provincial comparison of environmental control index and SDGP index. *Notes* From the area division perspective of eastern, central, western and northeastern areas, this chart arranges these regions from *left–right* in terms of indexes of SDGP in descending order

16.2.3 Measurement and Analysis of the Environmental Control Indicator on the Provincial Level

Given the current situation of policy making and implementation in regard to environmental protection and ecological management, we designated 30 % of weight to the Environmental Control Indicator in SDGP. Under the indicator were six Third-Level Indicators, namely area of afforestation per capita, removal rate of industrial sulfur dioxide emissions, removal rate of chemical oxygen demand in industrial waste water, removal rate of industrial nitrogen oxide emissions, removal rate of ammonia nitrogen in industrial waste water and the sudden accidents effecting environment. The weights and indications of all Third-Level Indicators were shown in Table 16.10.

Calculated results (Table 16.11) indicated that the values of the Environmental Control Indicator ranged from 0.089 to −0.082, with a slight provincial disparity. Beijing ranked first with the value of 0.089, 9 % higher than the national average. Another 14 provinces including Inner Mongolia, Yunnan, Guizhou, Anhui, Jiangsu, Shandong, Guangdong, Shanxi, Fujian, Hainan, Hebei, Tianjin, Jiangxi and Zhejiang were above the national average. However, the other sixteen including Ningxia, Shaanxi, Heilongjiang, Henan, Liaoning, Hubei, Sichuan, Hunan, Guangxi, Jilin, Shanghai, Gansu, Chongqing, Xinjiang and Qinghai were below the national average.

Calculated results showed a slight regional disparity of the Environmental Control Indicator while disparity within the regions was significant. The eastern region had the highest index values, significantly higher than other regions. The western and central regions ranked second and third whereas the northeast the last.

Table 16.10 Third-class indicators, their weights and attributes of inter-provincial environmental control

Sequence number	Indicator	Weight (%)	Attribute
14	Area of Afforestation per capita	1.50	Positively correlated
15	Removal rate of industrial SO2 emissions	1.50	Positively correlated
16	Removal rate of COD in industrial waste water	1.50	Positively correlated
17	Removal rate of industrial NOx emissions	1.50	Positively correlated
18	Removal rate of ammonia nitrogen in industrial waste water	1.50	Positively correlated
19	Sudden accidents effecting environment	1.50	Negatively correlated

Notes The contents in this table are determined by the task force after having conducted a lot of expert workshops

Table 16.11 Indexes of environmental control indicators and rankings of 30 provinces in China in 2009

Indicator	Environmental control indicators		Indicator	Environmental control indicators	
Province	Score	Ranking	Province	Score	Ranking
Beijing	0.089	1	Ningxia	−0.006	16
Inner Mongolia	0.058	2	Shaanxi	−0.009	17
Yunnan	0.057	3	Heilongjiang	−0.009	18
Guizhou	0.048	4	Henan	−0.010	19
Anhui	0.037	5	Liaoning	−0.010	20
Jiangsu	0.029	6	Hubei	−0.011	21
Shandong	0.027	7	Sichuan	−0.018	22
Guangdong	0.024	8	Hunan	−0.020	23
Shanxi	0.020	9	Guangxi	−0.021	24
Fujian	0.019	10	Jilin	−0.042	25
Hainan	0.013	11	Shanghai	−0.043	26
Hebei	0.007	12	Gansu	−0.044	27
Tianjin	0.002	13	Chongqing	−0.044	28
Jiangxi	0.001	14	Xinjiang	−0.062	29
Zhejiang	0.000	15	Qinghai	−0.082	30

Sources China Statistical Yearbook 2010*, Annual Statistical Report on Environment in China* 2009*, China Environmental Statistical Yearbook* 2010*, China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

All eastern cities except Shanghai were above the national average, among which Beijing, Jiangsu, Shandong, Guangdong, and Fujian ranked among the top ten. The six central provinces fluctuated around the national average level, with Anhui,

Jiangxi, and Hainan slightly higher than the national average and the other three below it. Most western cities were below the national average, except Inner Mongolia, Yunnan and Guizhou that were among the top five; the last three were all western cities, namely Qinghai (No. 30), Xinjiang (No. 29) and Chongqing (No. 28). The eastern region had the best environmental control, for the region had taken the lead in developing economy and optimizing its industrial structure by lowering the share of industry, heavy industry in particular and improving that of service. As a result, the industrial structure was "lightened". Among the region, Shanghai had the lowest indicator value. Among the western provinces, however, Inner Mongolia and Guizhou had the highest value. On a comparison basis, we found a weak correlation between the Environmental Control Indicator (ECI) and SDGP, for in East China, the ECI values were higher than the SDGP values; in Central China, the two indicator values were basically the same; in West and Northeast China, the ECI values were higher than the SDGP values.

16.3 Comparison of City SDGP

In order to fully compare the inter-city SDGP, taking into account data availability, the city's representativeness, and regional differences, we measured 34 typical cities by analyzing three indicators, namely Green Investment, Infrastructure and Environmental Control. Based on the provincial measurement system, we designed a city measurement system where the evaluation and weight method were slightly adjusted. Weighing 33 % in GDI, the inter-city SDGP Index was composed of 13 positive Third-Level Indicators, each weighing between 2.48 and −2.75 %.

16.3.1 Measurement and Analysis of the Green Investment Indicator on the City Level

Weighing 25 % in urban SDGP, city Green Investment was made up of three indicators, namely ratio of environmental protection expenditures to government expenditures, ratio of investment in the control of industrial environmental pollution to GRP, and ratio of expenditures for science and technology, education, culture, and medical and health care to government expenditures. The three indicators were currently the main areas of green investment. Through the averaging weight method, we worked out their weight as 2.75 % identically (see Table 16.12). The Green Investment rankings of different cities were listed in Table 16.13.

Table 16.12 Third-class indicators, their weights and attributes of inter-city green investment

Sequence number	Indicator	Weight (%)	Attribute
1	Ratio of environmental protection expenditures to government expenditures correlated	2.75	Positively
2	Ratio of investment in the control of industrial environmental pollution to GRP correlated	2.75	Positively
3	Ratio of expenditures for science and technology, education, culture, and medical and health care to government expenditures correlated	2.75	Positively

Notes The contents in this table are determined by the task force after having conducted a lot of expert workshops

Table 16.13 Indexes of green investment indicators and rankings of 34 cities in China in 2009

Indicator	Green investment indicators		Indicator	Green investment indicators	
City	Score	Ranking	City	Score	Ranking
Shijiazhuang	0.072	1	Jinan	−0.007	18
Lanzhou	0.060	2	Guiyang	−0.009	19
Fuzhou	0.043	3	Changsha	−0.009	20
Beijing	0.035	4	Shanghai	−0.010	21
Harbin	0.029	5	Tianjin	−0.011	22
Hangzhou	0.029	6	Qingdao	−0.012	23
Yinchuan	0.028	7	Nanjing	−0.019	24
Guangzhou	0.027	8	Xi'an	−0.019	25
Shenzhen	0.015	9	Xiamen	−0.019	26
Zhengzhou	0.013	10	Xining	−0.020	27
Taiyuan	0.013	11	Wuhan	−0.025	28
Shenyang	0.007	12	Chongqing	−0.026	29
Haikou	0.004	13	Kunming	−0.026	30
Ningbo	0.002	14	Dalian	−0.026	31
Changchun	−0.005	15	Hefei	−0.038	32
Nanchang	−0.006	16	Chengdu	−0.039	33
Nanning	−0.007	17	Hohhot	−0.039	34

Sources China Statistical Yearbook 2010*, Annual Statistical Report on Environment in China* 2009*, China Environmental Statistical Yearbook* 2010*, China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

Calculated results showed the values of city Green Investment ranged from 0.072 to −0.039, with a slight disparity. Shijiazhuang, capital of Hebei Province, ranked first, with a value 7.2 % higher than the national average; 14, or less than half of the cities, less than half of the cities were above the national average.

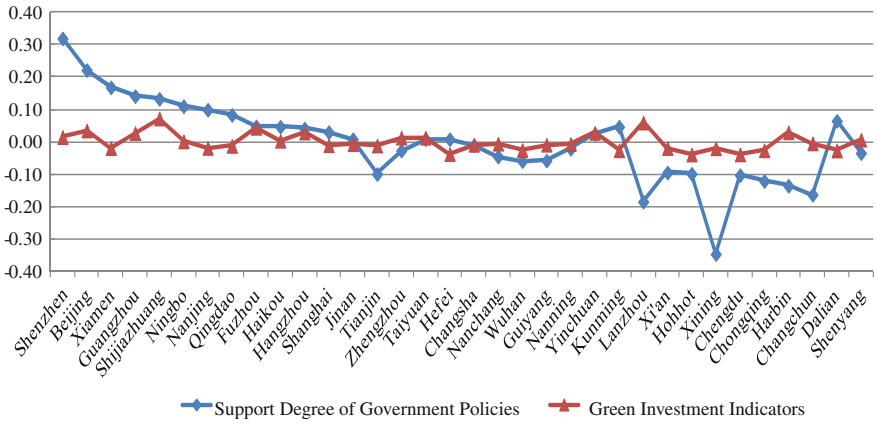

Fig. 16.8 Inter-city comparison of green investment index and SDGP index. *Notes* From the area division perspective of eastern, central, western and northeastern areas, this chart arranges these regions from *left–right* in terms of indexes of SDGP in descending order

In descending order they were Shijiazhuang, Lanzhou, Fuzhou, Beijing, Harbin, Hangzhou, Yinchuan, Guangzhou, Shenzhen, Zhengzhou, Taiyuan, Shenyang, Haikou and Ningbo. However, the other 20 such as Changchun and Hohhot were below the national average.

From the Fig. 16.8, the Green Investment Indicator (GII) values of all cities varied slightly. On a comparison basis, we found that the eastern cities had lower GII values compared with their SDGP values, which meant a small share of GII in SDGP; the central cities had basically the same GII and SDGP values; the western and northeastern cities had higher GII values than their SDGP values, which meant a large share of GII in SDGP.

16.3.2 Measurement and Analysis of the Infrastructure Indicator on the City Level

Given the current situation of policy making and implementation in infrastructure and urban management, we designated 45 % of weight to the Infrastructure Indicator in urban SDGP. Under the indicator were five positive Third-Level Indicators, namely area of green land per capita in urban areas, ratio of green covered area to completed urban area, coverage rate of urban population with access to tap water, treatment rate of urban waste water, ratio of urban consumption wastes treated, and public transportation vehicles per 10,000 urban population. Each of the indicators weighed 2.48 % Table 16.14.

Table 16.14 Third-class indicators, their weights and attributes of inter-city infrastructure

Sequence number	Indicator	Weight (%)	Attribute
4	Area of green land per capita in urban areas	2.48	Positively correlated
5	Ratio of green covered area to completed urban area	2.48	Positively correlated
6	Coverage rate of urban population with access to tap water	2.48	Positively correlated
7	Treatment rate of urban waste water	2.48	Positively correlated
8	Ratio of urban consumption wastes treated	2.48	Positively correlated
9	Public transportation vehicles per 10000 urban population	2.48	Positively correlated

Notes The contents in this table are determined by the task force after having conducted a lot of expert workshops

Table 16.15 Indexes of infrastructure indicators and rankings of 34 cities in China in 2009

Indicator	Infrastructure indicators		Indicator	Infrastructure indicators	
City	Score	Ranking	City	Score	Ranking
Shenzhen	0.287	1	Changsha	0.013	18
Beijing	0.077	2	Shanghai	0.010	19
Dalian	0.073	3	Chengdu	0.008	20
Xiamen	0.067	4	Zhengzhou	0.005	21
Qingdao	0.061	5	Xi'an	0.004	22
Nanjing	0.053	6	Jinan	−0.012	23
Hangzhou	0.049	7	Wuhan	−0.013	24
Nanchang	0.044	8	Yinchuan	−0.017	25
Shijiazhuang	0.042	9	Chongqing	−0.027	26
Nanning	0.036	10	Changchun	−0.031	27
Hefei	0.031	11	Taiyuan	−0.051	28
Shenyang	0.030	12	Tianjin	−0.052	29
Guangzhou	0.028	13	Hohhot	−0.090	30
Kunming	0.023	14	Xining	−0.119	31
Haikou	0.022	15	Guiyang	−0.119	32
Ningbo	0.020	16	Harbin	−0.194	33
Fuzhou	0.014	17	Lanzhou	−0.272	34

Sources China Statistical Yearbook 2010, *Annual Statistical Report on Environment in China* 2009, *China Environmental Statistical Yearbook* 2010, *China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

Calculated results (Table 16.15) showed the values of urban Infrastructure ranged from 0.287 to −0.272, with a large disparity. There are 22 cities above the national average. In descending order they were Shenzhen, Beijing, Dalian, Xiamen, Qingdao, Nanjing, Hangzhou, Nanchang, Shijiazhuang, Nanning, Hefei,

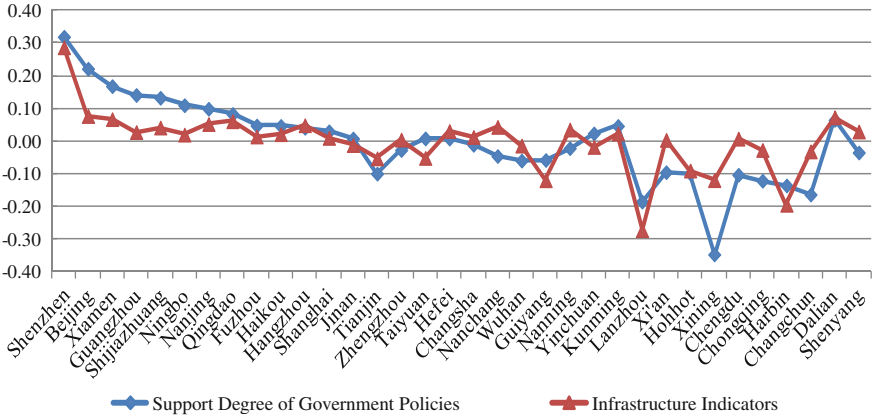

Fig. 16.9 Inter-city comparison of infrastructure index and SDGP index. *Notes* From the area division perspective of eastern, central, western and northeastern areas, this chart arranges these regions from *left–right* in terms of indexes of SDGP in descending order

Shenyang, Guangzhou, Kunming, Haikou, Ningbo, Fuzhou, Changsha, Shanghai, Chengdu, Zhengzhou and Xi'an. The No. 1 Shenzhen left Beijing far behind. The other 12 cities such as Jinan and Harbin were below the national average.

From a regional perspective, the eastern region had high Infrastructure value and ranked forward. The top ten included seven eastern cities and Dalian (No. 3), Nanchang (No. 8), and Nanning (No. 10) outside the region. The reason was that, compared with the other regions, eastern municipalities such as Beijing and Shanghai, provincial capital cities and cities specially designated in the state plan were highly urbanized and had sounder infrastructure, more scientific urban planning and more advanced urban management philosophy and levels. They had the following strengths: high green coverage, strong capacity in water supply and sewage Control, advanced roads and public transportation, fast-improving sanitation facilities and so on. The other cities outside the region should follow the example of the eastern counterparts to improve their infrastructure and urban management.

From the Fig. 16.9, the Infrastructure values varied greatly among the regions. The eastern cities, in general, had higher values than the rest. On a comparison basis, we found that a positive correlation existed between urban Infrastructure Indicator and urban SDGP and that SDGP mainly hinged on Infrastructure.

16.3.3 Measurement and Analysis of the Environmental Control Indicator on the City Level

Based on the goal and contents of the indicator, given the current situation of policy making and implementation in environmental protection and ecological

Table 16.16 Third-class indicators, their weights and attributes of inter-city environmental control

Sequence number	Indicator	Weight (%)	Attribute
10	Removal rate of industrial SO2 emissions	2.48	Positively correlated
11	Removal rate of COD in industrial waste water	2.48	Positively correlated
12	Removal rate of industrial NOx emissions	2.48	Positively correlated
13	Removal rate of ammonia nitrogen in industrial waste water	2.48	Positively correlated

Notes The contents in this table are determined by the task force after having conducted a lot of expert workshops

Table 16.17 Indexes of environmental control indicators and rankings of 34 cities in China in 2009

Indicator	Environmental control indicators		Indicator	Environmental control indicators	
City	Score	Ranking	City	Score	Ranking
Xiamen	0.120	1	Shenzhen	0.017	18
Beijing	0.109	2	Hefei	0.015	19
Ningbo	0.089	3	Yinchuan	0.014	20
Guangzhou	0.086	4	Fuzhou	−0.010	21
Guiyang	0.071	5	Changsha	−0.015	22
Nanjing	0.065	6	Wuhan	−0.021	23
Kunming	0.049	7	Tianjin	−0.035	24
Taiyuan	0.047	8	Hangzhou	−0.036	25
Qingdao	0.034	9	Zhengzhou	−0.045	26
Shanghais	0.031	10	Nanjing	−0.050	27
Hohhot	0.030	11	Chongqing	−0.068	28
Harbin	0.030	12	Shenyang	−0.071	29
Lanzhou	0.028	13	Chengdu	−0.072	30
Jinan	0.027	14	Xi'an	−0.080	31
Haikou	0.022	15	Nanchang	−0.084	32
Shijiazhuang	0.019	16	Changchun	−0.127	33
Dalian	0.018	17	Xining	−0.208	34

Sources China Statistical Yearbook 2010*, Annual Statistical Report on Environment in China* 2009*, China Environmental Statistical Yearbook* 2010*, China Industrial Economic Statistical Yearbook* 2010, and *China City Statistical Yearbook* 2010

control, we designated 30 % of weight to the urban Environmental Control Indicator in the SDGP. Under the indicator were four positive Third-Level Indicators, namely removal rate of industrial sulfur dioxide emissions, removal rate of chemical oxygen demand in industrial waste water, removal rate of industrial nitrogen oxide emissions, and removal rate of ammonia nitrogen in industrial waste water. Each indicator weighted 2.48 % Table 16.16.

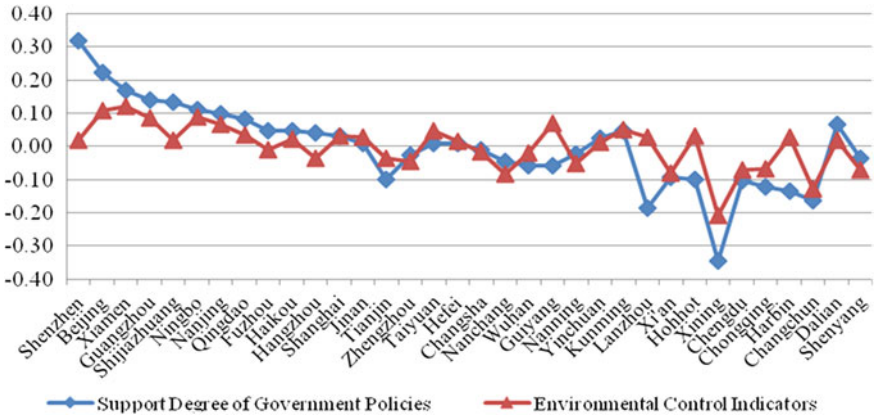

Fig. 16.10 Inter-city comparison of environmental control index and SDGP index. *Notes* From the area division perspective of eastern, central, western and northeastern areas, this chart arranges these regions from *left–right* in terms of indexes of SDGP in descending order

Calculated results (Table 16.17) indicated that the values of the urban Environmental Control Indicator ranged from 0.120 to −0.208. Xiamen had the highest value, which was 0.120 and about 12 % higher than the national average. 20 cities were above the national average, namely Xiamen, Beijing, Ningbo, Guangzhou, Guiyang, Nanjing, Kunming, Taiyuan, Qingdao, Shanghai, Hohhot, Harbin, Lanzhou, Jinan, Haikou, Shijiazhuang, Dalian, Shenzhen, Hefei and Yinchuan. The other 14 such as Fuzhou and Xining were below the national average.

From a regional perspective (see Fig. 16.10), the eastern cities had much higher indicator values and rankings. Seven of them ranked among the top ten and most of them were above the national average except Fuzhou (No. 21) and Tianjin (No. 24). Most of the central, western and northeastern cities were below the national average. The effective environmental control in eastern cities were mainly due to the early mover advantage in upgrading the industrial structure. For example, Beijing took the first place in this regard as a result of its sound and optimized industrial structure.

16.4 Conclusion

By measuring the SDGP Indicator values of 30 provinces (municipalities and autonomous regions) and 34 cities, we made the following conclusions:

All governments valued green development, but among them there was a huge disparity in terms of government policy support. The developed eastern region gave the strongest policy support, setting a good example to underdeveloped regions that economic development and green development were compatible.

To be specific, the disparity was mainly reflected in the disparity of infrastructure and urban management. The central and western regions fell far behind the eastern region. However, in terms of environmental control, different regions made similar progress.

We should coordinate infrastructure development with green development. Currently infrastructure was highly incompatible with environmental protection. The environmental infrastructure failed to catch up with other undertakings. Thus we should prioritize environmental protection and embed the ideal of green and low carbon development into the design, planning, construction and operation process, so that we could develop more environmental friendly facilities.

Urbanization should allow for green development. The Twelfth Five-Year Plan period would witness the acceleration of China's urbanization. Different regions had different carrying capacity of natural resources and environment, and foundation and potential for future development. Given their unique conditions, they should optimize the urban layout, intensify the use of urban land and solve the problems of resource constraints, urban functions, and urban management in a sustainable way.

Governments should play a dominant role in channeling investment. They should invest more in green development and spend more on environmental protection and pollutants control. The eastern provinces, in particular, should match investment with their economic strength. Meanwhile, governments should carry out incentives to prompt social investment, and improve investment and operational efficiency. In addition, science and technology played a critical role in greener economic development. Therefore, governments should, through investing more in this regard and encouraging technological innovation, speed up optimizing the industrial structure and transforming the economic development pattern so as to ease the conflict between economic development and resources and environment.