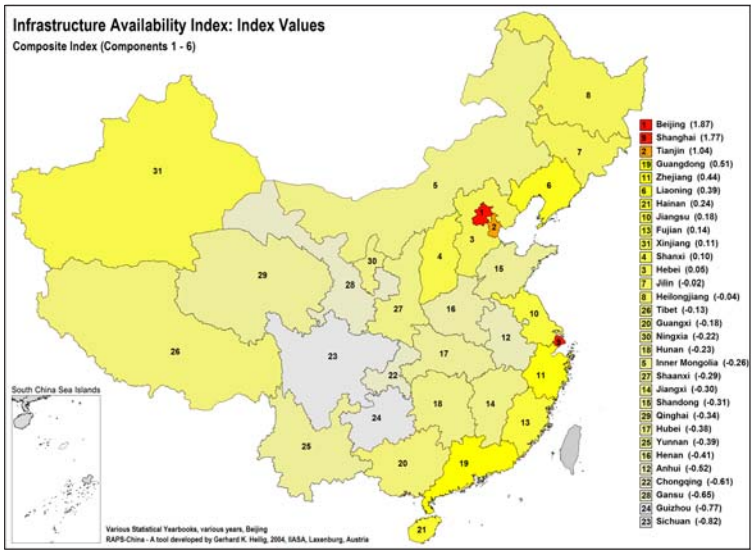
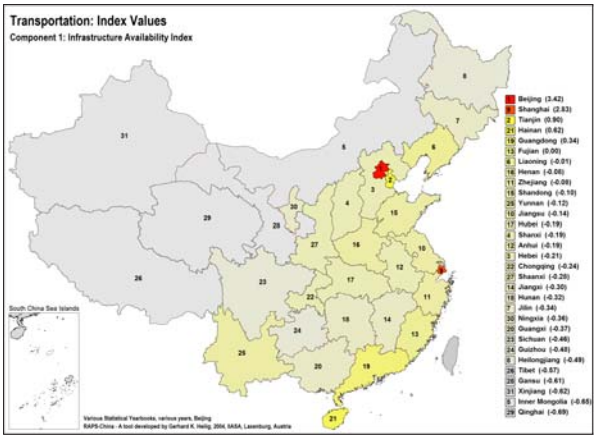
Infrastructure Availability Index

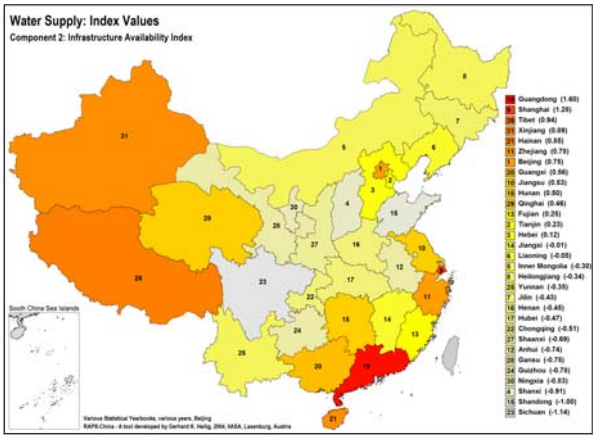
Components

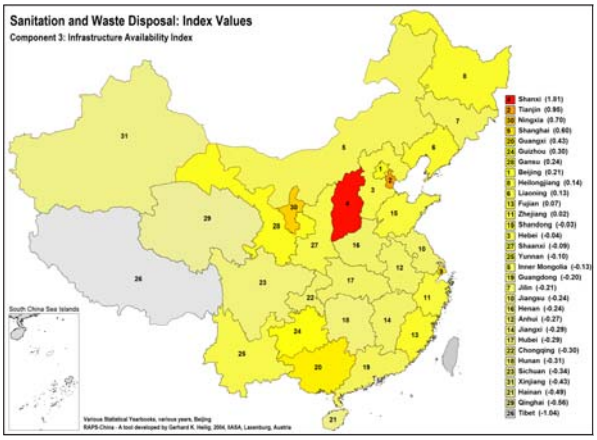
1. Transportation
2. Water Supply
3. Sanitation, Waste Disposal
4. Information, Telecommunication
5. Urban Energy
6. Public Health

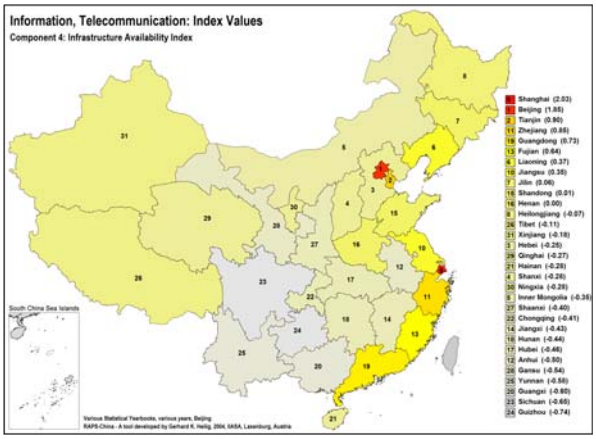
Notes:
More Red: Higher Index Values;
More Gray: Lower Index Values
Color Scales are not synchronized.

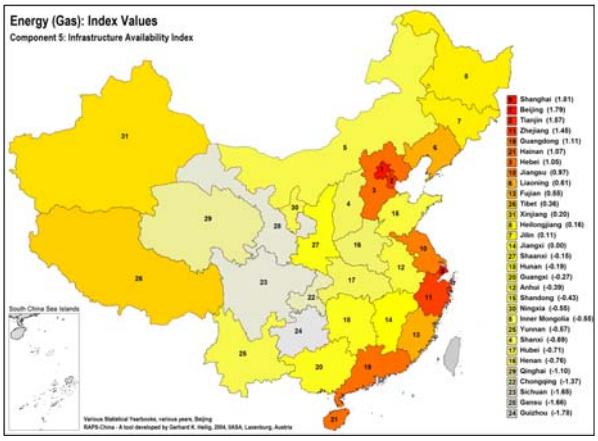


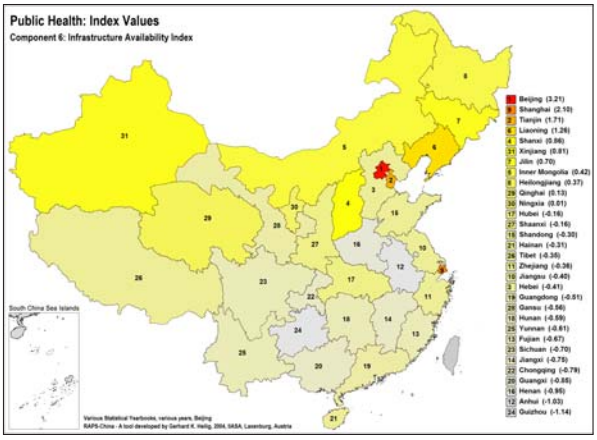












Infrastructure Availability Index (Revision 2)

	Transportation		Water Supply		Sanitation Waste Disposal		Information Tele-comunication		Energy		Public Health		Infrastructure Availability Index	
Provinces	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Beijing	3.422	**1**	0.750	**7**	0.212	**8**	1.848	**2**	1.787	**2**	3.210	**1**	1.872	**1**
Shanghai	2.825	**2**	1.275	**2**	0.599	**4**	2.031	**1**	1.811	**1**	2.100	**2**	1.774	**2**
Tianjin	0.895	**3**	0.234	**13**	0.949	**2**	0.903	**3**	1.568	**3**	1.711	**3**	1.043	**3**
Guangdong	0.338	**5**	1.598	**1**	-0.199	**18**	0.732	**5**	1.108	**5**	-0.510	**20**	0.511	**4**
Zhejiang	-0.081	**9**	0.781	**6**	0.024	**12**	0.849	**4**	1.454	**4**	-0.364	**17**	0.444	**5**
Liaoning	-0.012	**7**	-0.048	**16**	0.132	**10**	0.372	**7**	0.612	**9**	1.258	**4**	0.386	**6**
Hainan	0.615	**4**	0.850	**5**	-0.489	**29**	-0.278	**17**	1.065	**6**	-0.305	**15**	0.243	**7**
Jiangsu	-0.144	**12**	0.531	**9**	-0.240	**20**	0.347	**8**	0.968	**8**	-0.398	**18**	0.177	**8**
Fujian	-0.003	**6**	0.252	**12**	0.066	**11**	0.641	**6**	0.552	**10**	-0.666	**24**	0.140	**9**
Xinjiang	-0.621	**29**	0.888	**4**	-0.431	**28**	-0.179	**14**	0.204	**12**	0.814	**6**	0.112	**10**
Shanxi	-0.191	**14**	-0.909	**29**	1.806	**1**	-0.279	**18**	-0.686	**24**	0.861	**5**	0.100	**11**
Hebei	-0.211	**16**	0.124	**14**	-0.038	**14**	-0.245	**15**	1.049	**7**	-0.413	**19**	0.045	**12**
Jilin	-0.336	**21**	-0.427	**20**	-0.213	**19**	0.059	**9**	0.114	**14**	0.701	**7**	-0.017	**13**
Heilongjiang	-0.488	**26**	-0.340	**18**	0.141	**9**	-0.074	**12**	0.162	**13**	0.372	**9**	-0.038	**14**
Tibet	-0.566	**27**	0.935	**3**	-1.040	**31**	-0.113	**13**	0.359	**11**	-0.354	**16**	-0.130	**15**
Guangxi	-0.366	**23**	0.559	**8**	0.429	**5**	-0.599	**29**	-0.271	**18**	-0.852	**28**	-0.183	**16**
Ningxia	-0.357	**22**	-0.831	**28**	0.699	**3**	-0.283	**19**	-0.551	**21**	0.013	**11**	-0.219	**17**
Hunan	-0.324	**20**	0.497	**10**	-0.313	**26**	-0.436	**24**	-0.190	**17**	-0.586	**22**	-0.225	**18**
Inner Mongolia	-0.654	**30**	-0.302	**17**	-0.132	**17**	-0.348	**20**	-0.553	**22**	0.422	**8**	-0.261	**19**
Shaanxi	-0.277	**18**	-0.687	**24**	-0.085	**15**	-0.395	**21**	-0.151	**16**	-0.162	**13**	-0.293	**20**
Jiangxi	-0.298	**19**	-0.010	**15**	-0.287	**23**	-0.427	**23**	0.002	**15**	-0.749	**26**	-0.295	**21**
Shandong	-0.104	**10**	-0.997	**30**	-0.028	**13**	0.013	**10**	-0.432	**20**	-0.303	**14**	-0.309	**22**
Qinghai	-0.693	**31**	0.462	**11**	-0.557	**30**	-0.265	**16**	-1.099	**27**	0.130	**10**	-0.337	**23**
Hubei	-0.188	**13**	-0.471	**22**	-0.291	**24**	-0.457	**25**	-0.707	**25**	-0.161	**12**	-0.379	**24**
Yunnan	-0.117	**11**	-0.346	**19**	-0.100	**16**	-0.584	**28**	-0.567	**23**	-0.606	**23**	-0.387	**25**
Henan	-0.079	**8**	-0.445	**21**	-0.244	**21**	0.004	**11**	-0.761	**26**	-0.950	**29**	-0.413	**26**
Anhui	-0.193	**15**	-0.736	**25**	-0.272	**22**	-0.498	**26**	-0.394	**19**	-1.026	**30**	-0.520	**27**
Chongqing	-0.244	**17**	-0.513	**23**	-0.296	**25**	-0.412	**22**	-1.369	**28**	-0.793	**27**	-0.605	**28**
Gansu	-0.608	**28**	-0.751	**26**	0.237	**7**	-0.535	**27**	-1.655	**30**	-0.556	**21**	-0.645	**29**
Guizhou	-0.483	**25**	-0.778	**27**	0.297	**6**	-0.738	**31**	-1.777	**31**	-1.137	**31**	-0.769	**30**
Sichuan	-0.455	**24**	-1.144	**31**	-0.336	**27**	-0.652	**30**	-1.653	**29**	-0.701	**25**	-0.824	**31**

RAPS-China, 2004, IIASA (Prototype 0.9)

Interpretation

Infrastructure is the backbone of a country's economy. A modern society is *impossible* without appropriate transportation, without energy, without water supply and sanitation, without telecommunication, or without a public health infrastructure. In advanced societies we are often not aware of this infrastructure because it is so fundamental that we take it for granted. China, however, has still a huge deficit of vital infrastructure – particularly in interior regions. Our Infrastructure Index attempts to measure some of these infrastructure discrepancies between provinces.

Transportation is probably the most fundamental service in an advanced society. All spheres of life depend on sufficient transportation capacity. Consider, for instance, the food sector: The extended human food chain critically depends on transportation from producers to the food industries and from there to the (urban) consumers. In Europe, *food* transports make up one of the *largest* segments in the transportation sector. Obviously, transportation is also vital for the supply of industries and manufacturing plants and the distribution and (international) trade of industrial products. And finally, there is the transport of people. Without public and private transport facilities hundreds of millions would not be able to reach their workplace, visit friends and families or go on vacation. In advanced societies, particularly in Europe, there are widespread complaints about the negative aspects of the advanced transportation infrastructure – such as environmental degradation or increasing land-use. However, we often forget that it was the transportation infrastructure (railroads, roads) and the transportation facilities (steam engine, car, truck and airplane) which triggered and drove the industrial revolution on which we all depend.

As can be expected Beijing, Shanghai and Tianjin have top scores in our Transportation Index. Very good transportation infrastructure is also available in Heinan, Guangdong and Fujian. The poorest transportation infrastructure (according to our index) was calculated for the provinces of Qinghai, Inner Mongolia, Xinjiang, and Gansu.

A water supply infrastructure is essential for those sectors and regions, which cannot depend on the direct use of rainfall, river flows or groundwater. In particular these are farmers in arid regions, and industrial and urban consumers. Urban areas need water plants and distribution networks to provide everyone with safe drinking water. Our water supply index includes three measures: the percentage of urban people with access to tap water, and the urban and rural per capita water supply (which can be seen as a proxy of the underlying water infrastructure). On a per capita basis, the highest ranks in that component index were calculated for Guangdong and Shanghai. The 3rd highest rank goes to Tibet, which has very large water resources in relation to is small population. Rank 4 and 5 go to the provinces of Xinjiang and Hainan (again, we have to remember, that the index is *population*-based). The worst per capita water supply infrastructure in China, according to our Water Index, was calculated for Sichuan, Shandong, Shanxi and Ningxia.

We have already mentioned the vital role of proper water sanitation and waste disposal for public health and environmental protection. Our Sanitation and Waste Disposal Index has the highest ranks for Shanxi, Tianjin, Ningxia, and Shanghai. It is interesting, that in our Sanitation and Waste Disposal Index Beijing reaches only rank 8. In relation to its large population, the sanitation and / or waste disposal system is apparently insufficient. The lowest ranks in our Index of Sanitation and Waste Disposal were calculated for Tibet, Qinghai, Hainan, and Xinjiang.

A good information and telecommunication infrastructure is certainly essential for any modern society. In China, there is a big gap between Shanghai and Beijing on the one hand, and the rest of the country on the other hand. Only Tianjin, Zhejiang and Guangdong could reach moderately good scores in our Index. The "worst" telecommunication and information infrastructure (in relation to the population) was measured for the provinces of Guizhou, Sichuan, Guangxi, and Yunnan.

In our Energy component of the Infrastructure Availability Index we wanted to measure the regional

distribution of oil, gas, coal, and electricity infrastructure. Unfortunately, we could so far find only one indicator: the percentage of population with access to gas in cities. While this is important information, it does certainly not cover all the aspects of an energy infrastructure. However, for the moment, we have calculated the energy component based on these data (In a later revision of the RAPS tool we will include additional measures; at least for the consumption of electricity, which can be seen as an indicator of the electric infrastructure). Our "Energy" Index gave the highest scores to Shanghai, Beijing and Tianjin where most of the households are already connected to gas networks. Zhejiang, Guangdong and Hainan also had relatively high ranks in our "Energy" Index. The lowest ranks were calculated for the provinces of Guizhou, Gansu, Sichuan, and Chongqing, where gas networks in the cities are mostly unknown.

Finally, we have included a Public Health component in our Infrastructure Availability Index. This component should represent the regional availability of health facilities and trained personnel. Not surprisingly, Beijing and Shanghai reached top ranks in that index – followed by Tianjin, Liaoning, and Shanxi. The lowest scores for their public health infrastructure were calculated for the provinces of Guizhou, Anhui, Henan, and Guangxi.

The combination of these six components in our Infrastructure Availability Index shows the huge discrepancies between China's provinces. Beijing, Shanghai, Tianjin, Guangdong, and Zhejiang have much better infrastructure (in relation to their population) than all other provinces. The lowest scores in infrastructure availability were calculated for Sichuan, Guizhou, Gansu, Chongqing, and Anhui.

Problems

Our Infrastructure Availability Index should measure the actual availability of key infrastructure in the various regions of China. However, we are not fully satisfied with the results of our index. The biggest problem is the lack of information about China's energy infrastructure. Any suggestions and comments of how to improve this Index component are, of course, highly welcome.

5. Science & Technology Index

Science and technology are important factors of regional development. Regions with a high density of research facilities and high-tech companies will certainly have an advantage in economic and human development. Currently, many of the top research laboratories and development facilities are located in Beijing. However, in the future the government might want to decentralize some of these facilities to promote development in lagging regions.

Unfortunately, it is not easy to get detailed information about the *regional distribution* of China's top research and high-tech sector. The system of research and development in China is in a process of restructuring with overlapping activities between various Ministries, state agencies, universities, foundations (such as NSFC) and the Academy of Sciences. The Ministry of Science and Technology (MOST) has initiated various national programs to promote science and high-tech development, such as the 863 Program, the Torch Program, the Spark Program and the Mega Projects. However, we were not able to get detailed information about the geographical distribution of these programs. We have, therefore, tried to select indices that can at least *indirectly* measure, where in China the top research and development is located, such as the output of research papers and patents, or the per capita government expenditures in research and development. Our Science and Technology Development Index includes the following six components:

1. Research Output: Research Papers
2. Development Output: Patents
3. Research Staff
4. R&D Funding
5. High-tech Trade
6. Industrial High-tech

The first component of our R&D Index describes research output by the number of papers published in scientific and engineering journals (as listed in three major science publishing indices).

The second component attempts to measure technological development output. We have used statistics on the number of patent applications examined and granted (per 10,000 of the population).

In the third component we have included several indicators measuring the availability of research staff in the various regions of China. This includes, for instance, the number of scientists and engineers (per 10,000 of the population), the number of scientists and engineers in R&D, and the overall R&D personnel.

The fourth component measures R&D funding by the government with indicators such as the total expenditures on R&D of the central government per Yuan of GDP, and the R&D appropriation of local governments (as % of total local government expenditures).

The fifth component measures overall trade in high-tech commodities by province (such as electronics, computers, etc.). We assume that a large volume of imported or exported high-tech products in a certain province also indicates a higher level of research and technological development.

The sixth component includes indicators to measure industrial R&D trends by province. Currently, we have, for instance, included the number of high-tech industrial development zones from the "Torch Program". In the future, we hope to find more detailed statistics about R&D capacities in China's industry.

1. Research Output

R&D Papers Catalogued by SCI, ISTP and EI Per 10,000 Persons, 2000; Weight: 1

2. Patents

Number of Patent Applications Granted Per 10,000 persons, 2001; Weight: 1
Number of Patent Applications Examined per 10,000 persons, 2001; Weight: 1

3. Research Staff

R&D staff in enterprises per 10,000 inhabitants,1999 (persons); Weight: 1
Scientists and Engineers Per 10,000 Persons, 2001; Weight: 1
Scientists and Engineers in R&D Per 10,000 Persons, 2001; Weight: 1
Personnel of Scientific Activities Per 10,000 Persons, 2001; Weight: 1
Personnel in R&D Per 10,000 Persons, 2001; Weight: 1

4. R&D Funding

Per Capita Government Expenditures for Science and Technology Promotion, 2002 (Yuan/Person); Weight: 1
Total Expenditure for R&D Per Yuan GDP, 2001; Weight: 1
Local Government Science & Technology Appropriation as % of Total Local Govt. Expenditure, 2001; Weight: 1

5. High-tech Trade

Per Capita Export and Import of High-tech Products (High-tech Trade Volume), 2002 (U.S.$ / person); Weight: 1

6. Industrial High-tech

Number of National High-Tech Industry Development Zones, around 2000 (Torch Program); Weight: 1
Funding from Government on R&D in Enterprises per million Yuan of GDP, 1999 (mio. yuan); Weight: 1
Expenditure on R&D in enterprises per million Yuan of GDP, 1999 (mio. yuan); Weight: 1

Interpretation

Science, and in particular its application in the development of high-tech products, is certainly a key factor in the development of a competitive industry. From our six specialized indices, the Science and Technology Index is certainly the most explicit. It shows that most of the top research and development is concentrated in Beijing. Based on its population, Beijing has, by far, the greatest output in terms of scientific papers, the largest number of patents, the largest number of people employed in research and development, and the highest R&D funding. Only when it comes to high-tech industrial research, development and production, Guangdong and Shanghai are the leading regions (see table below). Let us have a detailed look at the six components of our Science and Technology Index:

The first component measures the number of scientific papers, where Beijing is, by far, the leading region. With a great gap in Index values, we also find Shanghai, Tianjin and Shaanxi in the higher ranks. Almost all other provinces have a very low ranking in our Index of scientific output.

The second component measures the number of requested and granted patents (in relation to population size). Beijing, Shanghai, Guangdong and Tianjin are again the leading provinces, followed by Zhejiang and Liaoning. All other Chinese provinces have very low scores in our Index of patent applications.

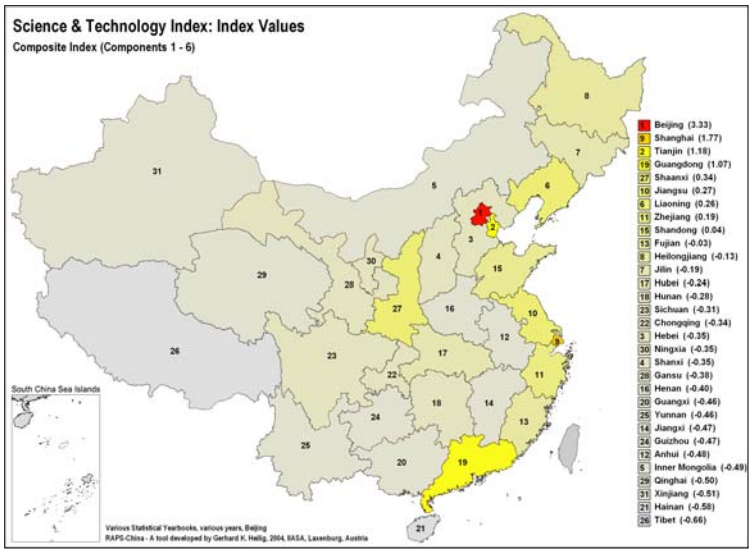
With the third component we measure the size of the research staff in relation to the population. As before, Beijing is by far leading all other provinces. Its score is almost twice as high as that of Shanghai – the second highest. Tianjin has the third largest research staff of all Chinese provinces (in

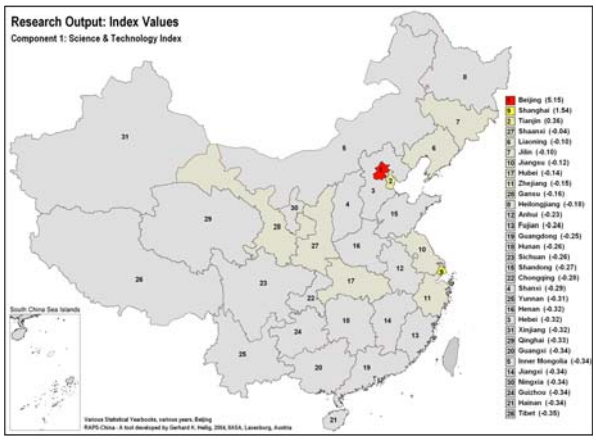
Science & Technology Index

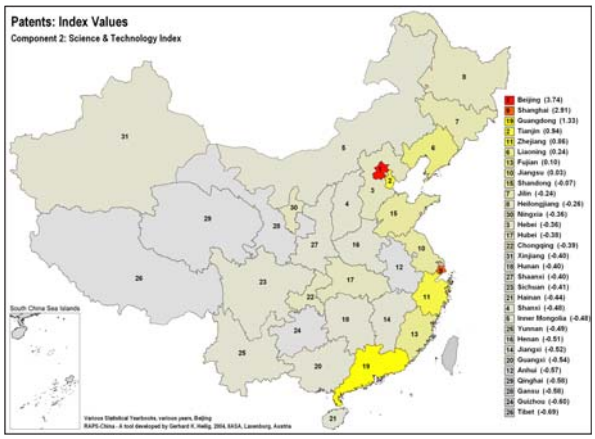
Components

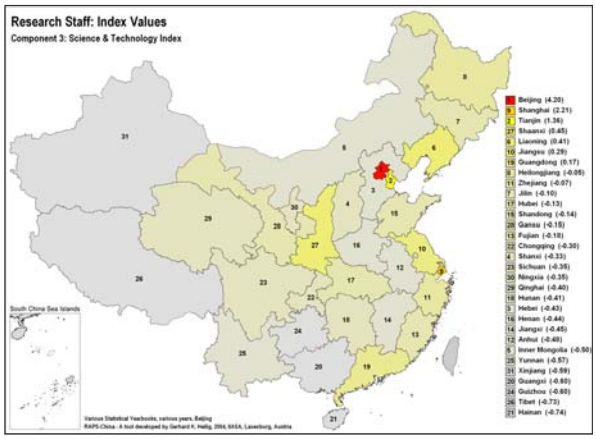
1. Research Papers
2. Patents
3. Research Staff
4. R&D Funding
5. High-tech Trade
6. Industrial High-tech Sector

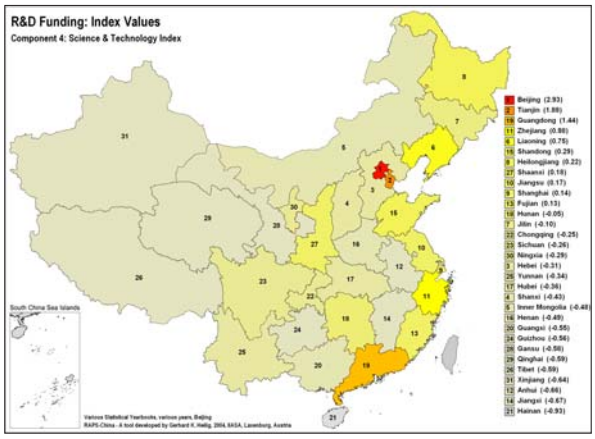
Notes:
More Red: Higher Index Values;
More Gray: Lower Index Values
Color Scales are not synchronized.

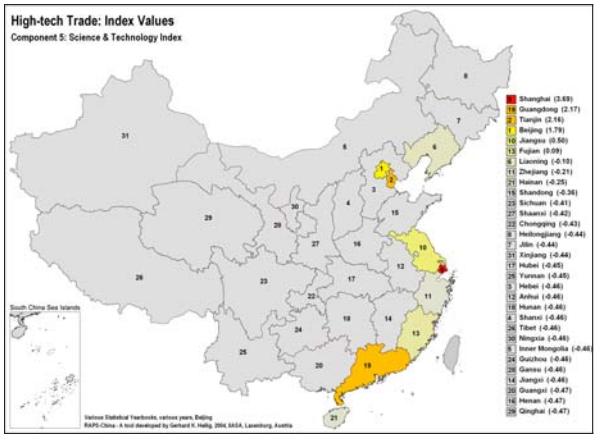


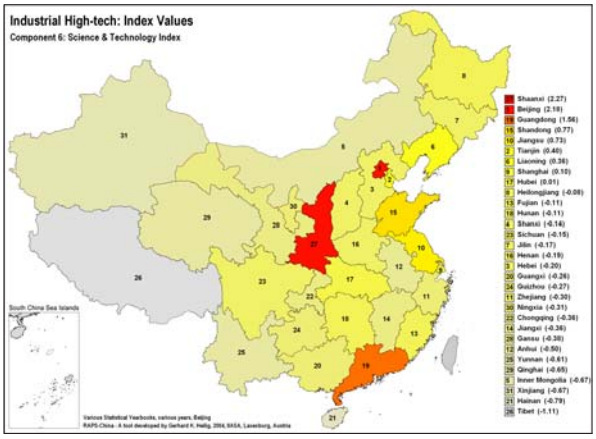












Science & Technology Index (Revision 1)

	Scientific Output (Research Papers)		Patents		Research Staff		R&D Funding		High-tech Trade		Industrial High-tech		Science & Technology Index	
Provinces	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Beijing	5.147	1	3.737	1	4.201	1	2.927	1	1.791	4	2.183	2	3.331	1
Shanghai	1.543	2	2.913	2	2.208	2	0.142	10	3.690	1	0.098	8	1.766	2
Tianjin	0.358	3	0.940	4	1.355	3	1.884	2	2.157	3	0.401	6	1.182	3
Guangdong	-0.251	14	1.325	3	0.173	7	1.442	3	2.172	2	1.560	3	1.070	4
Shaanxi	-0.039	4	-0.404	18	0.445	4	0.176	8	-0.418	12	2.270	1	0.338	5
Jiangsu	-0.120	7	0.025	8	0.294	6	0.167	9	0.502	5	0.732	5	0.267	6
Liaoning	-0.095	5	0.235	6	0.407	5	0.751	5	-0.095	7	0.358	7	0.260	7
Zhejiang	-0.147	9	0.858	5	-0.066	9	0.979	4	-0.209	8	-0.296	20	0.187	8
Shandong	-0.265	17	-0.065	9	-0.143	12	0.291	6	-0.362	10	0.771	4	0.038	9
Fujian	-0.242	13	0.096	7	-0.179	14	0.134	11	0.093	6	-0.110	11	-0.034	10
Heilongjiang	-0.177	11	-0.261	11	-0.052	8	0.218	7	-0.440	14	-0.081	10	-0.132	11
Jilin	-0.099	6	-0.235	10	-0.103	10	-0.101	13	-0.442	15	-0.171	15	-0.192	12
Hubei	-0.141	8	-0.383	14	-0.130	11	-0.363	19	-0.445	17	0.012	9	-0.242	13
Hunan	-0.257	15	-0.403	17	-0.413	20	-0.051	12	-0.459	21	-0.113	12	-0.283	14
Sichuan	-0.263	16	-0.408	19	-0.347	17	-0.256	15	-0.414	11	-0.145	14	-0.306	15
Chongqing	-0.283	18	-0.390	15	-0.301	15	-0.248	14	-0.434	13	-0.355	22	-0.335	16
Hebei	-0.318	22	-0.364	13	-0.425	21	-0.309	17	-0.458	19	-0.204	17	-0.346	17
Ningxia	-0.341	28	-0.360	12	-0.348	18	-0.288	16	-0.461	24	-0.314	21	-0.352	18
Shanxi	-0.287	19	-0.476	21	-0.331	16	-0.430	20	-0.459	22	-0.140	13	-0.354	19
Gansu	-0.163	10	-0.579	29	-0.147	13	-0.579	25	-0.463	27	-0.375	24	-0.384	20
Henan	-0.316	21	-0.507	24	-0.442	22	-0.485	22	-0.466	30	-0.192	16	-0.401	21
Guangxi	-0.337	25	-0.538	26	-0.595	28	-0.545	23	-0.465	29	-0.257	18	-0.456	22
Yunnan	-0.308	20	-0.487	23	-0.570	26	-0.344	18	-0.452	18	-0.608	26	-0.462	23
Jiangxi	-0.341	27	-0.523	25	-0.454	23	-0.666	30	-0.464	28	-0.361	23	-0.468	24
Guizhou	-0.342	29	-0.602	30	-0.595	29	-0.557	24	-0.463	26	-0.273	19	-0.472	25
Anhui	-0.226	12	-0.567	27	-0.480	24	-0.662	29	-0.458	20	-0.495	25	-0.482	26
Inner Mongolia	-0.339	26	-0.478	22	-0.501	25	-0.476	21	-0.462	25	-0.671	28	-0.488	27
Qinghai	-0.333	24	-0.575	28	-0.398	19	-0.590	26	-0.467	31	-0.651	27	-0.502	28
Xinjiang	-0.321	23	-0.402	16	-0.592	27	-0.644	28	-0.442	16	-0.674	29	-0.513	29
Hainan	-0.343	30	-0.435	20	-0.735	31	-0.929	31	-0.248	9	-0.790	30	-0.580	30
Tibet	-0.354	31	-0.686	31	-0.734	30	-0.590	27	-0.459	23	-1.110	31	-0.655	31

RAPS-China, 2004, IIASA (Prototype 0.9)

relation to the population). Then there is a big gap in the Index scores. Shaanxi, which has the 4th rank, has an index value which is only about *one tenth* of that of Beijing. All other provinces have a *very small* research staff in relation to their population.

In relation to R&D funding, our fourth Index component, the picture is somewhat different: While Beijing is again the province with the *highest* (per capita) R&D funding, and while Tianjin and Guangdong have the second and third highest funding, Shanghai is not among those provinces with a high R&D funding. In fact, Shanghai has "only" rank 10 among all Chinese provinces in terms of government spending for R&D. Obviously, much of the high-tech research and development in Shanghai is already financed by (private) companies – which corresponds to the fact that Shanghai has the first rank in high-tech trade.

In the high-tech *trade* component of our Science and Technology Index we use the high-tech trade volume (international import plus export) to measure the extent to which the industry is already involved in the high-tech sector. As mentioned above, Shanghai is the leading province, followed by Guangdong and Tianjin. Beijing has only rank 4. All other provinces have very little high-tech trade.

Finally, we have included a component that should measure the high-tech research and development in the industry (see list of variables above). Surprisingly, Shaanxi has the highest score for industrial high-tech research and development - followed by Beijing and Guangdong. Zhejiang only reaches rank 20 among all provinces in terms of industry-related research and development.

The combination of these six components in our Science & Technology Index yields a remarkably clear result: Beijing is clearly the research capital of China – no other province comes even close. Shanghai, Tianjin, Guangdong, Shaanxi, Jiangsu, and Liaoning also reached high ranks in our Research & Technology Index. All other provinces had very low index values.

From a regional development point of view, this *high concentration* of research capacity in China is not optimal. In relation to their population, all interior provinces have only *very small* (if not negligible) capacities of research and high-tech development.

Problem:

Of course, we are aware that many provincial capitals have important research universities and institutes. However, *in relation to their large population*, these provinces are by far not as well supplied with research and high-tech facilities as Beijing, Shanghai orTianjin (at least this is what we learn from the data available to us). We are considering the possibility to use the absolute numbers of research facilities, research staff and research funding, instead of population-based measures.

6. Index of Administrative Efficiency

Our Index of Administrative Efficiency is an attempt to measure the regional distribution of administrative "quality" in China. Obviously, it is not our task to make statements about China's political philosophy or political system. We only try to use official statistics for identifying specific administrative characteristics that promote or hinder regional development. Our Index includes the following components:

1. Potential Labor-related Conflicts
2. Political Representation
3. Personnel Efficiency
4. Financial Efficiency
5. Net Financial Transfers to Province
6. Government Consumption

The first aspect we try to measure is the potential of labor-related conflicts, which are certainly disruptive to the overall development of a particular region. An interesting indicator in that context is the number of laid-off workers in state-owned enterprises (measured in per 10,000 employed persons). Of course, not all lay-offs from the state-owned industry will result in conflicts, but a high number of lay-offs in relation to the overall workforce certainly indicate a potential for social problems.

The second aspect in our Index is the political representation. We have used the number of members in the 10th National People's Congress per million of the population to measure the political representation of each province. In addition, we have included a very interesting indicator, which we have complied from a research paper published by Cheng Li in the China Leadership Monitor, which is a research facility of the Hoover Institution and Stanford University, USA (see footnote 3). It measures the geographical background of the 29 new provincial leaders appointed since Hu Jintao became President of the PRC (March 2003) until the spring of 2004. The index is constructed in the following way: province of current position (3 points), province of past position (2 points), and province, in which the leader had some experience (1 point). In other words: this index measures the regional experience of newly appointed regional leaders in China.

The third aspect of our Index of Administrative Efficiency attempts to measure personnel efficiency. We use the percentage of persons employed in government agencies, party agencies and social organizations in relation to the overall labor force. We assume that an administration is more efficient, if this percentage is *smaller*. (Of course, this is a rather bold, if not problematic, assumption. If the percentage of people employed in administration and government agencies is getting *too* small, efficiency might actually decline. Due to the lack of a more appropriate indicator we tentatively use this assumption.)

In the fourth aspect we try to measure financial efficiency of the (regional) administration. We use the percentage of expenditures for government *administration* in relation to the total government expenditures.

For the fifth component we have calculated the *net* financial transfer to a particular province. We use the overall government revenues from a particular province (including various taxes) and the overall government expenditures. The net financial transfer is the total government expenditures (= money spent in the province) minus the revenues (= taxes taken from the province).

Finally, the sixth component measures the so-called (regional) "government consumption" in relation to the (regional) GDP.

Footnote 3: Cheng Li (2004): Hu's New Deal and the New Provincial Chiefs. In: China Leadership Monitor, No. 10 (Hoover Institution, Stanford University)

1. Potential Labor Conflicts

Numbers of Laid-off Workers in State-owned Enterprises, 2001 (Per 10,000 Employed Persons); Weight: -1

Urban Registered Unemployment Rate, 2002; Weight: -1

2. Political Representation

Number of Members in the 10th National People's Congress Per 1,000,000 Persons, 2003; Weight: 1

Geographic Background of 29 Newly Appointed Provincial Leaders (including deputies) between March 2003 and Spring 2004; Weight: 1

3. Personnel Efficiency

Employed Persons in Government Agencies, Party Agencies and Social Organizations as % of the Total Employed Persons, 2001; Weight: -1

4. Financial Efficiency

Expenditure for Government Administration as % of the total expenditure, 2001; Weight: -1

5. Net Financial Transfer

Per Capita Government Net-Financial Transfer, 2002 (Total Government Expenditures minus Total Government Revenues by Province); Weight: 1

6. Government Consumption

Rate of Government Consumption to GDP, 2001; Weight: -1

Interpretation

We know that our Index of Administrative Efficiency is not as consistent as we would like it to be. At least one or two of the Index components would require additional statistics to better measure the desired aspects. However, we have to work with those data we could find.

The first component should measure the potential for labor-related conflict. Provinces, where – according to our data – the conflict potential is *low*, have a *high* score in that index component. We use the registered unemployment rate (for cities) and the number of laid-off workers in the state-owned enterprises to measure the potential of labor-related conflict. According to these statistics, Beijing and Guangdong would have the *lowest* probability of labor related conflict (which seems to be plausible). A low potential for labor-related conflicts was also calculated for Henan, Hainan and Shandong. On the other hand, we calculated the *highest* probability of labor-related conflict for the provinces of Liaoning, Heilongjiang, Qinghai, Jilin, Hubei, and Xinjiang (see table and map above).

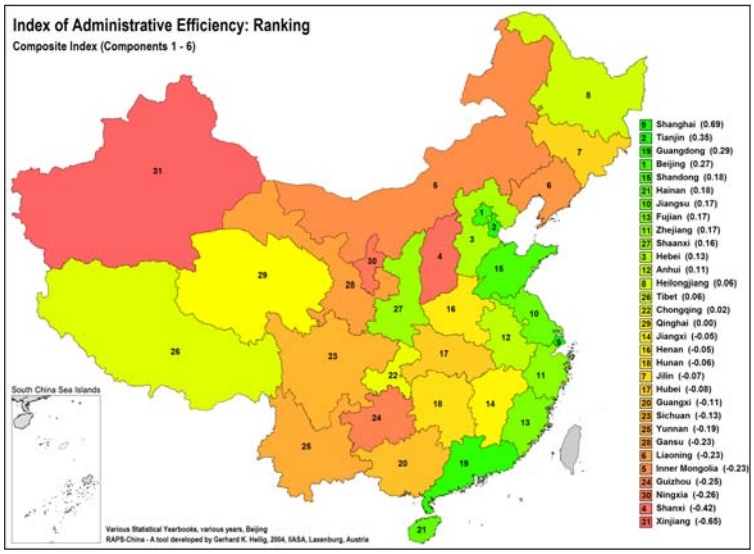
The next component of our Index of Administrative Efficiency is the extent of political representation. As described above, we use two measures to measure this component: the number of members in the 10th National Congress, and the geographical background of the 29 newly appointed provincial leaders. The index calculated from these two measures gives quite interesting results: The province with the *best* political representation is Tibet. In relation to its population, Tibet has the largest number of representatives at the 10th National Congress and three of the 29 newly appointed province leaders have previous experience with Tibet (one person is currently appointed to a leadership position in Tibet, the second leader was in Tibet during a previous appointment, and the third had some other kind

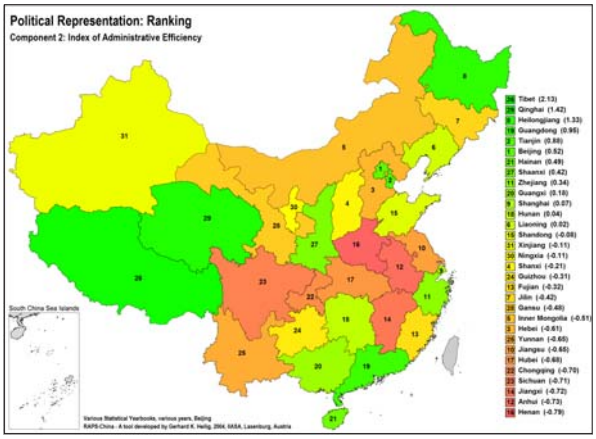
Index of Administrative Efficiency

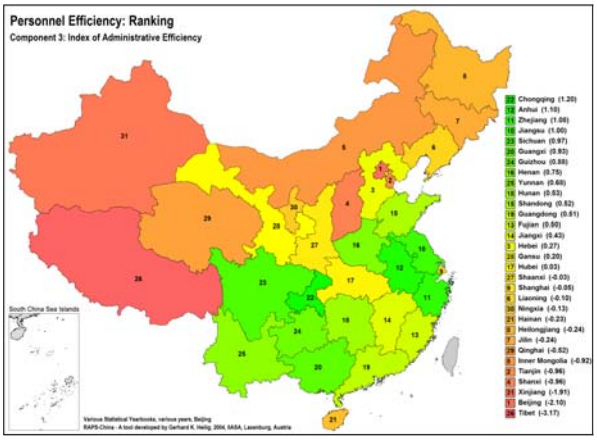
Components

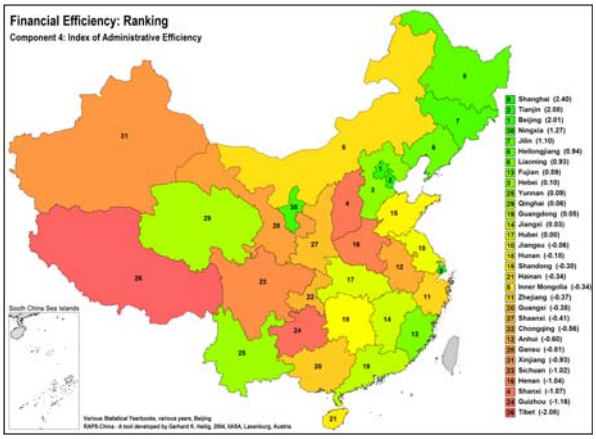
1. Potential Labor-related Conflicts
2. Political Representation
3. Personnel Efficiency
4. Financial Efficiency
5. Net Financial Transfer
6. Government Consumption

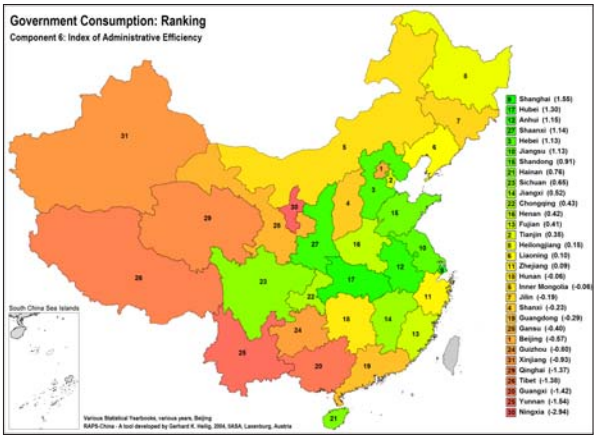
Notes:
More Green: Higher Index Values;
More Red: Lower Index Values
Color Scales are not synchronized.











Index of Administrative Efficiency (Revision 1)

	Potential Labor-related Conflict		Political Representation		Personnel Efficiency		Financial Efficiency		Net Financial Transfer		Government Consumption		Index of Administrative Efficiency	
Provinces	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**	**Value**	**Rank**
Shanghai	-0.007	**18**	0.067	**11**	-0.048	**19**	2.401	**1**	0.156	**6**	1.546	**1**	0.686	**1**
Tianjin	-0.414	**24**	0.877	**5**	-0.959	**27**	2.079	**2**	0.135	**7**	0.350	**14**	0.345	**2**
Guangdong	1.002	**2**	0.952	**4**	0.507	**12**	0.052	**12**	-0.495	**25**	-0.286	**22**	0.289	**3**
Beijing	1.944	**1**	0.518	**6**	-2.103	**30**	2.013	**3**	-0.184	**14**	-0.569	**24**	0.270	**4**
Shandong	0.701	**5**	-0.082	**14**	0.518	**11**	-0.299	**17**	-0.653	**31**	0.909	**7**	0.182	**5**
Hainan	0.716	**4**	0.486	**7**	-0.234	**22**	-0.336	**18**	-0.293	**16**	0.755	**8**	0.182	**6**
Jiangsu	0.262	**11**	-0.653	**25**	0.998	**4**	-0.059	**15**	-0.632	**30**	1.128	**6**	0.174	**7**
Fujian	0.394	**7**	-0.323	**19**	0.495	**13**	0.588	**8**	-0.552	**28**	0.405	**13**	0.168	**8**
Zhejiang	0.372	**9**	0.340	**9**	1.076	**3**	-0.371	**20**	-0.510	**27**	0.094	**17**	0.167	**9**
Shaanxi	-0.021	**19**	0.424	**8**	-0.025	**18**	-0.414	**22**	-0.148	**13**	1.138	**4**	0.159	**10**
Hebei	0.359	**10**	-0.605	**23**	0.267	**15**	0.100	**9**	-0.494	**24**	1.134	**5**	0.127	**11**
Anhui	0.251	**12**	-0.729	**30**	1.102	**2**	-0.603	**24**	-0.497	**26**	1.148	**3**	0.112	**12**
Heilongjiang	-1.762	**30**	1.325	**3**	-0.235	**23**	0.936	**6**	-0.035	**9**	0.151	**15**	0.063	**13**
Tibet	-0.063	**20**	2.131	**1**	-3.168	**31**	-2.079	**31**	4.930	**1**	-1.377	**28**	0.062	**14**
Chongqing	-0.004	**17**	-0.696	**27**	1.202	**1**	-0.560	**23**	-0.287	**15**	0.432	**11**	0.015	**15**
Qinghai	-0.816	**29**	1.416	**2**	-0.519	**25**	0.058	**11**	1.247	**2**	-1.370	**27**	0.003	**16**
Jiangxi	-0.145	**21**	-0.717	**29**	0.428	**14**	0.028	**13**	-0.411	**20**	0.517	**10**	-0.050	**17**
Henan	0.934	**3**	-0.787	**31**	0.746	**8**	-1.044	**28**	-0.568	**29**	0.418	**12**	-0.050	**18**
Hunan	-0.255	**23**	0.042	**12**	0.525	**10**	-0.176	**16**	-0.436	**22**	-0.055	**18**	-0.059	**19**
Jilin	-0.730	**28**	-0.415	**20**	-0.236	**24**	1.100	**5**	0.050	**8**	-0.188	**20**	-0.070	**20**
Hubei	-0.693	**27**	-0.681	**26**	0.028	**17**	-0.004	**14**	-0.445	**23**	1.300	**2**	-0.083	**21**
Guangxi	0.452	**6**	0.180	**10**	0.925	**6**	-0.383	**21**	-0.402	**19**	-1.423	**29**	-0.109	**22**
Sichuan	-0.245	**22**	-0.707	**28**	0.968	**5**	-1.016	**27**	-0.415	**21**	0.649	**9**	-0.128	**23**
Yunnan	0.393	**8**	-0.648	**24**	0.681	**9**	0.093	**10**	-0.093	**11**	-1.542	**30**	-0.186	**24**
Gansu	0.196	**15**	-0.476	**21**	0.201	**16**	-0.812	**25**	-0.064	**10**	-0.403	**23**	-0.226	**25**
Liaoning	-2.160	**31**	0.016	**13**	-0.104	**20**	0.931	**7**	-0.148	**12**	0.098	**16**	-0.228	**26**
Inner Mongolia	0.008	**16**	-0.510	**22**	-0.918	**26**	-0.340	**19**	0.441	**5**	-0.063	**19**	-0.230	**27**
Guizhou	0.202	**14**	-0.313	**18**	0.884	**7**	-1.155	**30**	-0.330	**18**	-0.800	**25**	-0.252	**28**
Ningxia	-0.546	**25**	-0.112	**16**	-0.129	**21**	1.268	**4**	0.877	**3**	-2.938	**31**	-0.263	**29**
Shanxi	0.243	**13**	-0.210	**17**	-0.964	**28**	-1.066	**29**	-0.313	**17**	-0.229	**21**	-0.423	**30**
Xinjiang	-0.569	**26**	-0.109	**15**	-1.908	**29**	-0.932	**26**	0.568	**4**	-0.930	**26**	-0.647	**31**

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of work experience in that province. Source: See Footnote 3). Qinghai, Heilongjiang, and Guangdong have also a good political representation, according to the measures in our index component. The *lowest* score in political representation was calculated for the provinces of Henan, Anhui, Jiangxi, Sichuan, and Chongqing.

A third component in our Index of Administrative Efficiency is what we call "personnel efficiency". This is measured by the percentage of people employed in government agencies, party agencies and social organizations in relation to the total labor force. We assume that a regional government and administration is more efficient, if this proportion is small. Based on this assumption we find that Chongqing, Anhui, and Zhejiang have the highest personnel efficiency, because only a very small proportion of the labor force works in government and party agencies and social organizations. On the other hand, Tibet, Beijing and Xinjiang have the highest proportion of government and party officials in their labor force. As China's political and administrative center, Beijing obviously needs a large proportion of government and party officials. In Tibet and Xinjiang, on the other hand, the high proportion is probably related to the government's intensified development efforts.

Financial efficiency is certainly an important component of administrative efficiency. We use the government expenditures *for administration* (as a percentage of the total expenditures) to measure financial efficiency – our fourth component of the Index of Administrative Efficiency. Based on this measure, Shanghai, Tianjin, Beijing and Ningxia used very little money for administration (as compared to the overall government expenditures). On the other hand, government expenditures in Tibet, Guizhou, Shanxi, Henan and Sichuan were used to a high percentage for the administration.

In the fifth component of our Index of Administrative Efficiency we try to measure the actual money flow from the central government to a particular province. We try to calculate a *net*-financial transfer, which is the balance between (tax) revenues and government expenditures in a particular province, based on the number of people of that province.

By far the highest net-transfer of government funds (on a per capita basis) is measured for the province of Tibet. On a per capita basis, they have a net-inflow of central government funds, which is more than four times larger than that of the next highest recipient: Qinghai. Above average net-inflow of government funds is also calculated for Ningxia and Xinjiang. The biggest "losers" in terms of financial transfers from the central government are the provinces of Shandong, Jiangsu, Henan, and Fujian. However, we should point out, that even these provinces have still a *positive* net-flow of funds: in other words, they receive *more* money from (central) government expenditures, than they have to submit in the form of taxes. They only get less (on a per capita basis) than other provinces.

Our final component in the Index of Administrative Efficiency is the so-called "government consumption", which measures the amount of public services provided by the government to the whole society and the net expenditure for the goods and services provided to households free of charge or at very low prices (based on the corresponding provincial GDP). Essentially this is what we could call state-subsidized goods and services (food, housing, etc.) - primarily for the urban population. We assume that provinces, where these state subsidies are still very high are less efficient than in those, where the subsidies are lower. In our index component Shanghai, Hubei, Anhui, and Shaanxi have high ranks – indicating the *lowest* government consumption. In the case of Shanghai this is probably due to the widespread introduction of market mechanisms (which replace goods and services provided by the government at subsidized prices). In the case of Hubei, Anhui and Shaanxi the government consumption is low, because these are predominantly agricultural provinces and farmers usually do not receive subsidized goods and services. The highest government consumption is measured in the provinces of Ningxia, Yunnan and Guangxi.

If we combine these six components to an Index of Administrative Efficiency, we find that the highest ranks are captured by the provinces of Shanghai, Tianjin, Guangdong and Beijing. According to our index these are the most efficiently administered regions. On the other hand, the lowest ranks in our

Index were calculated for the provinces of Xinjiang, Shanxi, Ningxia, Guizhou, and Inner Mongolia (see table and map above).

7. Regional Development Index

This Index combines all previous component indices and should give an overall view of China's regional development. In particular the Index includes the following specialized indices:

1. Human Development Index
2. Natural Resources Index
3. Economic Development Index
4. Infrastructure Availability Index
5. Science & Technology Index
6. Index of Administrative Efficiency

The definition of these specialized Indices was given above. We have only combined them (with equal weights) to build our overall Index of Regional Development. We simply used the (normalized) numerical results from the six specialized Indices. This second normalization is appropriate, because we wanted to give each component equal weight in our overall Regional Development Index (of course, it would be also possible to use the original, *not*-normalized values of the specialized Indices).

Interpretation

The overall results of our Regional Development Index can be seen in the two maps and the table below. The first map displays the Index values, where the colors *exactly* represent the values of the index. This is particularly suitable to display the actual diversity in China's regional development. Most provinces of China are, in fact, quite similar and reach values on our Index which are below average or close to the average. Only a small number of provinces in the East and North-east of China have above average values in our Regional Development Index. These provinces have Index values which are *significantly* above China's average. In other words, our Regional Development Index displays an *extremely skewed distribution*: Some provinces are *highly* developed, while all the rest are only average or below the average. These few highly developed provinces (or special administrative zones) include Shanghai, Beijing, Tianjin, and Guangdong.

The second map shows the Index values in the form of a ranking. Each rank has its own color – regardless of its underlying numerical value. This type of map display is particularly suitable to identify clusters of provinces. We believe that we can identify three types (or clusters) of provinces in China in regard to regional development (see table and map below):

1. The first group of 8 provinces is located on the coast of South, East and North-east China. They are the **most developed** in China. Typically, they have the highest ranking in the Economic Development Index, the Index of Administrative Efficiency, the Science and Technology Index, and the Infrastructure Availability Index. These Provinces include: Shanghai, Beijing, Tianjin, Guangdong, Zhejiang, Fujian, Jiangsu, and Liaoning.
2. The second group of 8 provinces is dispersed throughout China and very diverse. They have **average development** according to our Index, but apparently because of quite different reasons. This group includes Heilongjiang, Hunan, Jiangxi, Hainan, Jilin, Shaanxi, Shandong, and Hubei. While some of these provinces have rich natural resources, other components of development are underdeveloped. Please also note that our Regional Development Index gives *equal weight* to all component indices, which may lead to some unexpected results. Shandong, for instance, has ranks 5, 9 and 11 in the Index of Administrative Efficiency, the Index of Science & Technology, and the Index of Economic Development. However, in the combined "Regional Development Index" this province has only rank 15, which is simply the consequence of the province's rather limited natural resources (rank 25 in the Natural Resources Index). If we would give a higher weight to *economic* development, Shandong would reach a much higher Regional Development Index.

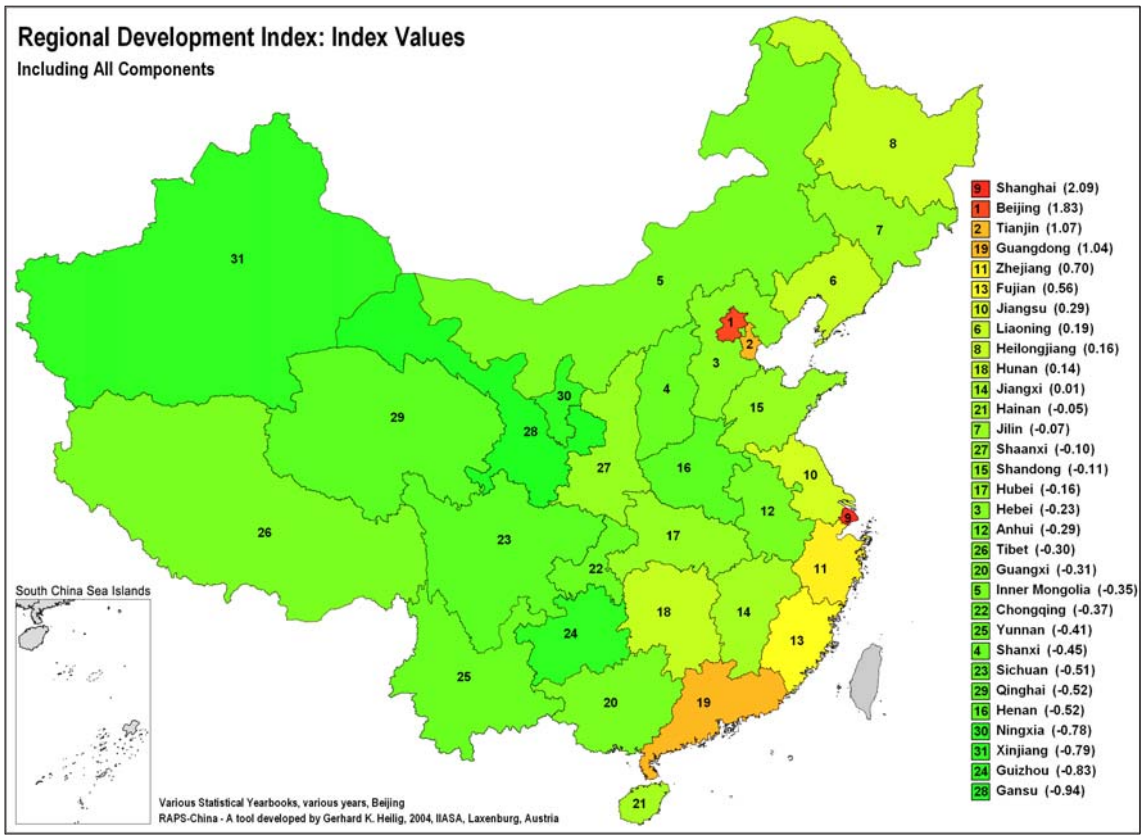
Regional Development Index (including all specialized indices, 1. Revision, May 12, 2004)

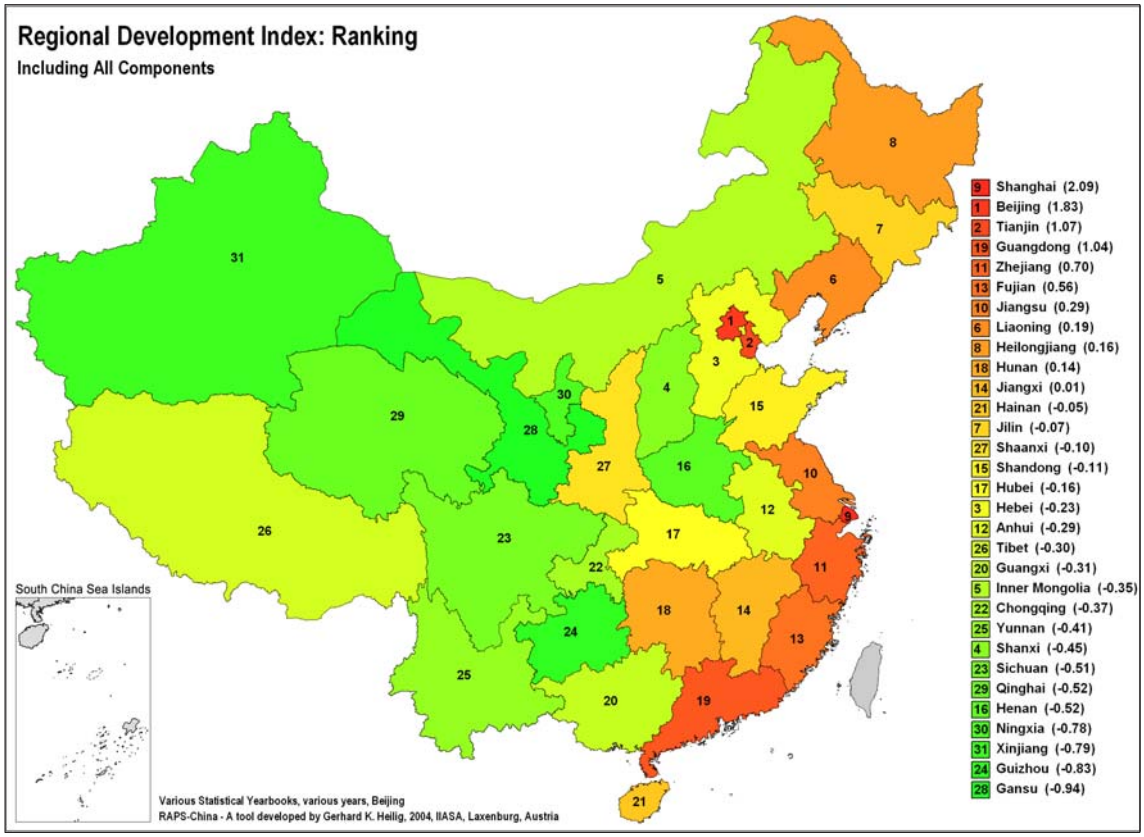
		Human Development Index		Natural Resources Index		Economic Development Index		Infrastructure Availability Index		Science & Technology Index		Index of Administrative Efficiency		Regional Development Index	
	Provinces	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
1. Group	Shanghai	2.888	2	-0.651	24	2.536	1	2.867	2	2.159	2	2.749	1	2.091	1
	Beijing	2.915	1	-1.998	31	1.873	3	3.026	1	4.073	1	1.082	4	1.828	2
	Tianjin	1.769	3	-1.125	28	1.262	5	1.686	3	1.445	3	1.383	2	1.070	3
	Guangdong	-0.070	13	0.677	8	2.311	2	0.826	4	1.308	4	1.158	3	1.035	4
	Zhejiang	-0.316	18	1.160	4	1.710	4	0.718	5	0.229	8	0.669	9	0.695	5
	Fujian	-0.313	17	1.659	3	1.177	6	0.226	9	-0.042	10	0.673	8	0.564	6
	Jiangsu	0.142	10	-0.477	20	0.739	7	0.286	8	0.326	6	0.697	7	0.286	7
	Liaoning	0.787	5	0.200	12	0.147	8	0.624	6	0.318	7	-0.914	26	0.194	8
2. Group	Heilongjiang	0.849	4	0.468	9	-0.374	16	-0.061	14	-0.161	11	0.252	13	0.162	9
	Hunan	-0.286	16	2.183	2	-0.103	13	-0.364	18	-0.346	14	-0.236	19	0.141	10
	Jiangxi	-0.470	22	2.329	1	-0.556	19	-0.477	21	-0.572	24	-0.200	18	0.009	11
	Hainan	0.208	8	-0.352	18	-0.576	23	0.393	7	-0.709	30	0.729	6	-0.051	12
	Jilin	0.628	6	-0.015	17	-0.459	17	-0.027	13	-0.235	12	-0.281	20	-0.065	13
	Shaanxi	-0.130	14	-0.545	22	-0.494	18	-0.473	20	0.413	5	0.637	10	-0.099	14
	Shandong	-0.190	15	-0.751	25	0.025	11	-0.499	22	0.046	9	0.729	5	-0.107	15
	Hubei	0.198	9	0.125	13	-0.021	12	-0.612	24	-0.296	13	-0.333	21	-0.157	16
3. Group	Hebei	-0.375	21	-1.178	29	0.027	10	0.073	12	-0.423	17	0.509	11	-0.228	17
	Anhui	-0.637	27	0.430	11	-0.567	20	-0.840	27	-0.589	26	0.449	12	-0.292	18
	Tibet	-1.792	31	0.733	7	0.035	9	-0.210	15	-0.801	31	0.248	14	-0.298	19
	Guangxi	-0.590	25	0.733	6	-0.725	26	-0.296	16	-0.558	22	-0.437	22	-0.312	20
	Inner Mongolia	0.328	7	0.091	14	-0.569	21	-0.422	19	-0.597	27	-0.922	27	-0.348	21
	Chongqing	-0.374	20	0.091	15	-0.592	24	-0.978	28	-0.410	16	0.060	15	-0.367	22
	Yunnan	-1.020	29	0.848	5	-0.338	15	-0.625	25	-0.565	23	-0.745	24	-0.408	23
	Shanxi	-0.031	11	-0.586	23	-0.120	14	0.162	11	-0.433	19	-1.695	30	-0.451	24
	Sichuan	-0.558	24	0.468	10	-0.769	28	-1.332	31	-0.374	15	-0.513	23	-0.513	25
	Qinghai	-0.332	19	-0.873	26	-0.737	27	-0.545	23	-0.614	28	0.012	16	-0.515	26
	Henan	-0.604	26	-0.530	21	-0.610	25	-0.667	26	-0.490	21	-0.200	17	-0.517	27
	Ningxia	-0.519	23	-1.727	30	-0.574	22	-0.354	17	-0.430	18	-1.054	29	-0.776	28
	Xinjiang	-0.032	12	-0.455	19	-1.239	30	0.181	10	-0.627	29	-2.593	31	-0.794	29
	Guizhou	-1.169	30	0.022	16	-1.026	29	-1.243	30	-0.577	25	-1.010	28	-0.834	30
	Gansu	-0.904	28	-0.951	27	-1.391	31	-1.042	29	-0.470	20	-0.906	25	-0.944	31

RAPS-China, 2004, IIASA (Prototype 0.9)

Regional Development Index

Components: 1. Human Development Index; 2. Natural Resources Index; 3. Economic Development Index; 4. Infrastructure Availability Index; 5. Science & Technology Index; 6. Index of Administrative Efficiency





3. The third group forms a geographical cluster of **least developed** provinces, reaching from the South of China to the North-west - but including also some interior provinces in central China. These include the provinces of Gansu, Guizhou, Xinjiang, Ningxia, Henan, Quinghai, Sichuan, Shanxi, and Yunnan; as well as the provinces of Chongqing, Inner Mongolia, Guangxi, Tibet, Anhui, and Hebei. Of course, these provinces are quite *different* in their specific development handicaps. But most of them have reached only below average values in our Economic Development Index; and some of them have also low values in our Human Development Index, our Infrastructure Availability Index, our Index of Administrative Efficiency, and our Science & Technology Index. Some readers may be surprised that Tibet has reached a relatively high rank (19) in the *upper range* of the least developed provinces. This is due to the fact that the province has a relatively high score (7) in our Natural Resources Index - primarily due to high values in the environment and water component of that index. Moreover, Tibet has a rather high score in our economic development index (9), which is the consequence of the high *annual* GDP growth rate for 2002, reported in the 2003 China Statistical Yearbook. We have already mentioned that we suspect that this rate is significantly overestimated. However, as long as it is *officially* reported, we will use it in our Index (except we find a solid scientific adjustment of this GDP growth rate).

In reviewing these results it is important to understand that the ranking of the provinces can easily change according to minor modifications in the various measurements of the index components. Therefore, it is essential to identify the most appropriate measures, which is a process of successive refinement. During the next few months we will fineadjust the various index components based on feedback from colleagues and collaborators.

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