Series report of national innovation survey

National Innovation Index Report 2024

Chinese Academy of Science and Technology for Development

科学技术文献出版社
SCIENTIFIC AND TECHNICAL DOCUMENTATION PRESS

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National Innovation Index Report 2024

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Foreword

Innovation is the primary driving force for development. At present, a new round of scientific and technological revolution and industrial transformation is gathering momentum, and the world is undergoing accelerated changes unseen in a century. The global economy is entering a complex and challenging recovery period, and the restructuring of industrial and supply chains is advancing. Under such circumstances, science, technology and innovation (STI) has become a strategic choice for countries around the world in pursuing development. China places innovation at the center of its national development agenda and vigorously implements an innovation-driven development strategy. In 2006, the Chinese government formulated and implemented the *Outline of the National Program for Medium-and Long-Term Scientific and Technological Development (2006–2020)*, which set the goal of establishing China as an innovative country by 2020. In 2022, the 20th National Congress of the CPC officially declared that China had become an innovative country, setting forth the strategic goal of reaching the forefront of innovative countries and becoming a world leader in science and technology by 2035.

In order to comprehensively monitor and evaluate the development of the country's innovation capacity, Chinese Academy of Science and Technology for Development (CASTED) has been releasing the *National Innovation Index Report* annually since 2011. The report draws on theories and methods related to national competitiveness and innovation evaluation, and constructs a matrix of indicators from five dimensions, i.e. innovation resources, knowledge creation, enterprise innovation, innovation performance, and innovation environment. It provides a comprehensive analysis of 40 countries that together contribute over 95% of global R&D expenditure. The National Innovation Index is measured using an internationally-recognized benchmarking method. The data presented in the report all come from databases and publications from international organizations and national statistical institutions, which ensures their international comparability and authority.

The *National Innovation Index Report 2024* is the 13th issue of this report series, with the statistical survey data of 2022 as the basis for evaluation research. Unless otherwise specified, the indicator values are all based on the 2022 data, and China's data currently exclude data from Hong Kong, Macao and Taiwan regions.

Compared with previous reports, the current edition features an improved set of indicators across five key dimensions. In terms of innovation resources, new indicators have been added to reflect national research institutions and STEM talent. Regarding the dimension of knowledge creation, indicators related to scientific papers and patents have been optimized. Concerning the enterprise innovation, indicators that measure the innovation capability and vitality of leading enterprises have been incorporated. For the innovation performance, a comprehensive evaluation of the country's industrial innovation and production efficiency has been conducted. In the area of innovation environment, a comprehensive assessment of the national policy environment, market mechanisms and innovation ecosystems has been carried out, with revised indicators reflecting an open and innovative S&T environment.

It must be noted that since the number of basic indicators has increased from 30 to 38 this year, direct comparison of the National Innovation Index rankings between current and previous years is not recommended. Unless otherwise specified, the analysis of "higher (lower) ranking compared to the previous year" in the report is all based on the comparison with the results of the previous year under the new indicator matrix.

To monitor and assess the changes in a country's innovation capacity and identify the STI gap between countries through comparative analysis is a challenging task that requires continuous exploration and in-depth research efforts. We will dynamically improve our indicator system to keep pace with the evolving landscape of innovation development, and expand the scope to more countries. We sincerely hope that through the annual series of the *National Innovation Index Report*, we can provide a window for all sectors at home and abroad to understand the development of China's scientific and technological innovation.

Editorial Committee of
National Innovation Index Report 2024

Contents

1 Rankings

Overall ranking on National Innovation Index

Ranking on innovation resources

Ranking on knowledge creation

Ranking on enterprise innovation

Ranking on innovation performance

Ranking on innovation environment

Overall ranking on National Innovation Index

Ranking	Country	Score
1	United States(US)	100.0
2	Switzerland	87.2
3	Republic of Korea(ROK)	78.1
4	Sweden	77.3
5	Denmark	76.9
6	Japan	74.2
7	United Kingdom(UK)	74.1
8	Netherlands	73.9
9	Germany	72.5
10	China	70.1
11	France	69.5
12	Finland	69.4
13	Singapore	69.2
14	Israel	69.1
15	Norway	68.0
16	Ireland	68.0
17	Australia	67.6
18	Belgium	65.7
19	Austria	65.0
20	Iceland	63.3
21	Canada	62.8
22	Hungary	56.3
23	Italy	56.2
24	Luxembourg	55.9
25	Spain	55.8
26	New Zealand	55.7
27	Czech Republic	55.2
28	Greece	52.9
29	Portugal	51.0
30	Poland	49.5
31	Slovenia	48.8
32	Türkiye	45.3
33	Romania	45.3
34	India	42.7
35	Slovakia	41.9
36	Mexico	41.0
37	Argentina	40.8
38	South Africa	39.6
39	Russia	39.2
40	Brazil	34.8

Ranking on innovation resources

Ranking	Country	Score
1	United States	100.0
2	Republic of Korea	63.3
3	Germany	57.1
4	United Kingdom	54.2
5	China	51.8
6	Finland	51.2
7	Switzerland	50.9
8	Sweden	50.9
9	Japan	50.1
10	Austria	49.7
11	Denmark	49.4
12	France	49.4
13	Netherlands	49.0
14	Israel	48.5
15	Greece	46.5
16	Australia	46.0
17	Belgium	45.2
18	Canada	45.2
19	Singapore	43.9
20	Norway	42.3
21	Spain	41.9
22	Iceland	39.5
23	Italy	39.2
24	Czech Republic	38.3
25	Ireland	38.3
26	Portugal	37.2
27	Slovenia	37.2
28	New Zealand	37.1
29	Russia	36.7
30	Poland	33.7
31	Türkiye	33.1
32	Argentina	30.8
33	Luxembourg	30.3
34	Hungary	28.4
35	Slovakia	25.8
36	Mexico	21.8
37	Brazil	21.6
38	India	20.5
39	Romania	19.7
40	South Africa	19.6

Note: Countries are sorted by score. The ranking of countries with the same score is based on the difference between one decimal place and two decimal places. The same below.

Ranking on knowledge creation

Ranking	Country	Score
1	Denmark	100.0
2	Switzerland	99.3
3	United States	98.6
4	Republic of Korea	95.2
5	Netherlands	85.2
6	Sweden	84.2
7	China	83.9
8	Iceland	82.7
9	Finland	82.2
10	United Kingdom	81.4
11	Canada	81.1
12	Singapore	80.5
13	Germany	80.5
14	Greece	80.1
15	Austria	80.0
16	New Zealand	79.7
17	France	78.9
18	Australia	78.4
19	Italy	77.3
20	Japan	76.8
21	Hungary	76.5
22	Romania	73.9
23	Israel	72.9
24	Belgium	72.8
25	Spain	72.2
26	Luxembourg	71.7
27	Norway	69.4
28	Portugal	69.3
29	Türkiye	68.5
30	South Africa	67.6
31	Ireland	66.7
32	Czech Republic	64.8
33	Slovenia	61.9
34	Argentina	59.8
35	Poland	58.7
36	India	58.4
37	Mexico	51.0
38	Slovakia	46.5
39	Russia	45.1
40	Brazil	36.9

Ranking on enterprise innovation

Ranking	Country	Score
1	United States	100.0
2	Japan	86.6
3	Switzerland	55.9
4	Netherlands	51.9
5	United Kingdom	50.5
6	Sweden	49.2
7	Republic of Korea	47.8
8	Germany	47.0
9	China	46.1
10	Israel	46.0
11	Luxembourg	43.8
12	Australia	42.3
13	Iceland	41.4
14	France	40.3
15	Finland	39.6
16	Denmark	39.5
17	Poland	38.9
18	Canada	38.9
19	New Zealand	37.4
20	Singapore	36.8
21	Belgium	35.4
22	Ireland	34.3
23	Hungary	31.0
24	Austria	30.2
25	Norway	28.4
26	Italy	27.3
27	Portugal	27.1
28	Slovenia	24.9
29	Spain	23.9
30	Türkiye	23.3
31	Czech Republic	22.3
32	South Africa	21.4
33	Romania	19.6
34	Greece	17.3
35	Brazil	17.1
36	India	16.8
37	Slovakia	15.1
38	Mexico	14.6
39	Argentina	14.5
40	Russia	11.8

Ranking on innovation performance

Ranking	Country	Score
1	Switzerland	100.0
2	Ireland	87.4
3	Singapore	84.8
4	Norway	84.8
5	Sweden	79.9
6	Denmark	70.9
7	United Kingdom	69.4
8	France	67.9
9	Israel	66.9
10	Belgium	65.9
11	Republic of Korea	65.8
12	Netherlands	65.6
13	Germany	64.2
14	United States	62.8
15	Australia	62.4
16	Czech Republic	59.0
17	Austria	58.1
18	Hungary	56.1
19	Iceland	56.0
20	Japan	55.0
21	Finland	52.0
22	China	49.8
23	Spain	48.2
24	Italy	47.4
25	Canada	45.9
26	Mexico	45.5
27	Slovakia	44.6
28	Romania	41.7
29	New Zealand	40.3
30	Luxembourg	40.2
31	India	38.4
32	Poland	36.9
33	Greece	36.8
34	Slovenia	35.2
35	Portugal	32.9
36	Russia	30.9
37	Brazil	29.7
38	Argentina	29.1
39	Türkiye	27.7
40	South Africa	23.7

Ranking on innovation environment

Ranking	Country	Score
1	Singapore	100.0
2	Denmark	91.4
3	Finland	89.5
4	Netherlands	85.2
5	Sweden	83.3
6	Switzerland	82.8
7	United States	81.4
8	Canada	78.6
9	Norway	78.6
10	Australia	77.9
11	Belgium	77.9
12	Republic of Korea	77.8
13	Luxembourg	77.2
14	United Kingdom	77.1
15	Israel	77.0
16	Germany	76.8
17	Ireland	76.6
18	France	76.3
19	Austria	76.2
20	China	73.6
21	Portugal	72.1
22	Iceland	69.4
23	Japan	68.2
24	Spain	67.9
25	India	67.8
26	Hungary	67.0
27	Slovenia	66.5
28	Italy	65.6
29	Czech Republic	63.3
30	New Zealand	61.6
31	Slovakia	60.7
32	Poland	60.2
33	Greece	59.4
34	Türkiye	58.7
35	Brazil	58.3
36	South Africa	57.8
37	Romania	56.3
38	Mexico	55.5
39	Argentina	54.6
40	Russia	53.8

2

Overview of Global Innovation Landscape

Leading countries hold significant strengths in science, technology and innovation(STI)

Asia, America and Europe remain the three pillars on the global innovation landscape

Innovation development is closely related to economic strength and national will

The eastward shift of the global STI center is increasingly evident

China continues to move up its position on the global innovation landscape

I. Leading countries hold significant strengths in science, technology and innovation (STI)

The National Innovation Index (NII) is a comprehensive index measuring a country's STI capacity. Based on the comparison of the results of previous editions of the *National Innovation Index Report*, we can divide the 40 countries into three groups. The top 15 countries in the overall ranking, which mainly consist of developed economies in Europe, America and Asia, make up the first group. They are all well-recognized innovative countries with strong comprehensive influence on the global innovation landscape. Countries ranked between the 16th and the 30th, which mainly consist of other developed countries and a few emerging economies, make up the second group. Countries in this group all have distinctive features of innovation development. Most of the countries ranking below the 30th are developing countries, which together make up the third group.

On the whole, the current global innovation landscape remains clearly structured, with relative stability in the rankings of leading countries. Countries in the first group include: one in North America (the US, No.1); five in Asia (the ROK, No.3; Japan, No.6; China, No.10; Singapore, No.13, and Israel, No.14); and nine in Europe (Switzerland, Sweden, Denmark, the UK, the Netherlands, Germany, France, Finland and Norway). Among them, Switzerland, Sweden, and Denmark are in the world's top five, ranking second, fourth, and fifth respectively. The UK, the Netherlands, and Germany rank seventh to ninth respectively, while France, Finland, and Norway rank 11th, 12th, and 15th respectively. The second group of countries is also mainly composed of European nations. Among the 15 countries, 12 are from Europe, with Ireland, Belgium, and Austria ranking 16th, 18th, and 19th respectively. The other three countries in the second group are Australia, Canada, and New Zealand, with overall rankings of 17th, 21st, and 26th respectively. In the third group, Slovenia, Türkiye, and Romania rank 31st to 33rd respectively. India, South Africa, and Russia rank 34th, 38th, and 39th respectively. In Latin America, Mexico, Argentina, and Brazil rank 36th, 37th, and 40th respectively (Figure 2-1).

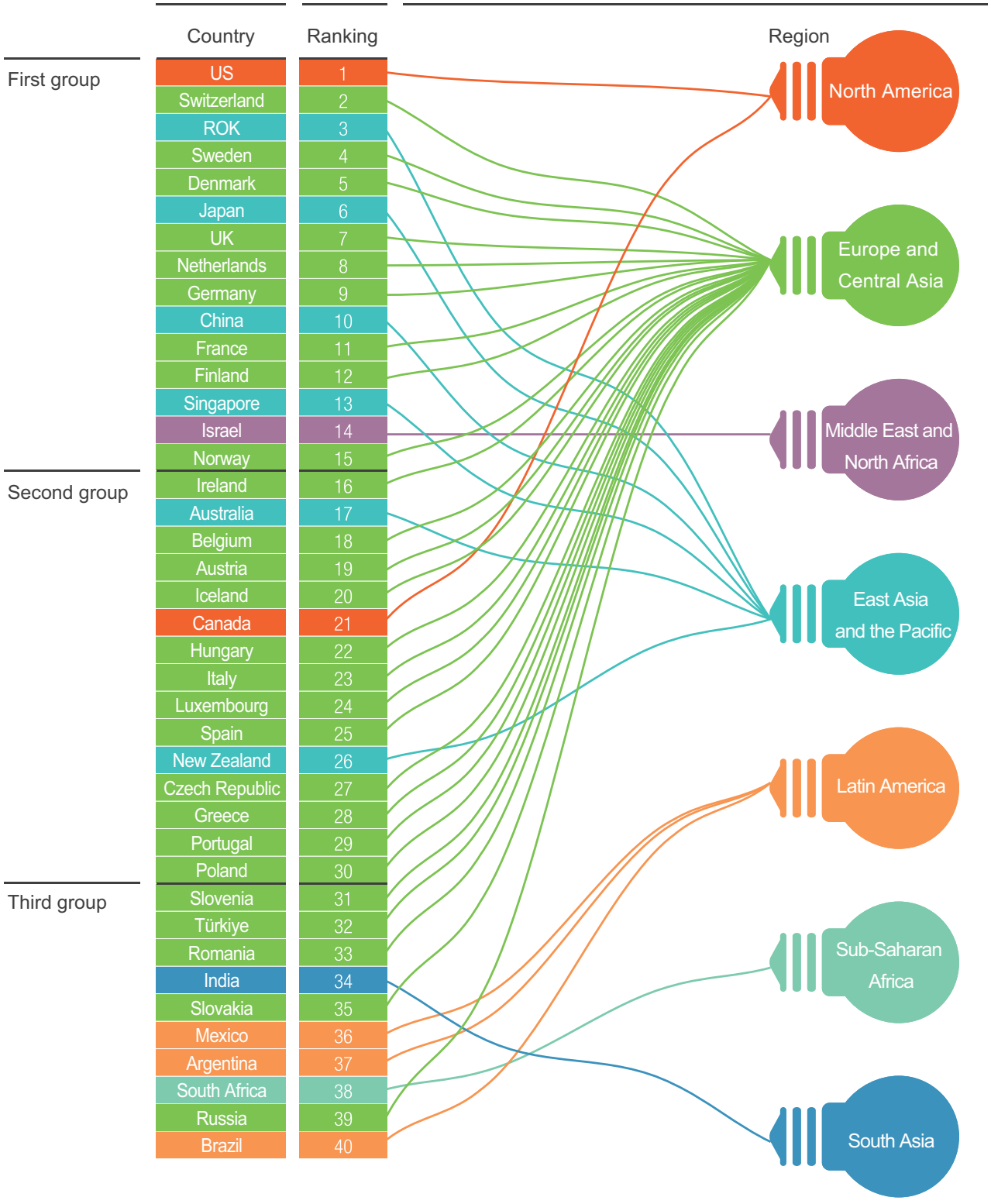


Figure 2-1 Global rankings of countries on National Innovation Index by three groups

Note: The continental division of countries is based on the World Bank criteria.

Compared globally, the innovation gap among countries remains significant, with the majority of R&D activities and innovation outputs concentrated in the first group of countries. By calculating the population, R&D expenditure, and GDP shares of each country globally, we can see that: The first group of countries, though representing only 27.8% of the global population, contributes 84.5% of the global R&D expenditure and 63.4% of the global GDP. The second group of countries represents 3.5% of the global population, 7.6% of the global R&D expenditure, and 10.8% of the global GDP. The third group of countries accounts for 26.7% of the global population but only 3.1% of the global R&D expenditure and 11.3% of the global GDP (Figure 2-2).

01 First-group countries

R&D/USD100 million	Population/ 10,000 persons	GDP/USD100 million	Share of global R&D expenditure	Share of global population	Share of global GDP
20,196	221,003	642,241	84.5%	27.8%	63.4%

02 Second-group countries

R&D/USD100 million	Population/ 10,000 persons	GDP/USD100 million	Share of global R&D expenditure	Share of global population	Share of global GDP
1823	28,164	109,141	7.6%	3.5%	10.8%

03 Third-group countries

R&D/USD100 million	Population/ 10,000 persons	GDP/USD100 million	Share of global R&D expenditure	Share of global population	Share of global GDP
751	212,193	114,528	3.1%	26.7%	11.3%

Figure 2-2 Position of three country-groups on the global innovation landscape in terms of major indicators

Over the years, the first group of countries has shown a significant advantage in comprehensive STI capabilities, with relatively stable innovation index rankings since 2012. Among the 15 countries, only China has seen a substantial change in its overall ranking, jumping from the 20th place in 2012 to the 10th place in 2024. The rankings of the remaining 14 countries have exhibited stability with only minor fluctuations (Figure 2-3). The US, which ranked second in 2012, has held the top position since 2013. Switzerland has consistently remained in the top three, ranking second in 2024. The UK, Germany, France,

Sweden, Denmark, the Netherlands, Finland, and Norway have also kept their overall rankings between fourth and the 15th place. The ROK and Japan, as the two leading countries in East Asia, have consistently remained at the global forefront of innovation capabilities, with their rankings fluctuating within three positions over the past decade, ranking third and sixth respectively in 2024. It is evident that the first group of countries has long held an advantageous leading position in global STI activities.

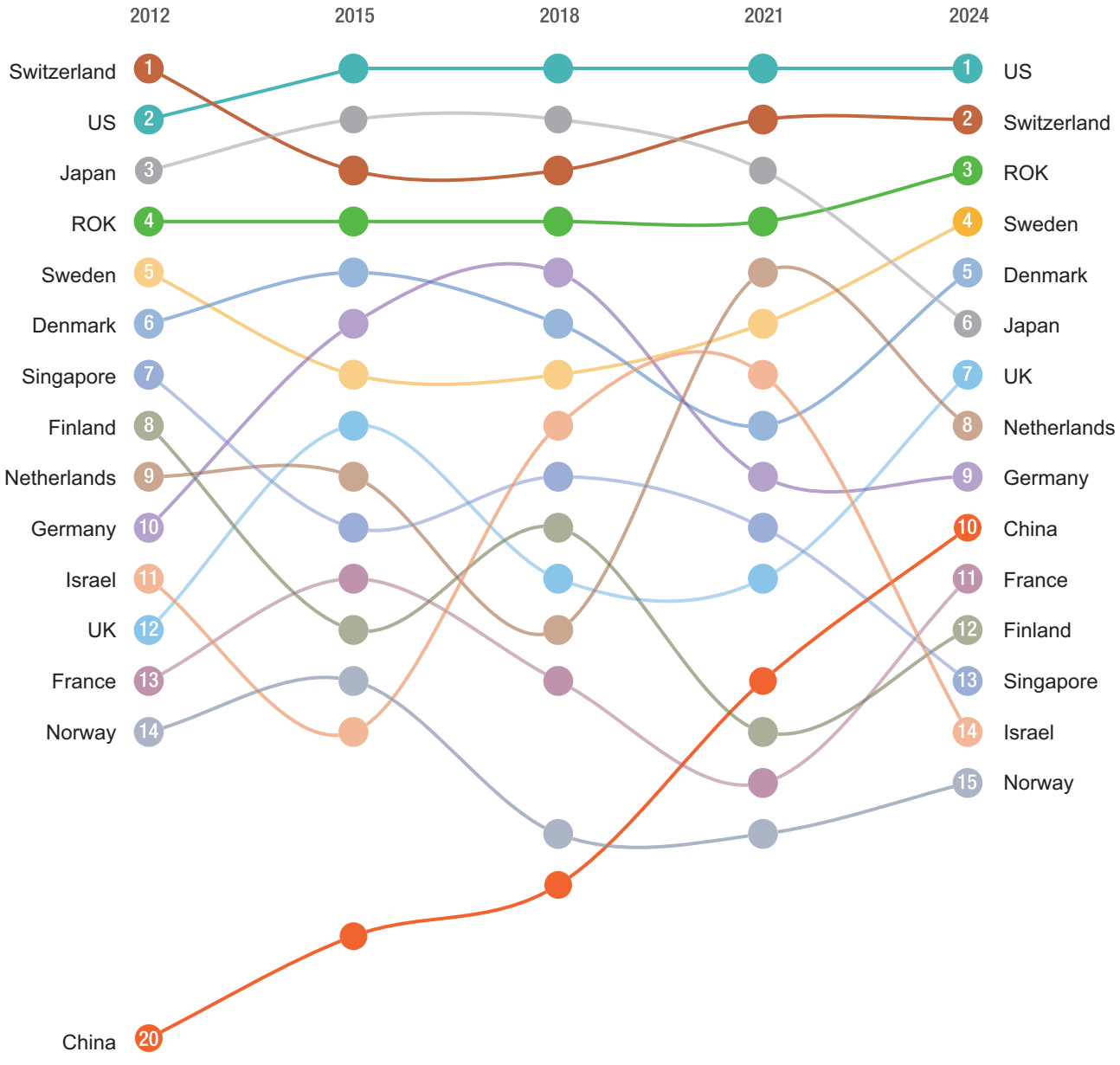


Figure 2-3 Annual rankings of first-group countries on innovation index

II. Asia, America and Europe remain the three pillars on the global innovation landscape

In terms of overall ranking, the NII performance of countries in each region is basically stable, and Asia, America and Europe remain the three pillars on the global innovation landscape.

North America undoubtedly remains the world's strongest innovation pole. For the purpose of this report, the US and Canada have been selected for analysis. The two countries together represent 4.7% of the global population and 27.6% of the world's GDP. Their combined R&D expenditure accounts for 40.2% of the world's total, even higher than the previous year. With its comprehensive strengths, the US continues to occupy the first place in the overall NII ranking. Among the five first-level indicators, it ranks first in innovation resources and enterprise innovation, third in knowledge creation, and seventh in innovation environment. Canada ranks 21st overall, with relatively strong performances in knowledge creation (11th) and innovation environment (8th), while ranking 18th in both innovation resources and enterprise innovation.

Europe and Central Asia have delivered strong overall performance. In this report, 26 countries have been selected for analysis, including Switzerland, Germany and France. Collectively, these 26 countries account for 9.3% of the global population, 23.8% of the global GDP, and 21.6% of the global R&D expenditure, a decrease of 2.2 percentage points from the previous year. Nine countries from this region are in the first group, while most of the others fall into the second group. Among them, Switzerland ranks second overall, followed by Sweden (fourth), Denmark (fifth), the UK (seventh), the Netherlands (eighth), Germany (ninth), France (11th) and Finland (12th).

Major countries in East Asia and the Pacific are also performing well, as evidenced by a clear upward trend. For the purpose of this report, six countries have been selected for analysis, including Japan, the ROK, China, Singapore, Australia and New Zealand. Collectively, these six countries account for 20.4% of the global population, 25.9% of the global GDP, and 30.4% of the global R&D expenditure, a decrease of 2.7 percentage points from the previous year. The ROK and Japan rank second and ninth respectively in innovation resources, and seventh and

second respectively in enterprise innovation. China ranks 10th overall, becoming a highlight of innovation development in Asia and the world. Singapore and Australia rank 13th and 17th respectively overall.

In South Asia, India, which represents 17.8% of the global population and 3.3% of the global GDP, accounts for approximately 0.7% of the global R&D expenditure, a figure that has remained largely stable compared to previous years. India is in the 34th place in overall ranking, and ranks 31st in innovation performance, 25th in innovation environment, 38th in innovation resources, and 36th in both knowledge creation and enterprise innovation. Given the acceleration of its economic and social development in recent years, India's future prospects are widely seen as promising.

In Latin America, three countries, i.e. Mexico, Argentina and Brazil, have been selected for the purpose of this report. Collectively, these three countries account for 4.9% of the global population, 4.0% of the global GDP, and 1.0% of the global R&D expenditure, a decrease of 0.6 percentage points from the previous year. Mexico, Argentina, and Brazil rank 36th, 37th, and 40th respectively in the overall NII ranking.

In the Middle East and Africa, two countries, i.e. Israel and South Africa, have been selected for the purpose of this report. Together, these two countries account for 0.9% of the global population, 0.9% of the global GDP, and 1.4% of the global R&D expenditure, basically the same as in the previous year. Israel ranks 14th overall, while South Africa ranks 38th (Figure 2-4).

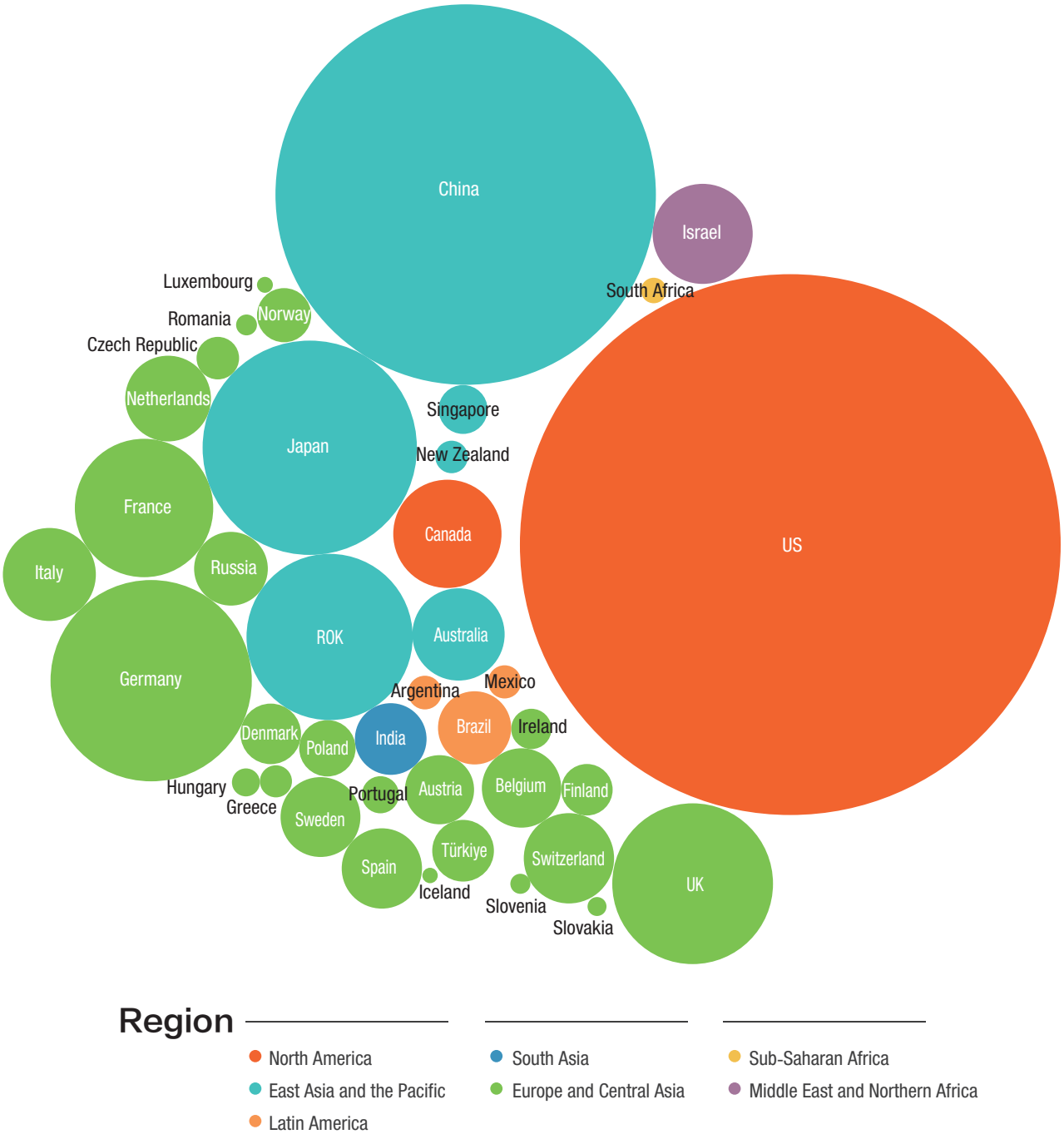


Figure 2-4 Regional distribution of R&D expenditure by countries

Notes: The size of the bubble is proportionate to the scale of R&D expenditure. Regional classification of countries follows the World Bank's classification standards.

III. Innovation development is closely related to economic strength and national will

A country's NII score is closely related to its stage of economic development. International institutions such as the World Bank and the International Monetary Fund (IMF) generally use GDP per capita as the main indicator for the classification of countries by their development stage. As can be seen from Figure 2-5, there is a relatively significant positive correlation between countries' NII scores and GDP per capita. In other words, countries with higher GDP per capita generally score higher on the NII. Most countries are located near the trend line in the figure, which represents the typical development path for nations. In the first group, 14 countries, excluding China, have a per capita GDP above USD30,000. Five countries—the US, Switzerland, Denmark, Singapore, and Norway—have a per capita GDP above USD60,000. Four countries—Sweden, the Netherlands, Finland, and Israel—have a per capita GDP between USD50,000 and USD60,000. Three countries—the UK, Germany, and France—have a per capita GDP between USD40,000 and USD50,000. Two countries—the ROK and Japan—have a per capita GDP between USD30,000 and USD40,000. In the second group, nine countries, including Ireland, Australia, and Belgium, have a per capita GDP above USD30,000 and all of them are at the forefront in the second group. Four countries—Spain, the Czech Republic, Greece, and Portugal—have a per capita GDP between USD20,000 and USD30,000. Hungary and Poland have a per capita GDP below USD20,000.

In the third group, Slovenia and Slovakia have a per capita GDP above USD20,000. Five countries—Türkiye, Romania, Mexico, Argentina, and Russia—have a per capita GDP between USD10,000 and USD20,000. Three countries—India, South Africa, and Brazil—have a per capita GDP below USD10,000. It is evident that economic strength is an important foundation for a country to develop its innovation capability.

China's innovation capability is notably stronger than that of countries at the same level of economic development. Among middle-income countries with comparable per capita GDP—such as Argentina, Mexico, and Türkiye—China performs far ahead in terms of comprehensive innovation performance. It is the only middle-income country to achieve R&D intensity above 2% and make it into the first

group in the overall rankings; the other three remain in the third group. Compared by the stage of economic development, China's GDP per capita totaled USD12,663 in 2022, which is only higher than that of Mexico, Türkiye, Brazil, South Africa, and India out of the 40 countries. However, China's NII score is already close to that of European countries with a per capita GDP of around USD50,000.

The improvement of national innovation capability is also closely related to a country's innovation strategy and willpower. A few countries, including the US, Japan, the ROK and China, perform exceptionally well in NII scores, notably above the trend line that relates NII rankings to per capita GDP. A shared trait among them is the central role their governments assign to science, technology, and innovation strategies in shaping national progress. The US pursues a strategy that aims to ensure its global leadership in all fields of science and technology, positioning innovation as a cornerstone for its economic sustainability and global dominance. Japan emphasizes a development strategy centered on technological advancement and intellectual property. The ROK maintains a high level of R&D investment and supports large conglomerates in seeking breakthroughs in specific areas. The Chinese government also places innovation at the center of its national development strategy.

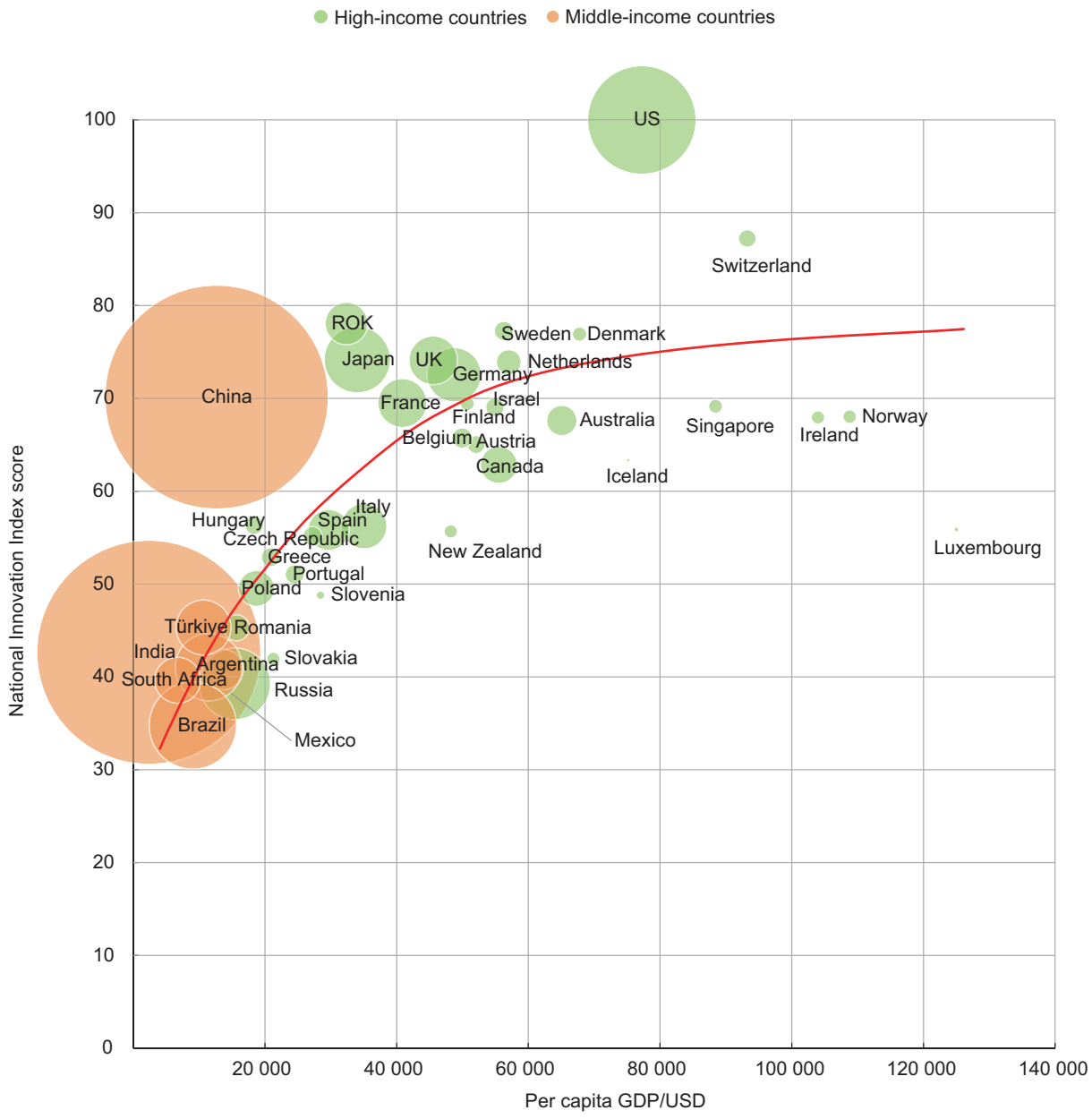


Figure 2-5 Per capita GDP and scores of countries on National Innovation Index

Note: The size of the circle in the figure is proportionate to the size of population.

IV. The eastward shift of the global STI center is increasingly evident

As revealed by the changes in key NII indicators, the global STI center is gradually shifting eastward, with Asian countries rising in status on the global innovation landscape. The share of North American countries is relatively stable, while that of European countries is on the decline.

In terms of the regional distribution of R&D expenditure, East and South Asian countries in the Asian region significantly increased their global share from 27.3% in 2010 to 31.0% in 2022, up by 3.7 percentage points. China's share in global R&D expenditure increased from 8.5% in 2010 to 20.1% in 2022, up by 11.6 percentage points, making it a key driver in the eastward shift of the global STI center. The share of North American countries increased from 35.9% in 2010 to 42.2% in 2022. Within that, the US' share stayed at around 38% from 2015 to 2021 and went up in 2022 due to the increase in funding and changes in exchange rates. European countries have seen a notable decline in their share, dropping from 30.4% in 2010 to 22.7% in 2022, down by 7.7 percentage points. Germany, France, and the UK together account for approximately half of Europe's R&D expenditure.

In terms of the regional distribution of R&D personnel, East and South Asian countries in the Asian region have seen a continuous rise in their global share, increasing from 40.9% in 2010 to 49.6% in 2022, up by 8.7 percentage points. Among them, China alone accounts for over one-third of the global R&D personnel, equivalent to the combined total of the US, Germany, France, the UK, Japan, the ROK, Australia and Canada. The share of North American countries slightly dropped from 17.9% in 2010 to 17.4% in 2022, with the US accounting for approximately 15.7% of the global total. The share of European countries declined more significantly, from 34.2% in 2010 to 28.1% in 2022, down by 6.1 percentage points.

The shift in the priorities of innovation resource input results in a corresponding shift in the output of innovation activities. The global share of scientific papers produced by East and South Asian countries in the Asian region climbed from 24.0% in 2010 to 45.1% in 2022, up by 21.1 percentage points. The share of North American countries dropped from 32.9% in 2010 to 23.5% in 2022, down by 9.4 percentage points. The share of European countries dropped from 50.1% in 2010 to 44.1% in 2022, down by 6 percentage points.

In terms of invention patents in force, the global share of East and South Asian countries in the Asian region rose from 56.7% in 2010 to

69.3% in 2022, up by 12.6 percentage points. The share of North American countries dropped from 30.7% in 2010 to 18.8% in 2022, down by 11.9 percentage points. The share of European countries slightly dropped from 11.7% in 2010 to 11.4% in 2022 (Figure 2-6).

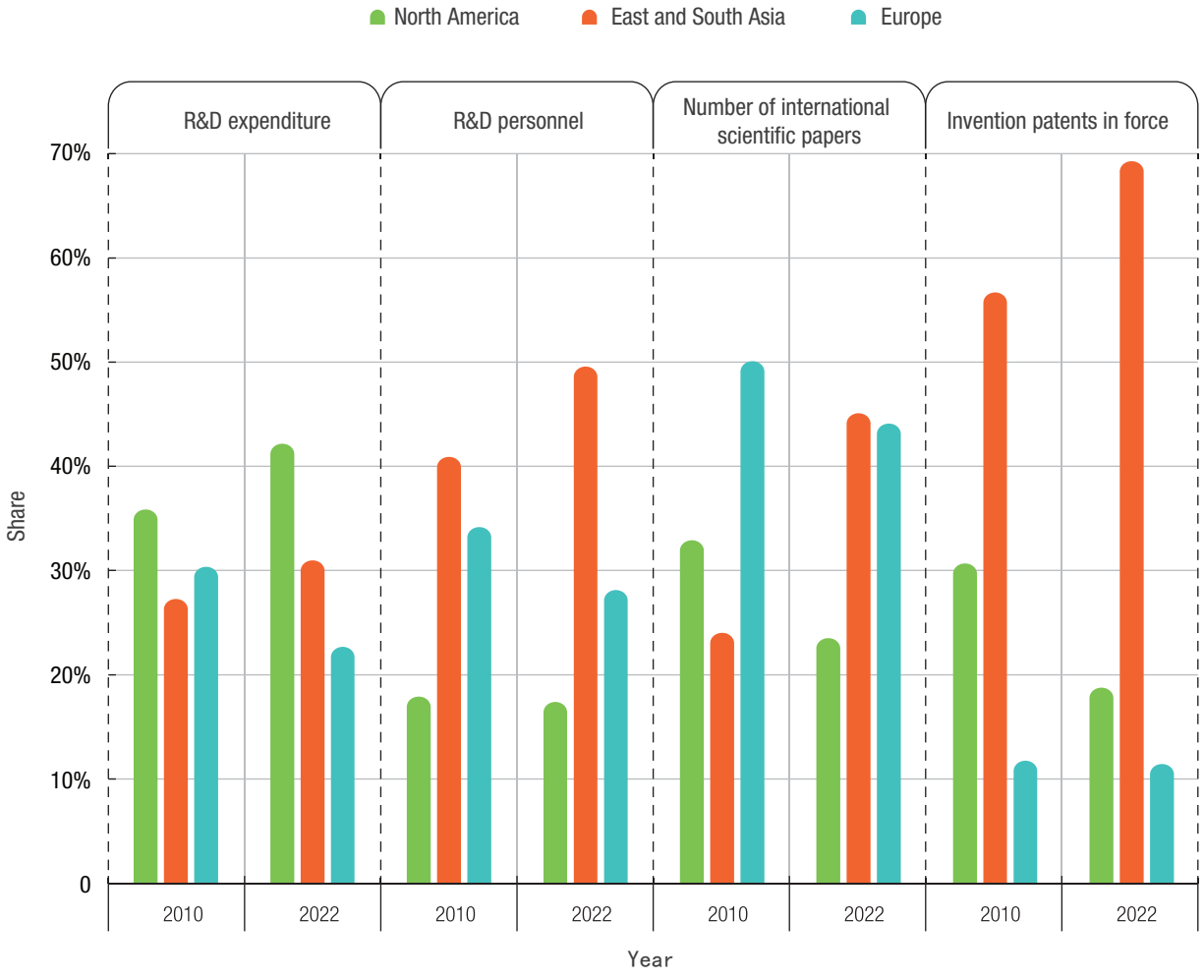


Figure 2-6 Changes in the share of the world's major regions in STI input and output

V. China continues to move up its position on the global innovation landscape

China is the country that has made the most significant progress in STI development over the past decade, occupying an important place on the global innovation landscape. In terms of the change of its NII ranking among the 40 countries, China had remained in the third group before 2003, and after entering the second group in 2003, its international ranking steadily advanced, leaping to the first group in 2019. In 2023, China entered the global top ten on NII rankings, and stayed at the 10th place in 2024, continuing a steady upward trajectory within the first group of innovative countries (Figure 2-7).

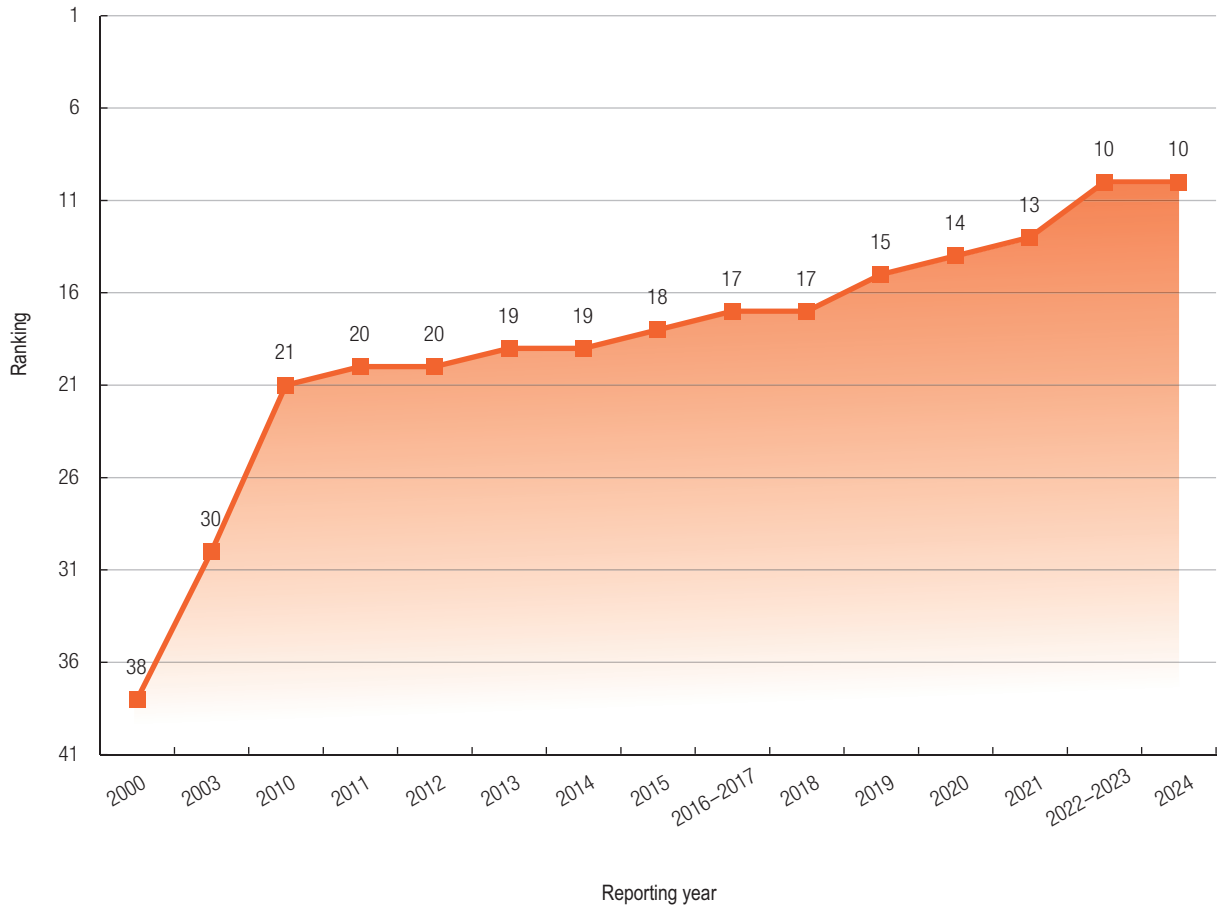


Figure 2-7 China's National Innovation Index ranking in the world

In recent years, China has made improvements in all five first-level NII indicators, though of varying degrees, remained visibly behind leading countries. In 2024, China scored 51.8, 83.9, 46.1, 49.8, and 73.6 points respectively on innovation resources, knowledge creation, enterprise innovation, innovation performance, and innovation environment, ranking fifth, seventh, ninth, 22nd, and 20th respectively respectively. Figure 2-8 shows that China is already at a level comparable to that of leading innovative countries on the indicators of innovation resources and knowledge creation, while more efforts are required on enterprise innovation. On the two indicators of innovation performance and innovation environment, China is still trailing far behind.

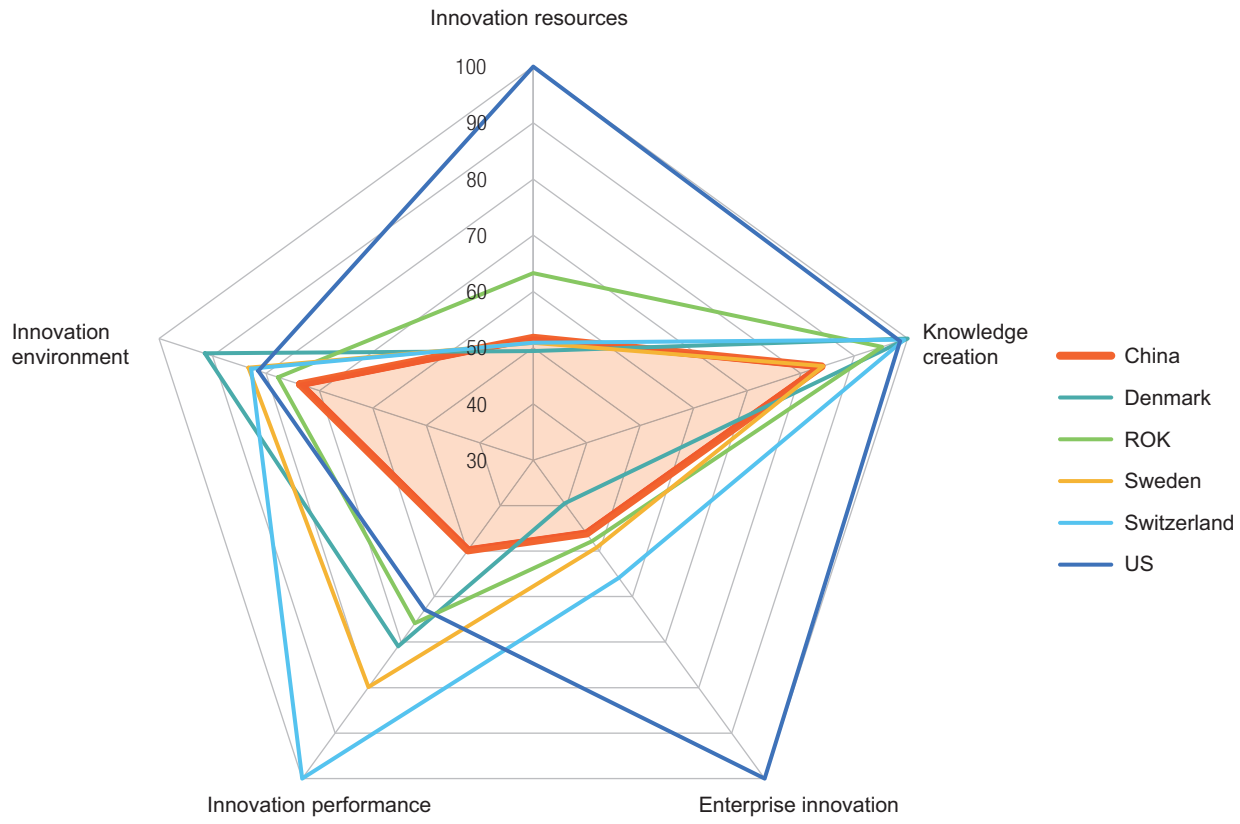


Figure 2-8 China and the top five countries on the National Innovation Index ranking

Looking at the international rankings for individual indicators, China is already a global leader with clear advantages on some indicators, but also lagging behind on other indicators. Among the 38 basic indicators, China has made it into the global top five on 10 indicators, including eight in the top three. However, there are also nine indicators where China ranks below 30th. Additionally, on NII scores, China has scored below 60 points on 27 indicators. The indicators where China is falling behind in either ranking or score largely correspond to the weak links of China's innovation development and will affect China's progress on NII. How to maintain and build up the innovation strengths already established and make up for and reverse the innovation weak links is an important challenge for China to realize innovation-driven, high-quality development in the future (Table 2-1).

Table 2-1
China's main leading and lagging indicators

Leading indicators	Ranking	Lagging indicators	Ranking
Share of global R&D expenditure	2	Proportion of basic research funding in total R&D expenditure	34
Number of top-tier research institutions	2	R&D personnel intensity	34
Proportion of STEM graduates in all college graduates	1	Level of S&T human resource development	31
Number of highly cited scientists	2	Number of S&T papers per USD1 million of R&D expenditure	31
Average score of top three domestic universities in the world university rankings	4	Labor productivity	38
Invention patents in force per 10,000 employed individuals	8	Economic output per unit of energy consumption	34
Number of industrial design applications per USD100 million of industrial value-added	1	Economic output per unit of CO_2 emission	37
Triadic patents as a share of the world's total	3	Rule-of-law environment	34
Number of high-growth technology companies	2	Proportion of international co-authored papers in all domestic papers	40
Proportion of high-tech products in total manufacturing exports	8		
Availability of venture capital	8		
Business-university collaboration in R&D	5		
Entrepreneurial culture	2		

3

Innovation Resources

Developed countries have strong capability of resource aggregation
Major innovative countries possess substantial financial and talent resources
China's scale advantage in innovation resources is becoming more evident

Innovation resources, which cover a country's input in innovation activities, allocation of innovation resources and reserve of human resources for innovation, provide the fundamental guarantee for sustaining innovation efforts. The sub-index of innovation resources consists of nine second-level indicators, i.e. R&D expenditure intensity, share of global R&D expenditure, proportion of basic research funding in total R&D expenditure, number of top-tier research institutions, proportion of STEM graduates in all college graduates, R&D personnel intensity, number of highly cited scientists, level of S&T human resource development, and average score of top three domestic universities in the world university rankings. These indicators are used to measure a country's ability to the allocation of innovation resources.

I. Developed countries have strong capability of resource aggregation

In the ranking of the innovation resources sub-index, developed countries have demonstrated a strong ability for resource aggregation. China is the only developing country that has made it into the first group. The US holds considerable strengths in innovation resource aggregation, scoring higher than all other countries. The ROK and Germany rank second and third with scores of 63.3 and 57.1 respectively. The UK, China, Finland, Switzerland, Sweden, and Japan all scored over 50 points, ranking from fourth to ninth. Austria, Denmark, France, the Netherlands, Israel, and Greece are also in the first group (tenth to 15th). Australia, Belgium, Canada, Singapore, and Norway are in the second group (16th to 30th), and all of them are developed countries. Developing countries such as Türkiye, Argentina, and Mexico, as well as developed countries like Luxembourg and Hungary, are in the third group (Figure 3-1).

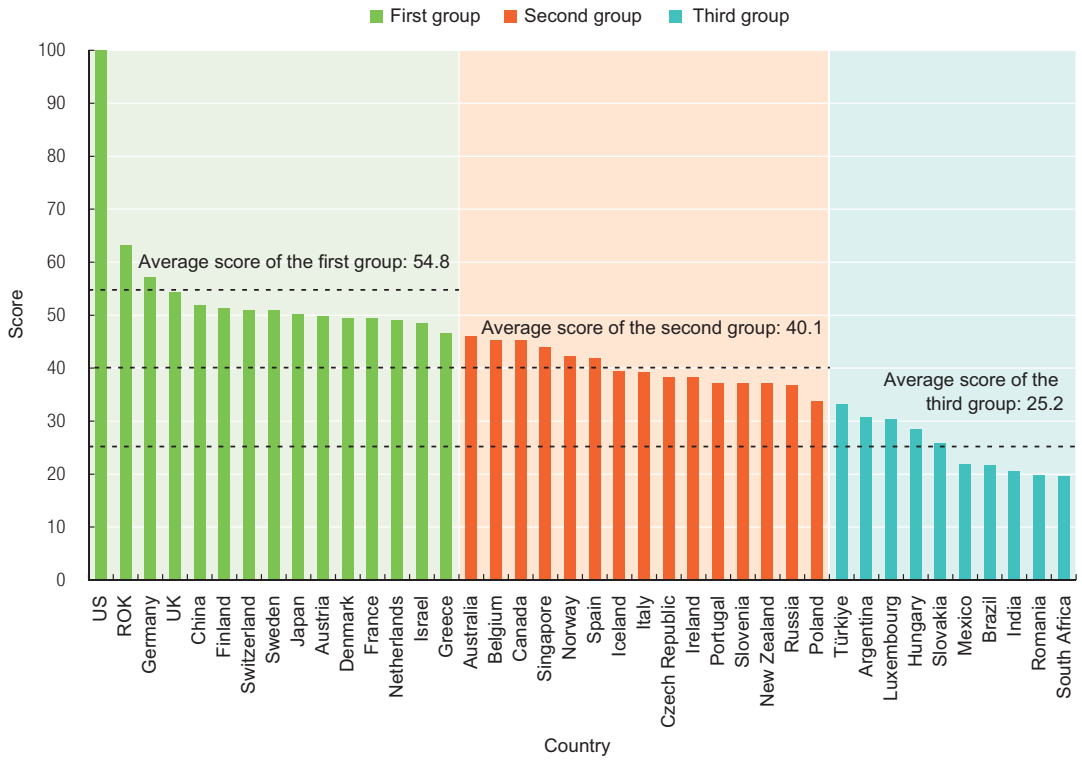


Figure 3-1 Global rankings and scores of countries under the sub-index of innovation resources

II. Major innovative countries possess substantial financial and talent resources

1. Major innovative countries have notable advantages in the scale and intensity of R&D expenditure, with a relatively high proportion of basic research funding for European countries

The global distribution of R&D expenditure is highly concentrated, with major innovative countries holding a distinct scale advantage. The US, China, Japan, and Germany are the top four contributors of R&D expenditure, each exceeding USD120 billion. They each account for more than 5% and together account for over 70% of the total R&D expenditure of the 40 countries combined. Specifically, the US has an R&D expenditure of over USD920 billion, representing 40.5% of the combined total of the 40 countries and firmly holding the first place. China's R&D expenditure is over USD450 billion, close to half of the US' amount, accounting for approximately one-fifth of the total and ranking the second. Japan and Germany account for 6.4% and 5.6% of the total respectively, placing them in the third and the fourth place. The ROK, the UK, and France also have substantial R&D expenditure, each exceeding USD60 billion and accounting for more than 2.5%. The combined share of these seven countries exceeds 80%. Canada, Israel, Italy, Australia, Switzerland, and the Netherlands each account for over 1% of the total R&D expenditure, while no other country exceeds this threshold (Figure 3-2).

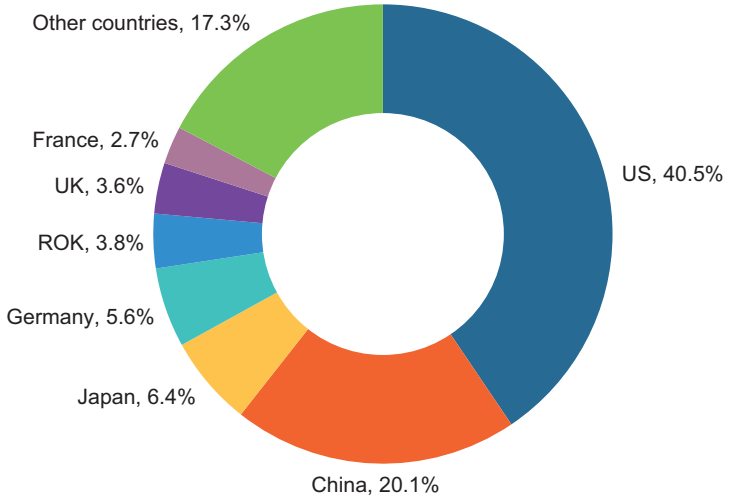


Figure 3-2 Distribution of R&D expenditure

Countries with strong innovation capabilities internationally typically have an R&D expenditure intensity of over 2% of GDP. Israel and the ROK have particularly high R&D expenditure intensity, with R&D expenditure as a percentage of GDP reaching 6.02% and 5.21%, respectively. The US, Sweden, Belgium, Japan, Austria, Switzerland, and Germany all exceed 3%, with the US reaching 3.59% and ranking the third; Japan and Germany are at 3.41% and 3.13%, respectively. Finland, Denmark, Iceland, the UK, and China all exceed 2.5%, while the Netherlands, France, and Slovenia are above 2%. Except for China and Türkiye, no other developing country among the evaluated 40 countries has an R&D expenditure intensity exceeding 1% (Figure 3-3).

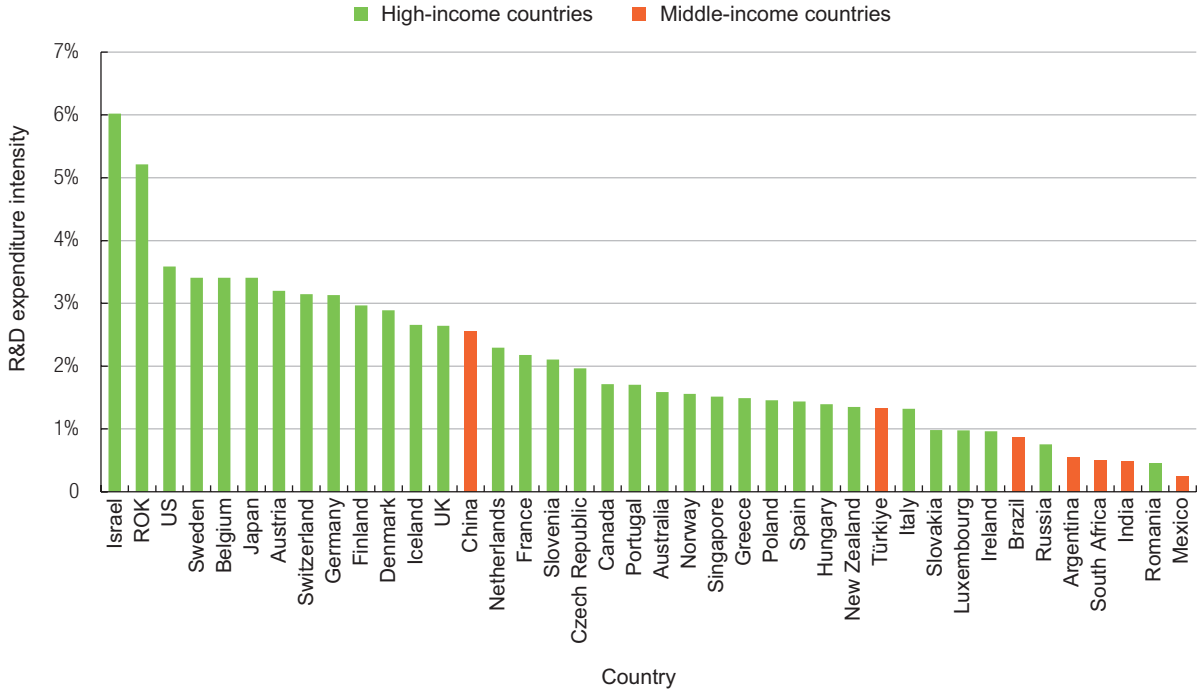


Figure 3-3 R&D expenditure intensity

In terms of the structure of R&D expenditure, European countries generally have a higher proportion of basic research funding. Luxembourg leads with over 40%, followed by Slovakia and Greece at approximately 38%. South Africa, Poland, and Mexico exceed 30.0%, while Switzerland, the Czech Republic, the Netherlands, and Australia exceed 25.0%. Most other European countries are above 15.0%, with France at 23.0% and the UK at 18.3%. The ROK, the US, and Japan have lower proportions of basic research funding compared to most European countries, at 15.0%, 14.3%, and 12.0%, respectively (Figure 3-4).

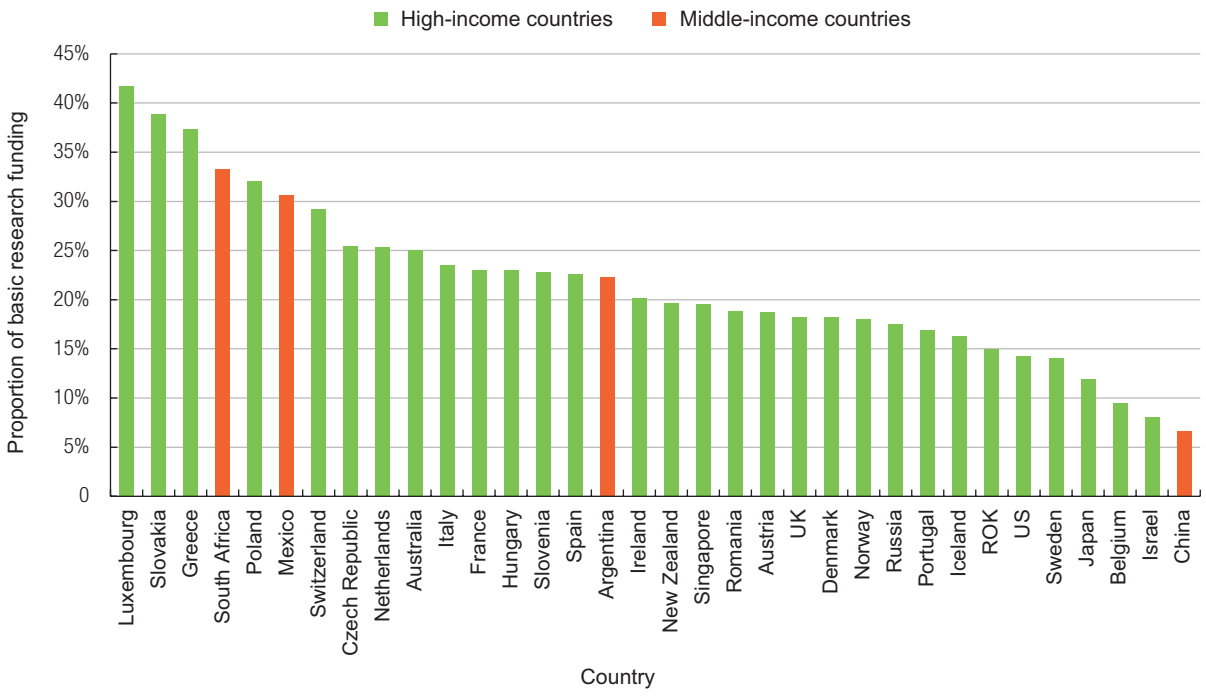


Figure 3-4 Proportion of basic research funding in total R&D expenditure

Note: Data of Brazil, Canada, Finland, Germany, India and Türkiye are not available.

2. Developing countries need to put greater efforts to cultivate high-end R&D personnel, and the US and China are global leaders in the aggregation of top-notch talents

Countries that lead in R&D activities typically have a moderate level of R&D personnel intensity, while developing countries are mostly lagging behind. Belgium has the highest R&D personnel intensity, with 247.5 person-years of R&D personnel per 10,000 employed individuals. Denmark, the ROK, and Iceland all exceed 210 person-years, while Finland and Sweden are above 200 person-years, ranking second to sixth. Austria, the Netherlands, Norway, Switzerland, Germany, Israel, France, and the US are among the 11 countries exceeding 150 person-years. Portugal, Canada, Greece, New Zealand, Japan, and the UK are among the 14 countries exceeding 100 person-years. Slovakia and Romania, the two developed countries, as well as Türkiye, China, and five other developing countries, all fall below 100.0 person-years. Among the top seven countries in R&D expenditure, the ROK has a high R&D personnel intensity, while China's is relatively low. The others range from 130 to 175 person-years, with Germany, France, and the US approximately 170 person-years and Japan and the UK approximately 136 person-years (Figure 3-5).

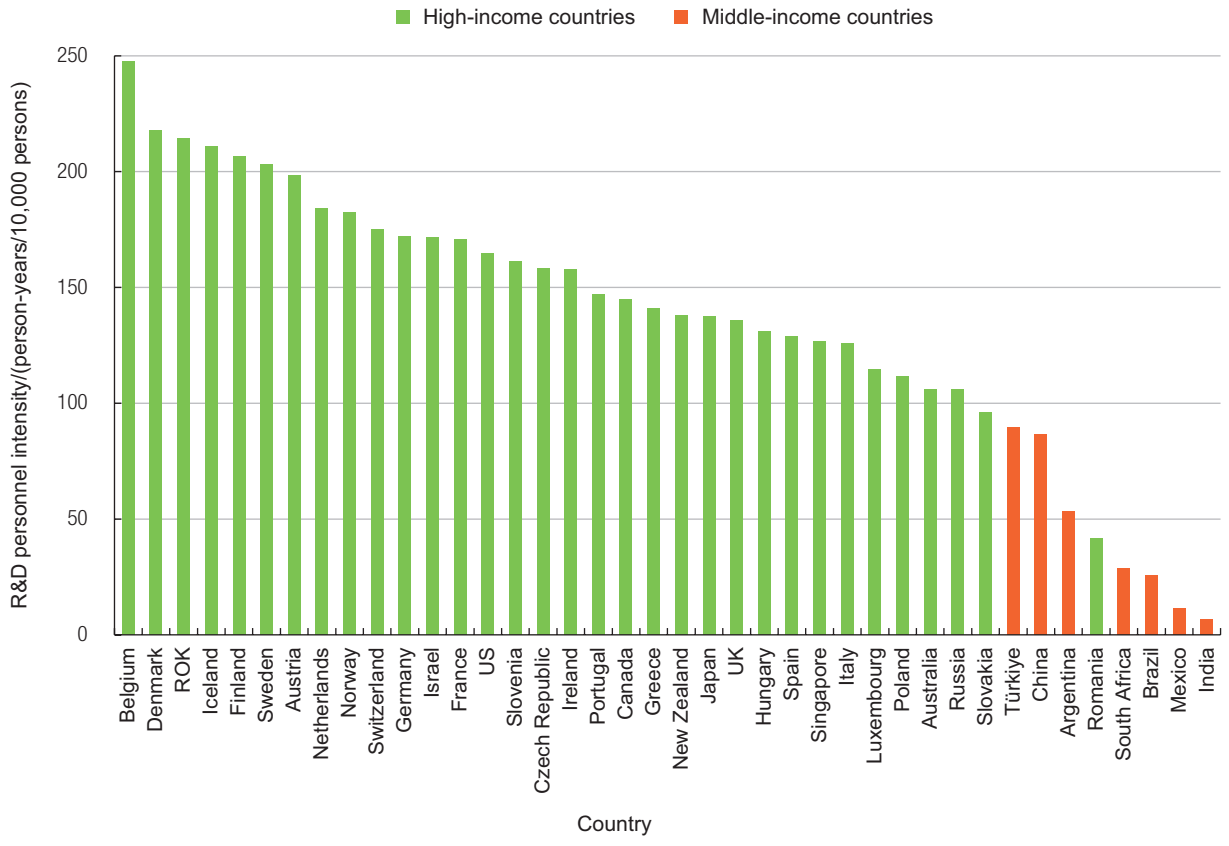


Figure 3-5 R&D personnel intensity

Major innovative countries, particularly the US and China, have gathered a significant number of top talents. The 40 countries combined have 6,814 highly cited scientists, accounting for over 95% of the global total. The US has the most highly cited scientists, amounting to 2,657 in total, nearly two-fifths of the global total. China follows with 1,303, representing almost one-fifth. Together, the US and China account for over 55% of the global total. The UK ranks third with over 570 highly cited scientists. Germany and Australia are both above 300, Canada over 200, and the Netherlands close to 200. These seven countries combined account for nearly four-fifths of the global total. France, Italy, Singapore, Spain, and Switzerland all have over 100 highly cited scientists, while Japan and Belgium are above 80. The ROK, Sweden, and Denmark are above 50. The remaining 23 countries all have fewer than 50 highly cited scientists (Figure 3-6).

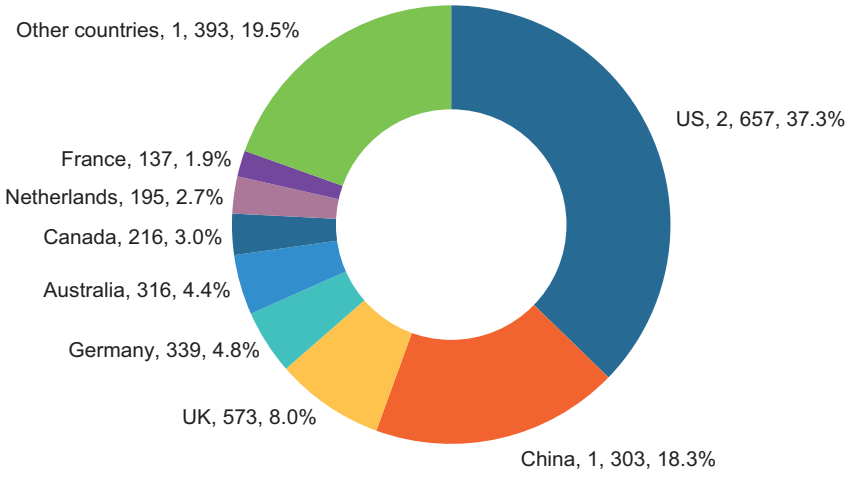


Figure 3-6 Number of highly cited scientists

3. Innovative countries have a high level of higher education enrollment, and East Asian countries are particularly focused on cultivating STEM talent

In terms of S&T human resource development, the gross enrollment rate in higher education reflects the depth of the R&D talent reserve and the potential level of R&D personnel input. Innovative countries generally have a high enrollment in higher education. Greece has the highest gross enrollment rate in higher education at 150.2%, followed by Türkiye at over 125%. Argentina, Australia, Finland, and the ROK all exceed 100%. Singapore, Spain, Austria, and Norway are above 90%. The Netherlands, Iceland, Denmark, and 17 other countries exceed 60%, including major STI countries like the UK, the US, Germany, France, and Japan. The UK and the US are at around 80%, Germany and France are above 75% and 70% respectively, and Japan is at 63.2%. Brazil, one of the BRICS countries, also falls into this range at 60.4%. The remaining 10 countries are all below 60%. Among them, in the other four BRICS countries, China is close to 60%, Russia exceeds 55%, while India and South Africa are relatively low, at over 30% and 25% respectively (Figure 3-7).

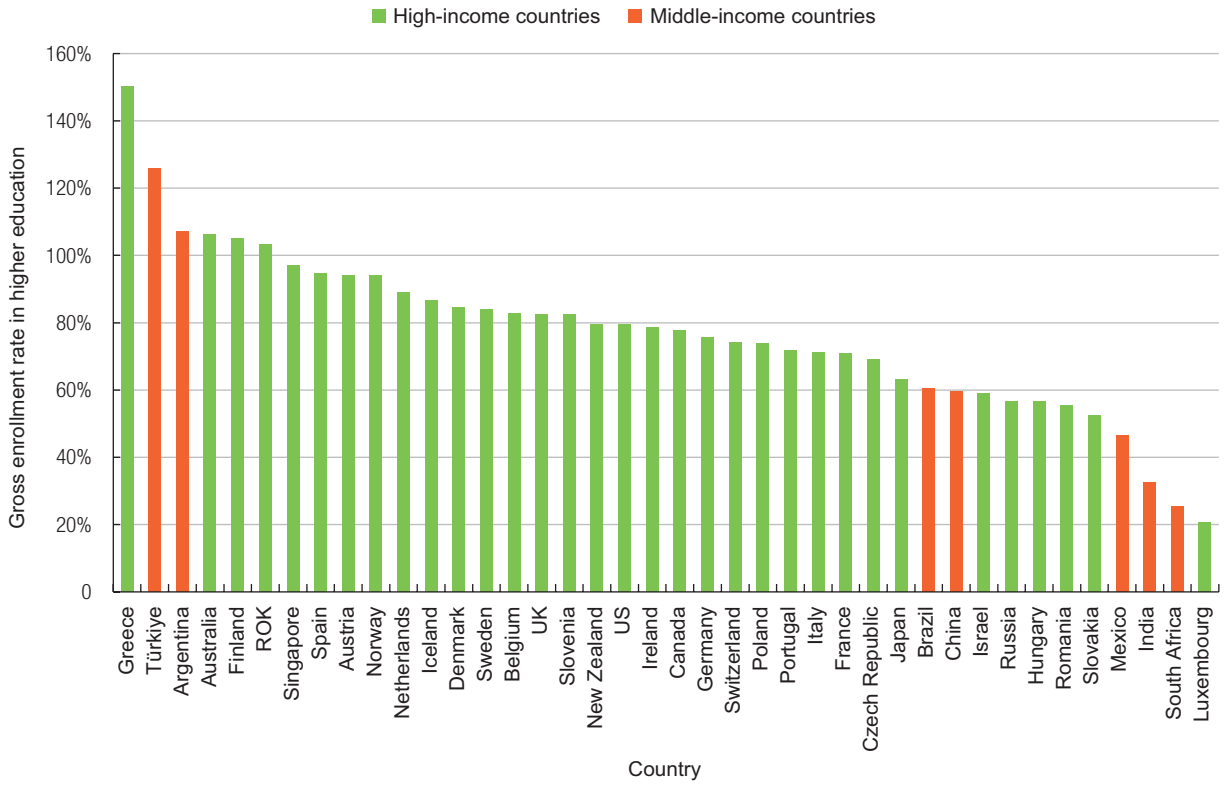


Figure 3-7 Gross enrollment rate in higher education

East Asian countries pay close attention to the cultivation of homegrown STEM talent, while the UK and the US have relatively lower proportions of STEM graduates. STEM (Science, Technology, Engineering, and Mathematics) graduates represent the future of S&T talent, and their proportion in all college graduates reflects the structure of talent cultivation. China has the highest proportion of STEM graduates at 46.7%. Singapore and Germany follow at 35.9% each. Russia, Japan, Austria, and the ROK all exceed 30%. Slovenia, Finland, India, Romania, Sweden, and eight other countries are above 25%, with Canada and France at around 26%. Mexico, Denmark, Italy, New Zealand, and eight other countries are above 20%, with the UK and the US at 22.3% and 20.1% respectively. Poland, Australia, Belgium, and five other countries are between 15% and 20% (Figure 3-8).

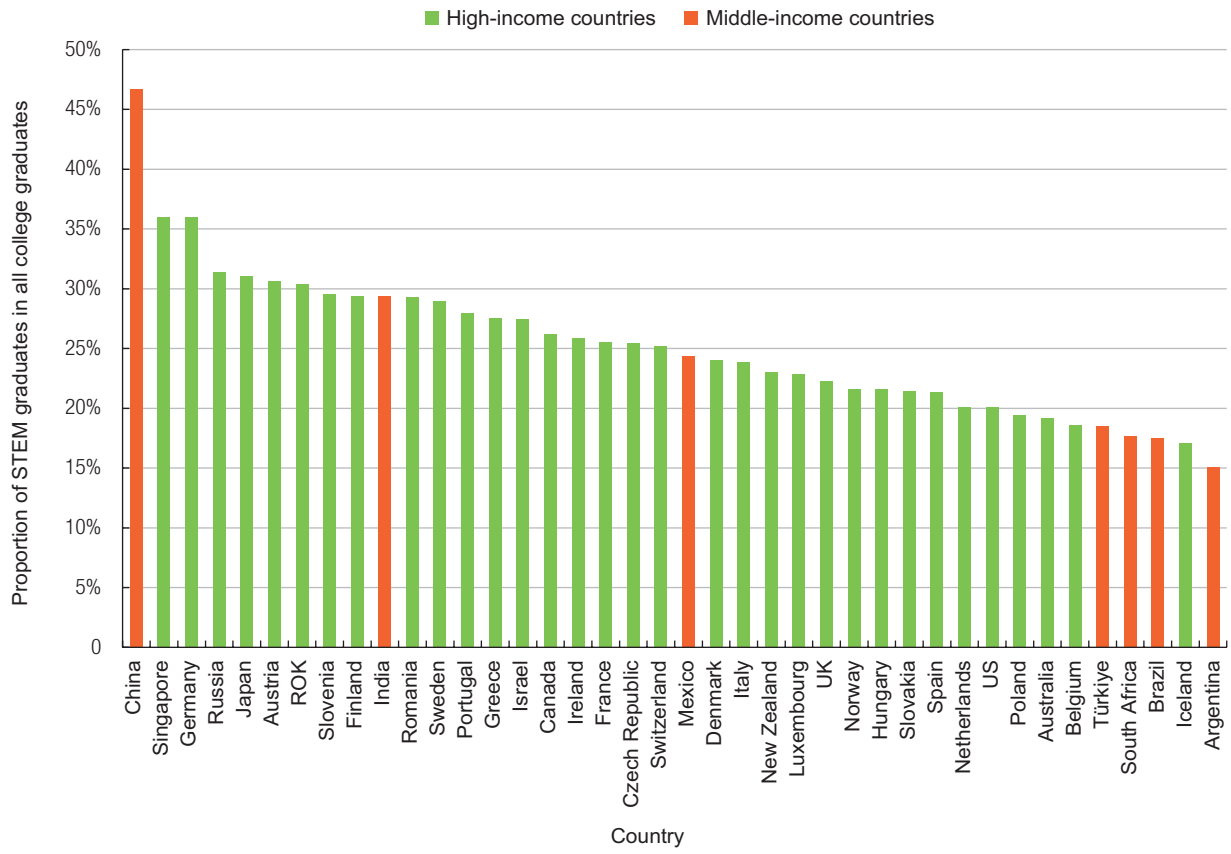


Figure 3-8 Proportion of STEM graduates in all college graduates

4. Major innovative countries are home to the world's top research institutions, and world-class universities in the UK and the US are the most popular

Among the 1,000 top-tier research institutions, including the top 500 government-funded research institutions and top 500 non-profit institutions in the Nature Index, 965 institutions are from the 40 countries. The US is home to 224 top research institutions, accounting for nearly one-fourth of the total number of the 40 countries. China follows with 111 top research institutions. The UK, Japan, and Spain have between 50 and 60 institutions each, while Germany and France have 49 and 45 respectively. These seven countries combined account for over 60% of the total number of the 40 countries. India, Australia, Italy, the ROK, and Canada each have between 30 and 36 institutions. Switzerland, the Netherlands, Norway, Belgium, Brazil, and Greece each have between 12 and 21 institutions. None of the other 22 countries has more than 10 institutions on the list (Figure 3-9).

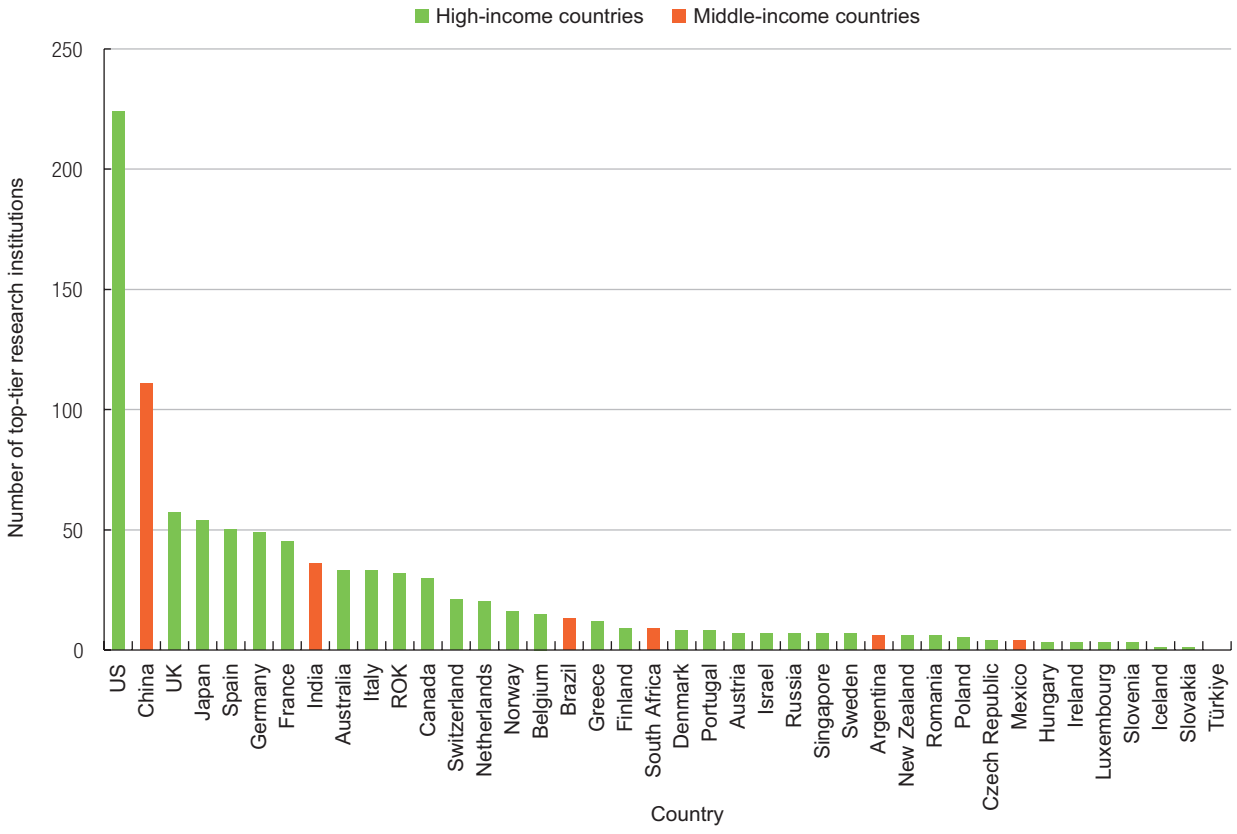


Figure 3-9 Number of top-tier research institutions

According to the QS World University Rankings, 35 out of the 40 countries have universities that made it into the top 500. The higher education systems of the US and the UK are renowned worldwide for their world-class universities. In the US, the top three institutions—MIT, Harvard University, and Stanford University—have an average score of 97.6 points. In the UK, the top three—Imperial College London, Oxford University, and Cambridge University—have an average score of 97.4 points. The top three universities in Australia, China, and Canada all have average scores exceeding 80 points. Switzerland, France, the ROK, Japan, and Germany all have scores above 70 points. The Netherlands, Singapore, Argentina, Sweden, Denmark, and seven other countries have scores between 50 and 70 points, while the remaining countries all have scores below 50 points (Figure 3-10).

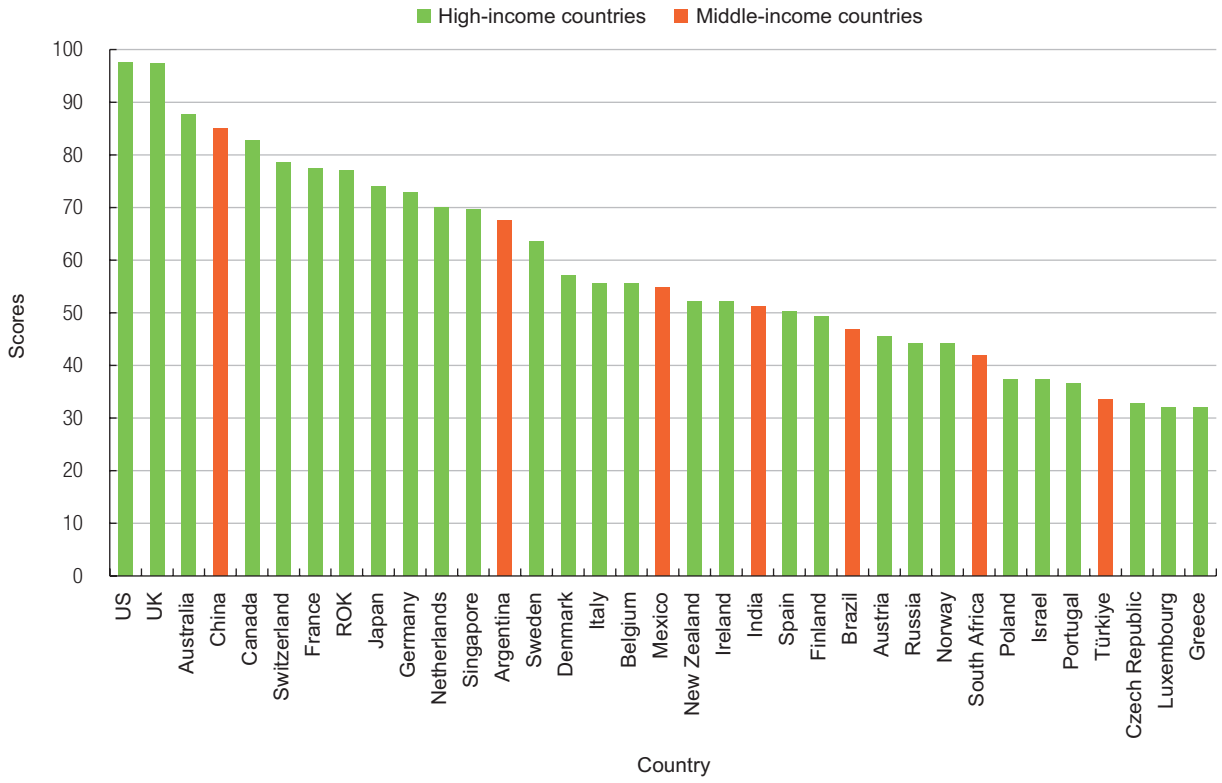


Figure 3-10 Average score of top three domestic universities in the world university rankings

Note: No universities from Romania, Hungary, Slovenia, Iceland and Slovakia have entered the top 500 universities in the world.

III. China's scale advantage in innovation resources is becoming more evident

1. China leads in innovation resources ranking with notable scale advantages

China has scored 51.8 points in the innovation resources sub-index, ranking fifth globally. While there is still a significant gap compared to the world's No.1, the US, the differences compared to the second to fourth-ranking countries—the ROK, Germany, and the UK—are relatively smaller. Specifically, China's score is 2.4 points lower than that of the UK (Figure 3-11).

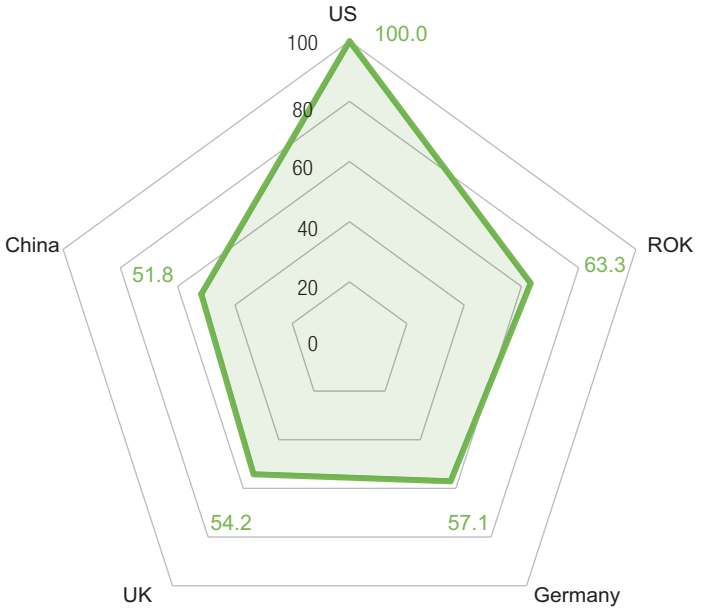


Figure 3-11 Scores of China and the top four countries on the innovation resources sub-index

China's high ranking in innovation resources is primarily due to its scale advantages, particularly in the following five indicators: share of global R&D expenditure, number of top-tier research institutions, proportion of STEM graduates in all college graduates, number of highly cited scientists, and average score of top three domestic universities in the world university rankings. On the one hand, China has scored close to 50 points for the share of global R&D expenditure, number of top-tier research institutions, and number of highly cited scientists, all ranking second globally. On the proportion of STEM graduates in all college graduates, China has scored 100 points, ranking first globally. On the average score of top three domestic universities in the world university rankings, China is at the world's fourth place. On the other hand, China's weaknesses are mainly reflected in three indicators, i.e. proportion of basic research funding in total R&D expenditure, R&D personnel intensity, and level of S&T human resource development, all with scores below 40 points, ranking 34th, 34th, and 31st respectively (Figure 3-12).

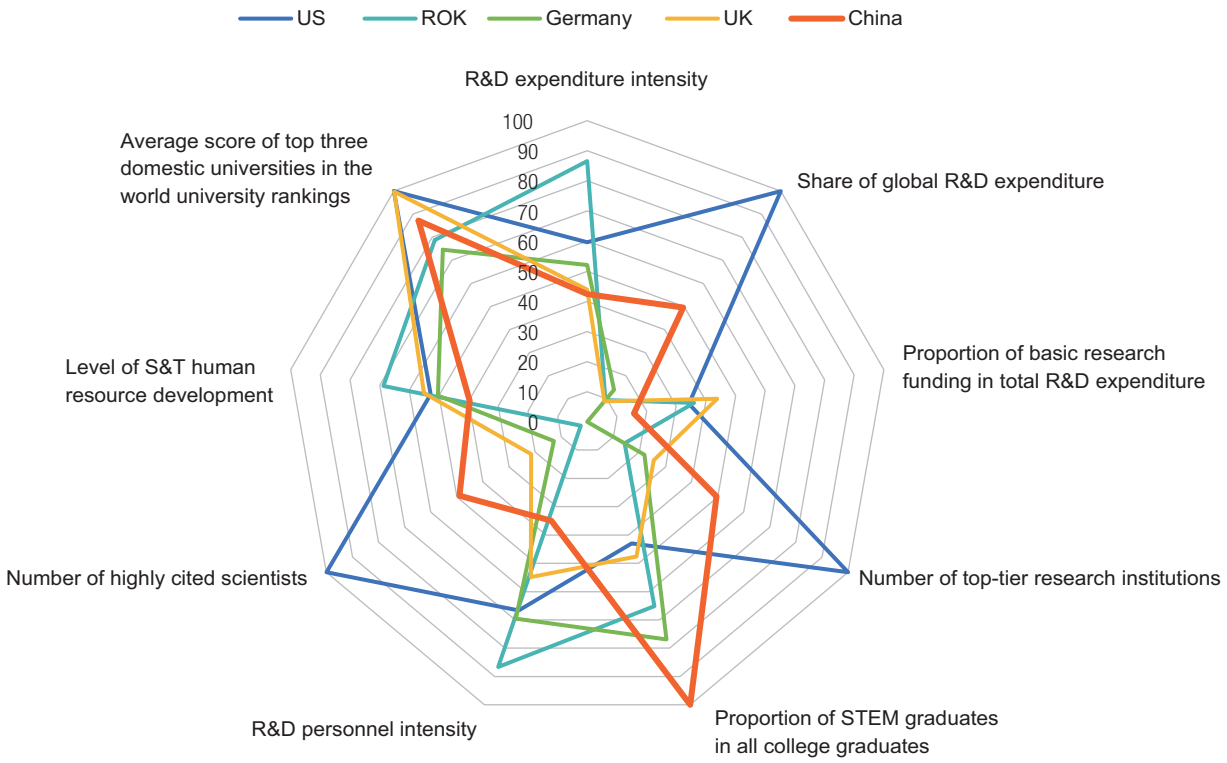


Figure 3-12 Scores of China and the top five countries on the innovation resources sub-index

2. China has secured its second place on the scale of R&D expenditure, yet improvement is needed in both intensity and structure

The three indicators related to R&D expenditure reflect the scale, intensity, and structure of R&D funding. Among them, China has made it into the global top 15 on both R&D expenditure intensity and share of global R&D expenditure, ranking 14th and second respectively. On the proportion of basic research funding in total R&D expenditure, China is relatively lagging behind, ranking 34th globally (Figure 3-13).

From 2010 to 2022 (statistical year, same below), China's R&D expenditure continued to increase in scale, with its share of the global total (referring to the total amount of the 40 countries) rising from 8.5% to 20.1%. China has kept its position as a global leader for several consecutive years, ranking second only to the US (40.5%) since 2013. Its R&D expenditure intensity has steadily increased from 1.71% to 2.56%, but its ranking has improved relatively slowly, remaining at the 14th place since 2018. The proportion of basic research funding in total R&D expenditure has risen from 4.59% to 6.57%, but still lags far behind developed countries such as the US (14.3%), Japan (12.0%), the ROK (15.0%), the UK (18.3%), and France (23.0%). The improvement in global ranking faces significant challenges, making basic research the critical weak link in the entire innovation chain (Figure 3-13, Figure 3-14).

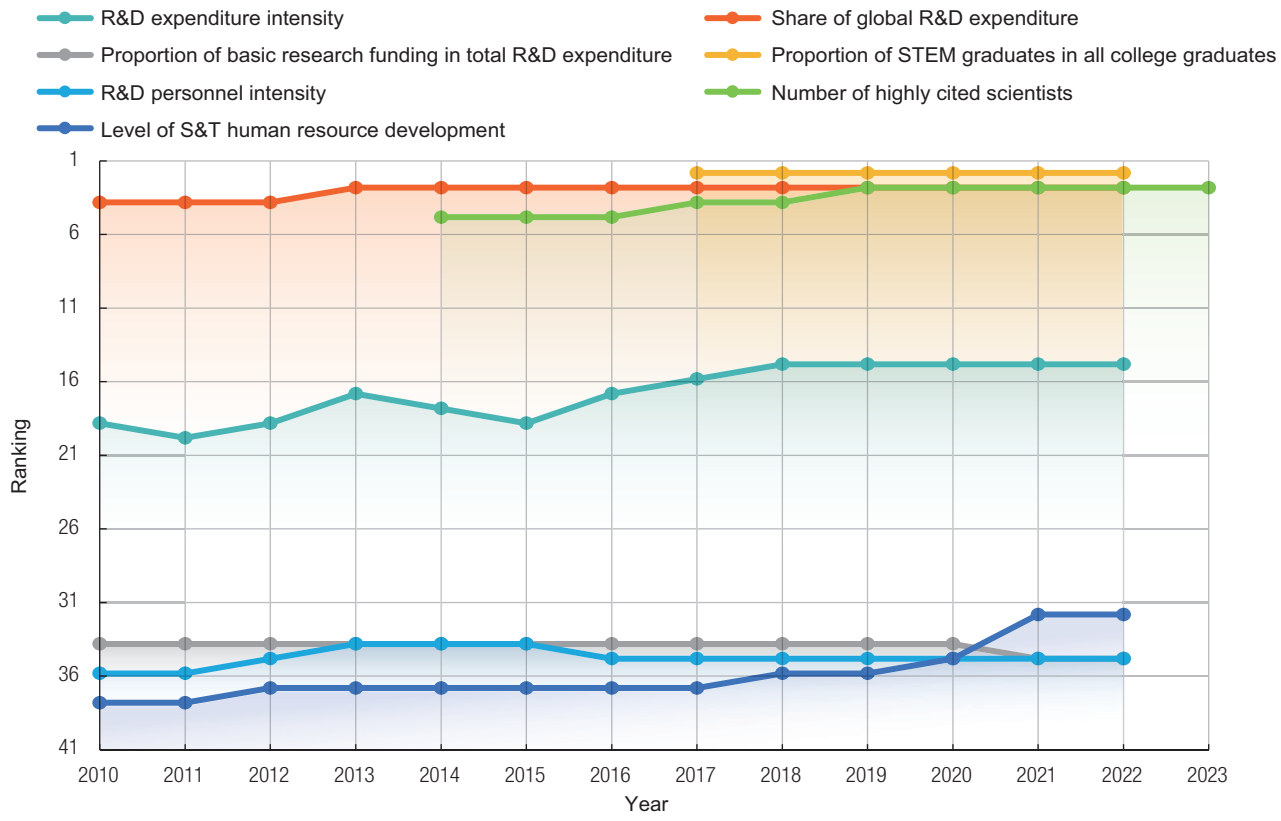


Figure 3-13 Changes in the rankings on the innovation resources sub-index

Note: "Year" indicates the year of data.

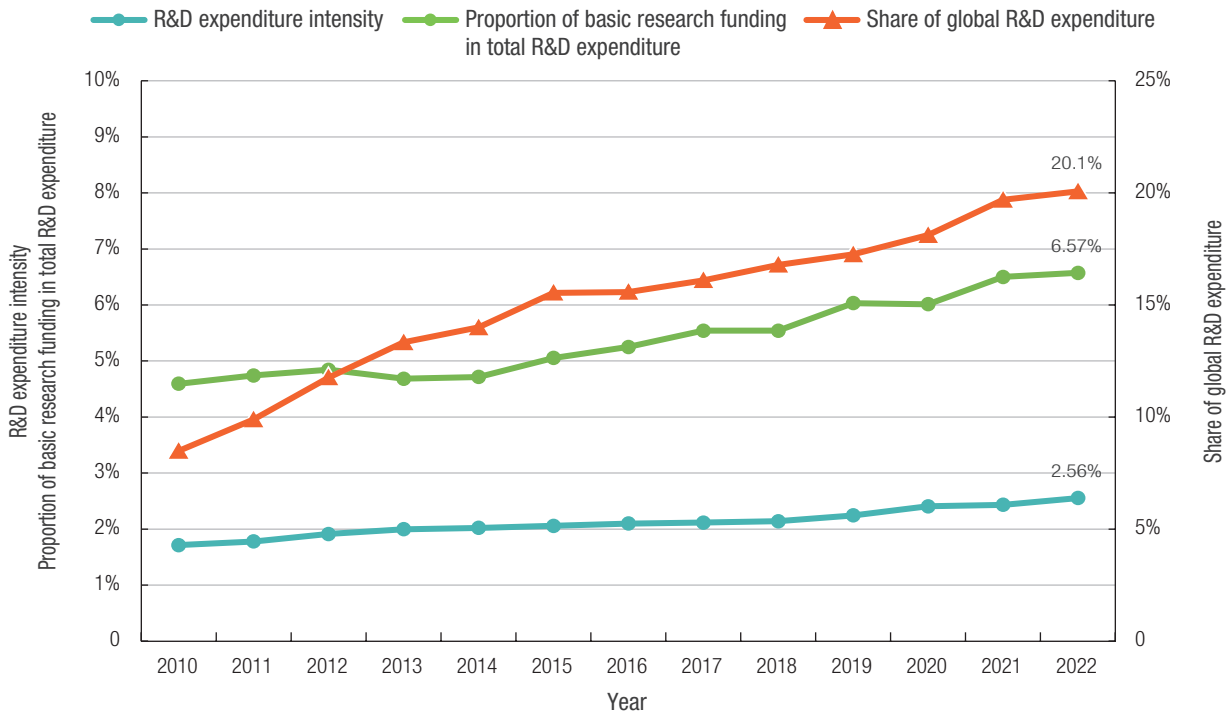


Figure 3-14 Changes in data on R&D-expenditure-related indicators

Note: "Year" indicates the year of data.

3. Top scientists are aggregating at a faster pace, yet more efforts are required in talent input and training

The four indicators related to STI talents reflect the current scale of personnel input, the status of top talents, and the progress of talent development. From Figure 3-13, China is high on the global ranking table in both the number of highly cited scientists and the proportion of STEM graduates in all college graduates, ranking second and first respectively. On the other hand, China lags behind in R&D personnel intensity and the level of S&T human resource development, ranking 34th and 31st respectively.

From the perspective of changes, between 2010 and 2022, the R&D personnel intensity (measured as the number of R&D personnel per 10,000 employed individuals) jumped from 33.6 to 86.6 person-years per 10,000 employees. Although the gap with developed countries has notably narrowed, China still remains far behind major innovation leaders such as Germany (172.1 person-years per 10,000 employees), France (170.8 person-years per 10,000 employees), the US (165.0 person-years per 10,000 employees), Japan (137.6 person-years per 10,000 employees), and the UK (135.8 person-years per 10,000 employees). It is quite difficult to improve China's ranking on this indicator, which has remained between the 33rd and the 35th place for an extended period. China has increased its number of highly cited scientists from 119 in 2014 to 1,303 in 2023, moving up its global ranking from the fourth to the second place, next only to the US. The proportion of STEM graduates in all college graduates has remained stable and kept at a high level, ranking first globally with a share of 46.7% in 2022. The level of S&T human resource development, as measured by the gross enrollment rate in higher education, has stabilized after a period of rapid growth, currently standing at 59.6%. Its global ranking has moved up from the 37th to the 31st place, edging closer to Japan (63.2%). However, there is still significant room for improvement compared to countries such as the UK (82.7%), the US (79.4%), Germany (75.7%), and France (70.8%) (Figure 3-15).

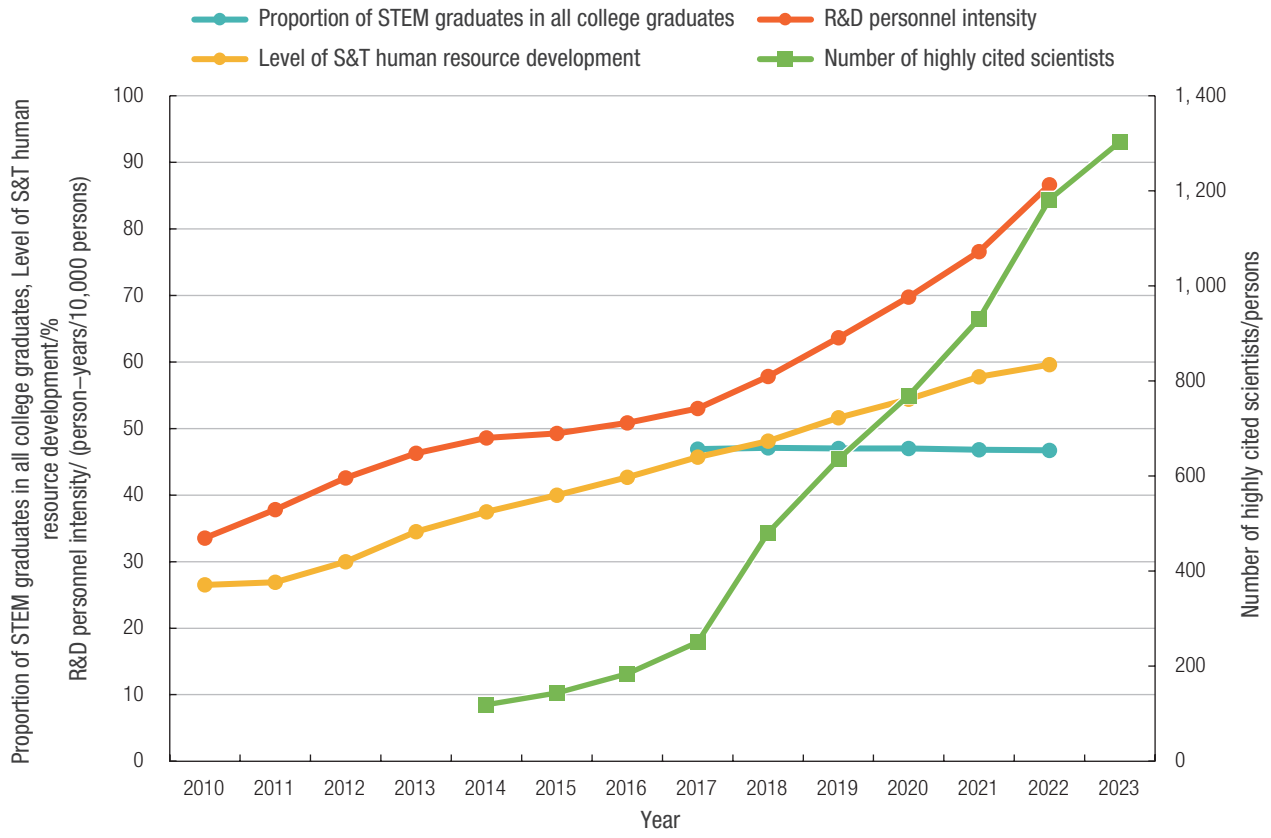


Figure 3-15 Changes in data on R&D-personnel-related indicators

Note: "Year" indicates the year of data.

4. China has established a significant number of top-tier research institutions, and exhibited great potential in developing world-class universities

The two indicators related to R&D institutions reflect the excellence of research institutions and universities. China ranks highly on the global ranking table in both of these indicators. Specifically, China now has 111 top-tier research institutions, ranking second globally. This is approximately half the number of the US (224), and significantly higher than the UK (57), Japan (54), Germany (49), and France (45). China also leads other BRICS countries such as India (36), South Africa (9), and Russia (7) in this regard. The average score of the top three Chinese universities in the world university rankings is 85.1 points. Peking University, Tsinghua University, and Fudan University have all made it into the global top 40, with an average score close to that of Australia (87.8 points), but still trailing behind that of the US (97.6 points) and the UK (97.4 points).

4

Knowledge Creation

The gaps in knowledge creation among countries are relatively small

Some developing countries and small European nations have relatively high efficiency in S&T paper output

The US, Japan, the ROK, and China stand out in intellectual property creation

China is in the global top ten on knowledge creation

The performance in knowledge creation is a direct manifestation of a country's innovation capacity and indication of its R&D output and overall S&T strength. The sub-index of knowledge creation consists of five second-level indicators, i.e. number of S&T papers per USD1 million of R&D expenditure, invention patents in force per 10,000 employed individuals, number of industrial design applications per USD100 million of industrial value-added, number of scientific paper citations per USD1 million of R&D expenditure in academic departments, and proportion of highly cited papers in all domestic papers, which are used to measure a country's performance in knowledge output.

I. The gaps in knowledge creation among countries are relatively small

In the ranking of the knowledge creation sub-index, the gaps among countries are relatively small, with some small European nations and major innovative countries such as the US, the ROK, and China standing out in performance. Denmark ranks first, followed by Switzerland and the US, scoring 99.3 and 98.6 points and ranking second and third respectively. The ROK comes next with 95.2 points, ranking fourth. These four countries significantly outpace the others. The Netherlands, Sweden, China, Iceland, Finland, the UK, Canada, Singapore, Germany, Greece, and Austria all have scores exceeding 80 points, which put them in the first group. New Zealand, France, Australia, Italy, Japan, and 10 other countries have scores ranging from 67 to 80 points, placing them in the second group. Among them, Türkiye and South Africa, two developing countries, rank 29th and 30th, respectively. Two developed countries, i.e. Ireland and the Czech Republic, as well as four developing countries, i.e. Argentina, India, Mexico, and Brazil, are in the third group (Figure 4-1).

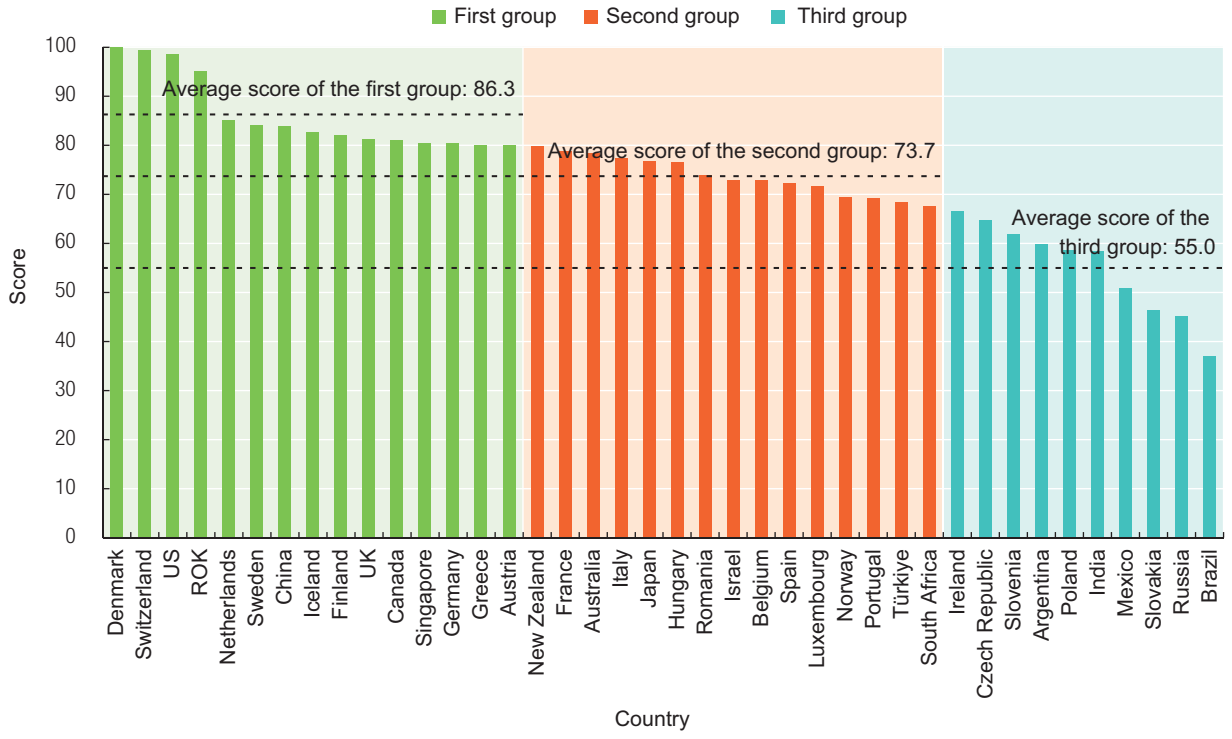


Figure 4-1 Global rankings and scores of countries on the knowledge creation sub-index

II. Some developing countries and small European nations have relatively high efficiency in S&T paper output

In terms of the scale of paper output, China, the US, the UK, and Germany lead in the number of S&T papers. Some developing countries have high output efficiency, with India standing out in both scale and efficiency. Specifically, China has the largest number of S&T papers, exceeding 740,000, which accounts for over 30% of the global total. The US follows with over 450,000 papers, representing nearly 20% of the global total. The UK, Germany, and India each have over 120,000 papers, ranking third to fifth globally, with each accounting for more than 5% of the global total. When it comes to the number of S&T papers per USD1 million of R&D expenditure, South Africa and Romania both have more than nine papers, and India has 7.7 papers, ranking among the top three. Mexico, Portugal, Greece, Slovakia, Slovenia, Türkiye, Poland, and Hungary each have more than four papers. In contrast, larger countries have relatively fewer papers per USD1 million of R&D expenditure. The UK and China have 1.8 and 1.6 papers respectively. France and Germany each have more than one paper. The ROK, Japan, and the US have fewer than one paper (Figure 4-2).

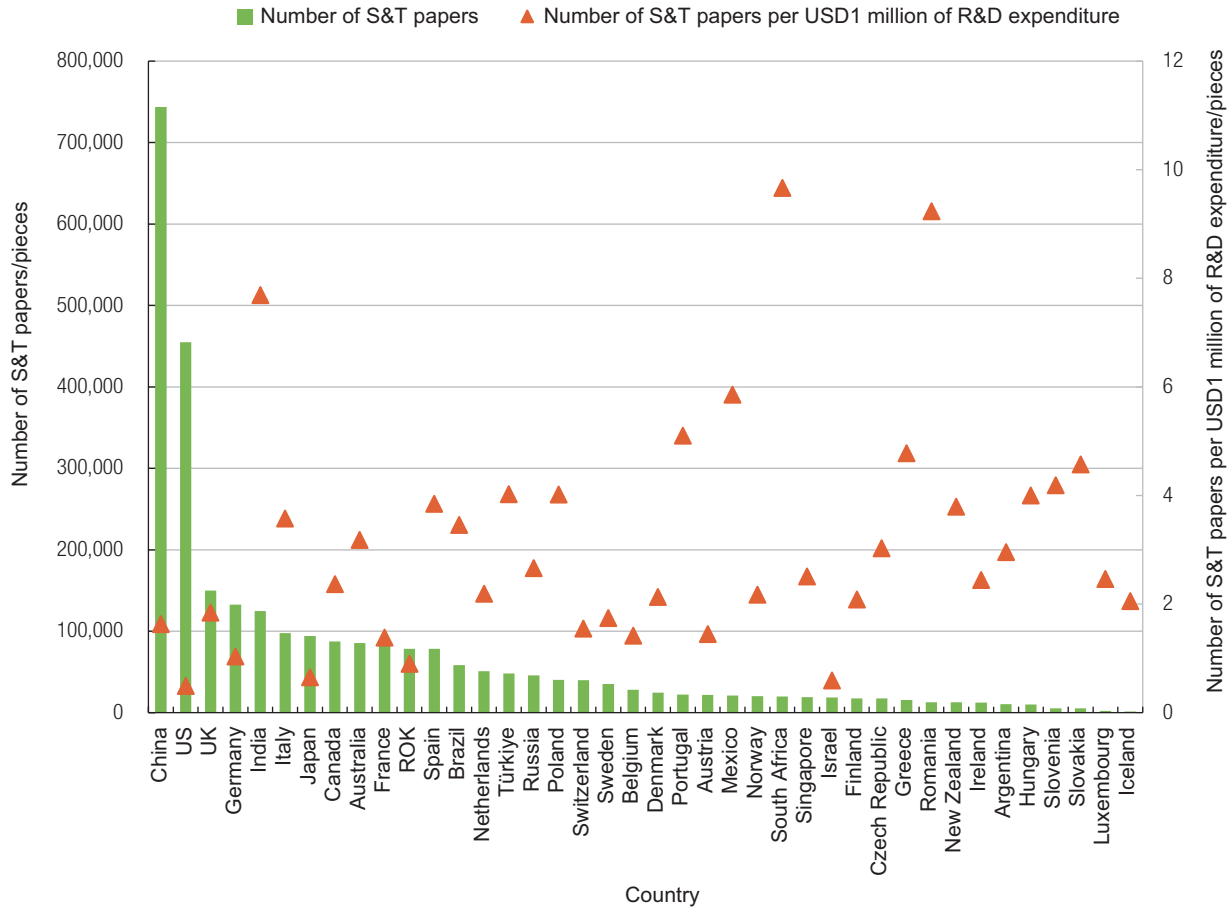


Figure 4-2 Number of S&T papers

In terms of the influence of papers, China, the US, the UK, and Germany have a large number of highly cited papers, but small European countries perform better overall. On the number of highly cited papers, China, the US, the UK, and Germany rank in the top four with over 1,800 highly cited papers each. Australia, Italy, Canada, France, Spain, and India all have over 1,000 highly cited papers. On the proportion of highly cited papers in all domestic papers, Singapore ranks first with a proportion of 2.7%. Denmark, Switzerland, Ireland, Belgium, and Australia are all above 2%, ranking second to sixth. The performances of major innovative countries are starkly divided, but mostly at the lower end of the ranking table. The UK ranks 11th with a proportion of 1.9%, while France and Germany, both exceeding 1.5%, rank 20th and 24th respectively. China and the US are around 1.4%, and the ROK and Japan are around 1%, all ranking after the 25th place. On the number of scientific paper citations per USD1 million of R&D expenditure in academic departments, Romania and South Africa both exceed 100 citations, ranking first and second. Ireland, Portugal, Hungary, and Slovenia are between 85 and 90 citations, ranking third to sixth. Singapore, Greece, Poland, and 10 other countries exceed 50 citations. Among the major innovative countries, only the UK and China, with 54.5 and 48.9 citations respectively, have made it into the top 25, while the ROK, France, Germany, Japan, and the US all have fewer than 30 citations (Figure 4-3).

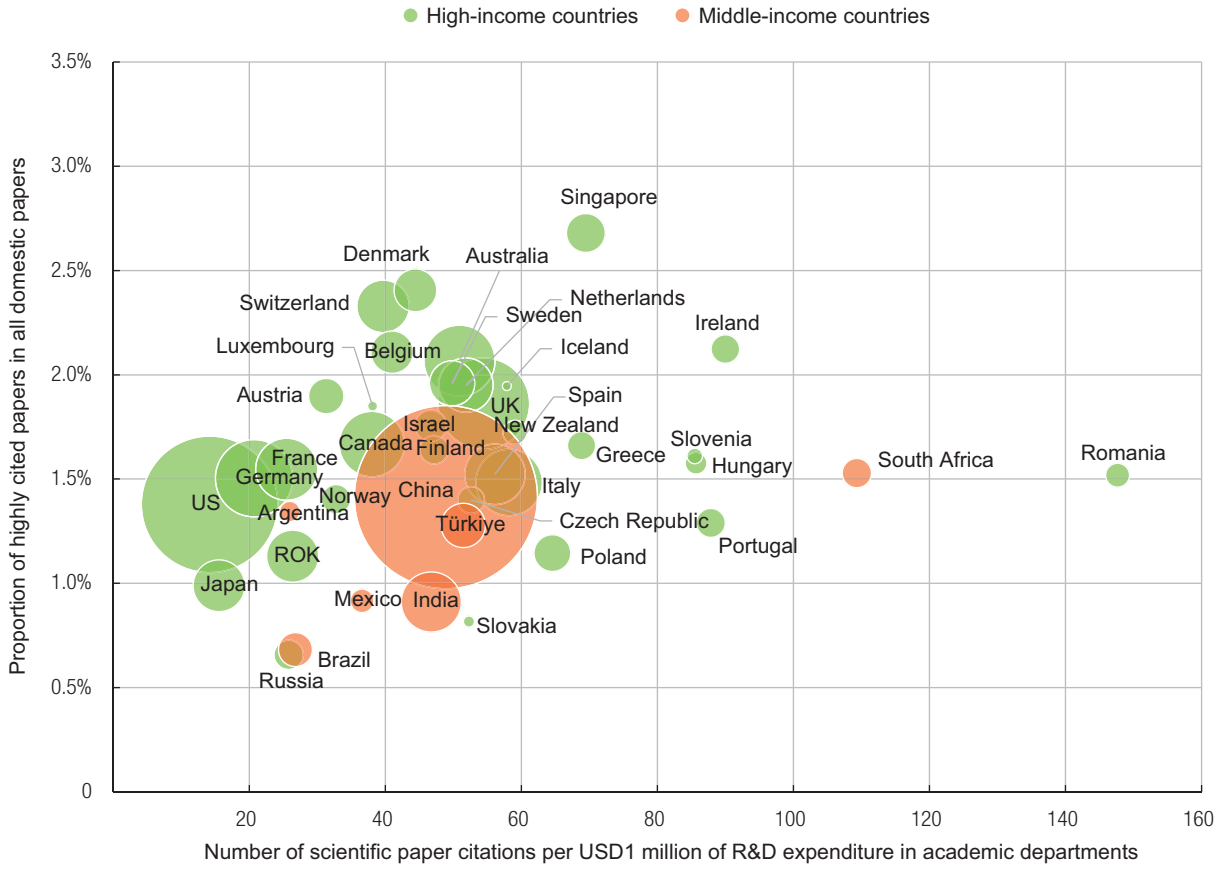


Figure 4-3 Influence of S&T papers

Note: The size of the bubble is proportionate to the number of highly cited papers.

III. The US, Japan, the ROK, and China stand out in intellectual property creation

The US, Japan, and the ROK are global leaders in both the scale and efficiency of invention patent output. China holds over 3.3 million invention patents, firmly placing it at the top globally. Japan and the US each have over 1.5 million patents, while the ROK has over 900,000, ranking second to fourth respectively. Germany has over 240,000 patents, and Italy, France, and Russia each have over 160,000, all making it into the top eight. In terms of output efficiency, most of these countries excel in performance. Measured by invention patents in force per 10,000 employed individuals, the ROK leads with 331.2 patents, followed by Japan with close to 240 patents. The US has close to 100 patents, Italy has over 75 patents, France, Switzerland, and Germany each have 50 to 60 patents, and China has over 45 patents, all of which are in the top eight. Austria, Finland, Sweden, and five other countries have between 20 and 35 patents. The UK, Israel, Canada, Slovenia, and Spain have between 10 and 18 patents. Australia, Singapore, New Zealand, and 16 other countries have fewer than 10 patents (Figure 4-4).

From Figure 4-4 China and the ROK are the top two in terms of both the scale and efficiency of industrial design output, and some developing countries also have high output efficiency. China has over 700,000 industrial design registrations, far ahead of other countries. The ROK follows with over 47,000 registrations, Japan has over 20,000, and India, the US, and Türkiye each have over 13,000, ranking second to sixth. France, the UK, Germany, Brazil, Russia, and five other countries have over 1,000 registrations. In terms of output efficiency, measured by the number of industrial design applications per USD100 million of industrial value-added, China ranks first with 10.1 registrations, followed by the ROK with nearly nine registrations. Türkiye, India, Japan, France, and Luxembourg each have more than one registration, ranking third to seventh. The UK, Brazil, Argentina, South Africa, New Zealand, the Netherlands, and Russia have between 0.5 and 1 registrations. The remaining 26 countries have fewer than 0.5 registrations.

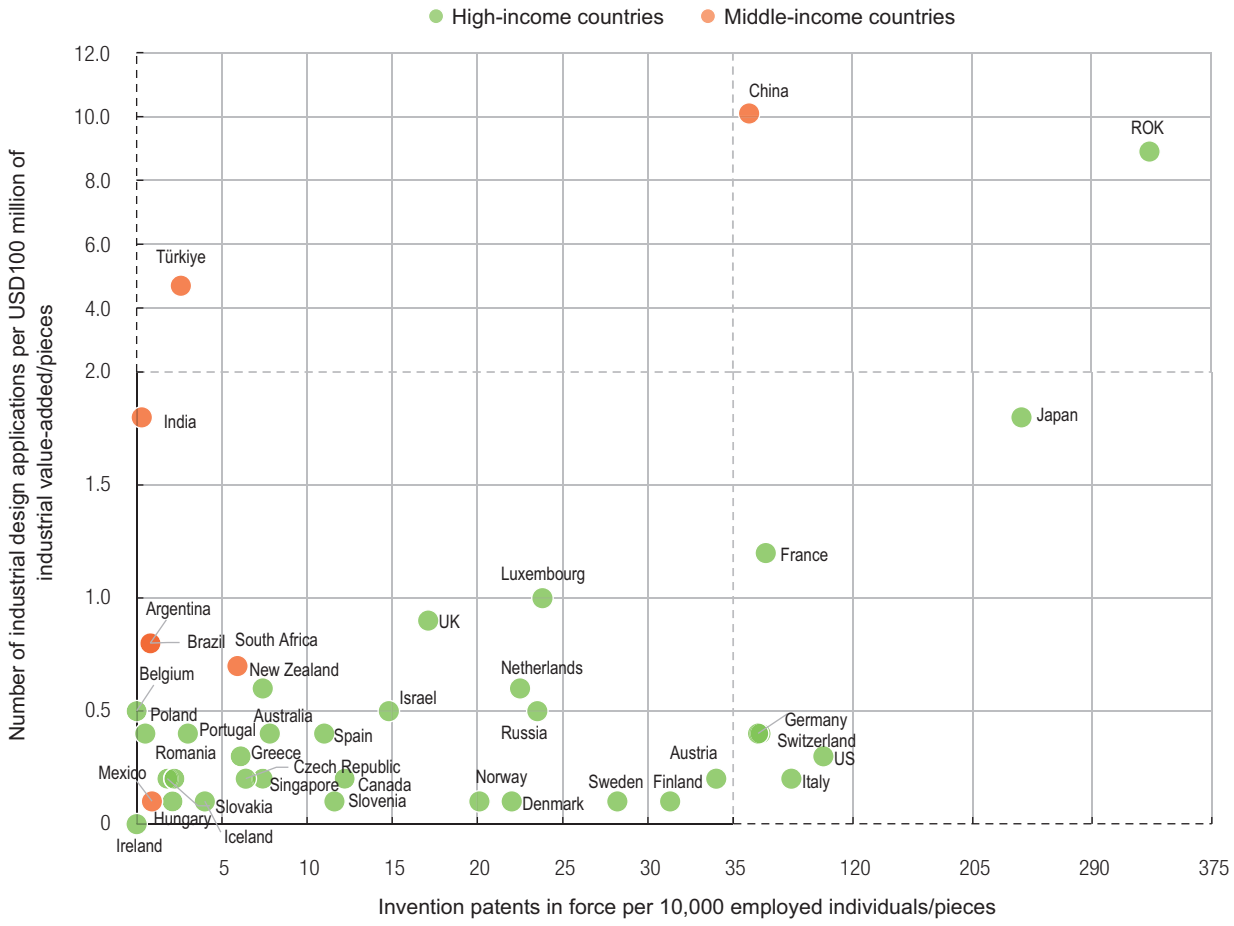


Figure 4-4 Intellectual property output

IV. China is in the global top ten on knowledge creation

1. China has made it into the top ten on knowledge creation with outstanding performance on intellectual property

China has scored 83.9 points on the knowledge creation sub-index, ranking seventh globally. While there remains a significant gap compared to the top three countries, i.e. Denmark, Switzerland, and the US, the differences with the Netherlands and Sweden, ranking fifth and sixth respectively, are relatively smaller, at 1.3 and 0.3 points (Figure 4-5).

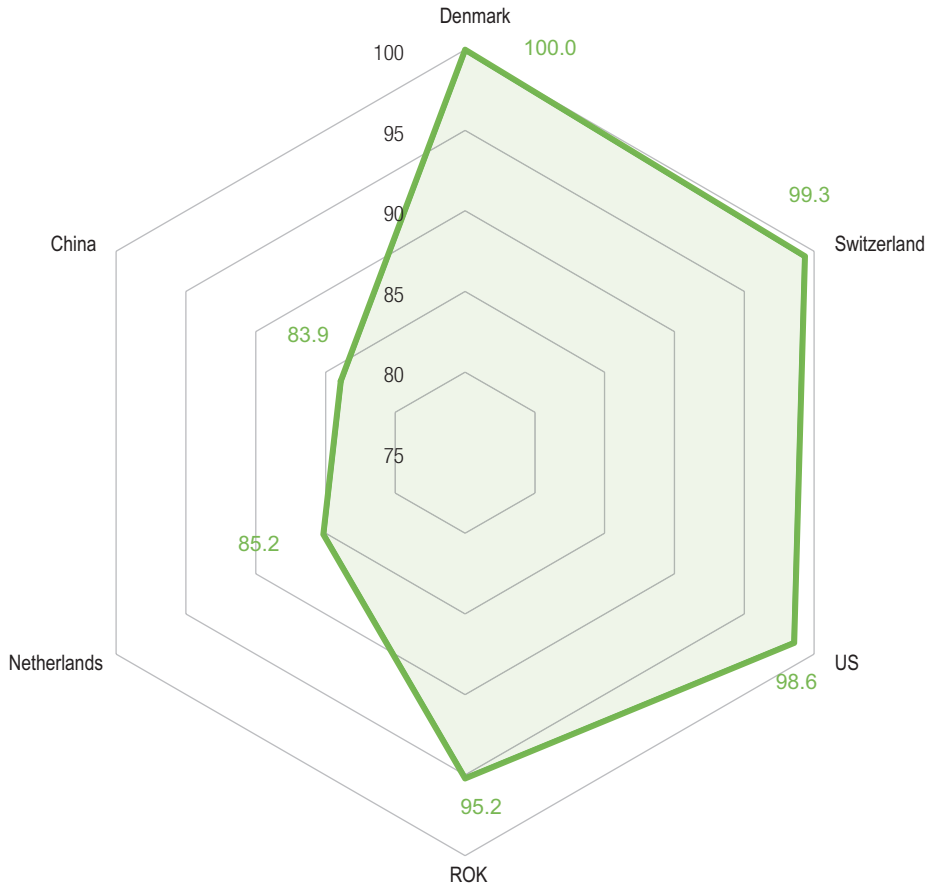


Figure 4-5 Scores of China and the top five countries on the knowledge creation sub-index

China's high ranking in knowledge creation is primarily due to its strong performance in intellectual property-related indicators. Specifically, China excels in two indicators, i.e. invention patents in force per 10,000 employed individuals and number of industrial design applications per USD100 million of industrial value-added, ranking eighth and first respectively. On the other hand, its weaknesses are mostly reflected in academic paper-related indicators. On the two indicators of number of scientific paper citations per USD1 million of R&D expenditure in academic departments, and proportion of highly cited papers in all domestic papers, although China has scored over 50 points, its rankings are relatively low, at 21st and 26th respectively. Moreover, on the number of S&T papers per USD1 million of R&D expenditure, China is even at the 31st place (Figure 4-6).

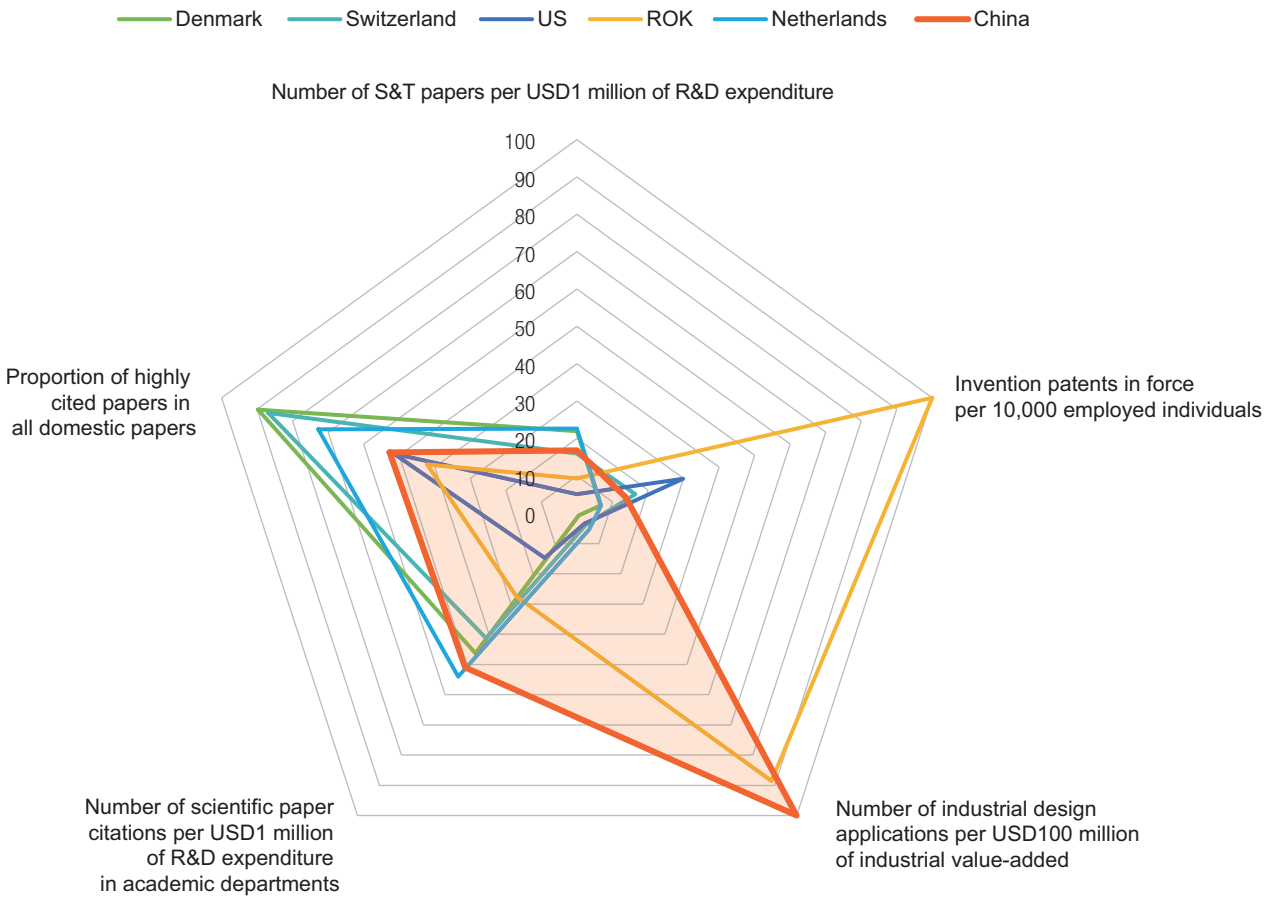


Figure 4-6 Scores of China and the top five countries on the innovation resources sub-index

2. China's invention patents in force is rapidly increasing, and it leads the world in industrial design registrations

The two indicators related to intellectual property reflect the output efficiency of invention patents and industrial designs. Specifically, China ranks eighth on invention patents in force per 10,000 employed individuals, trailing behind France, Switzerland, and Germany. It also holds a distinctive advantage in the number of industrial design applications per USD100 million of industrial value-added, ranking first globally (Figure 4-7).

From the perspective of changes, between 2010 and 2022 (statistical year, same below), China has witnessed a surge in invention patents in force per 10,000 employed individuals, rising from 3.4 to 45.7, and the advance of its global ranking from the the 27th to the eighth place, thanks to the rapid growth in the invention patents in force, for which China is the world's No.1. This represents a leapfrog development. However, to catch up with France (57.9), Switzerland (54.3), and Germany (52.6), which are ahead of China, further efforts are needed. The gaps with leading countries such as the ROK (331.2), Japan (239.7), and the US (98.8) are even wider. The number of industrial design applications per USD100 million of industrial value-added has fluctuated over the years, mostly remaining between 9 and 12. It currently stands at 10.1 and has consistently ranked first globally in most years. Compared to the countries behind, i.e. the ROK (8.9), Türkiye (4.7), Japan (1.8), France (1.2), the UK (0.9), Germany (0.4), and the US (0.3), China has a clear lead and a significant advantage (Figure 4-7, Figure 4-8).

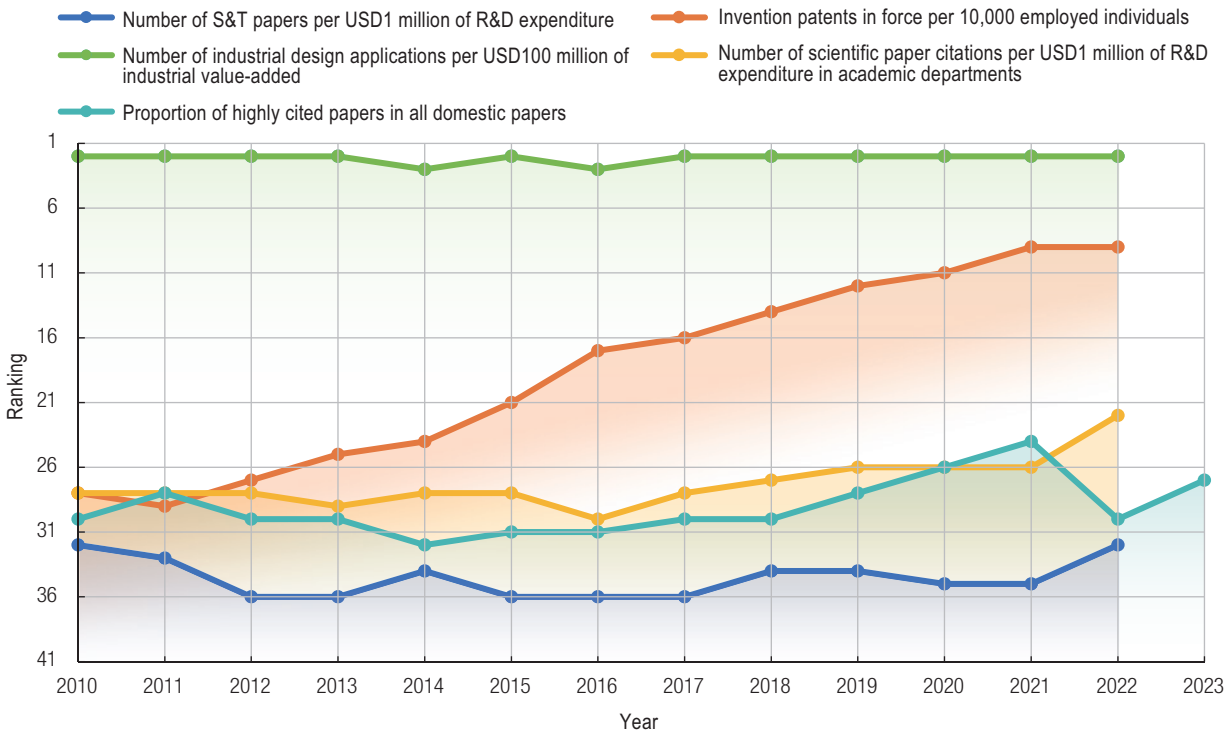


Figure 4-7 Changes in rankings on the knowledge creation indicators

Note: "Year" indicates the year of data.

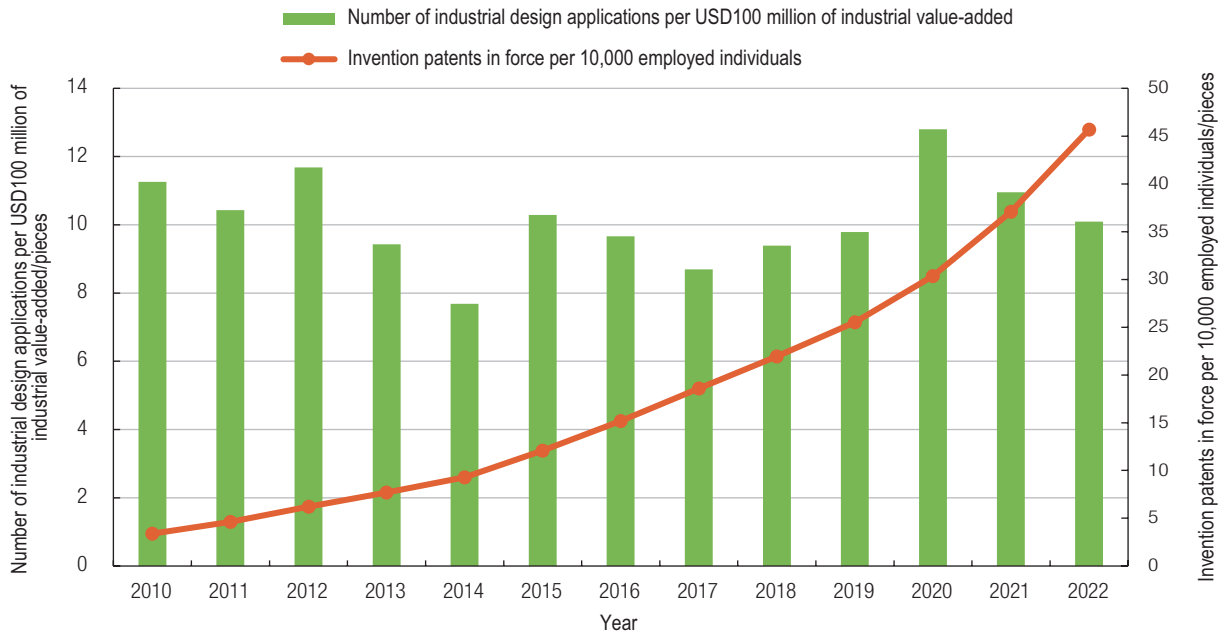


Figure 4-8 Changes in data on intellectual-property-related indicators

Note: "Year" indicates the year of data.

3. China is relatively low on the efficiency of paper output, but holds certain advantages over major innovative countries

The three indicators related to paper output reflect the output efficiency and impact of S&T papers. Specifically, China ranks 31st on the number of scientific papers per million US dollars of R&D expenditure, which is lower than most small European countries but higher than major innovative countries. On the number of scientific paper citations per USD1 million of R&D expenditure in academic departments, China ranks 21st, also higher than major innovative countries. On the proportion of highly cited papers in all domestic papers, China is at the 26th place (Figure 4-9).

From the perspective of changes, since 2012, the number of S&T papers per USD1 million of R&D expenditure has maintained an upward trend, increasing from 1.1 to 1.6 papers in 2022. Although there is still a significant gap compared to leading countries such as South Africa (9.7 papers) and Romania (9.2 papers), this indicator is generally low among major countries. China's figure is similar to the UK's (1.8 papers) and higher than those of France, Germany, the ROK, Japan, and the US. The ranking has improved slowly, rising from the 35th to the 31st place. The proportion of highly cited papers in all domestic papers has slightly dropped after a decade of steady increase, but remained above 1.4% in recent years, which is comparable to France (1.5%), Germany (1.5%), and the US (1.4%), and higher than the ROK (1.1%) and Japan (1.0%), as shown in Figure 4-9.

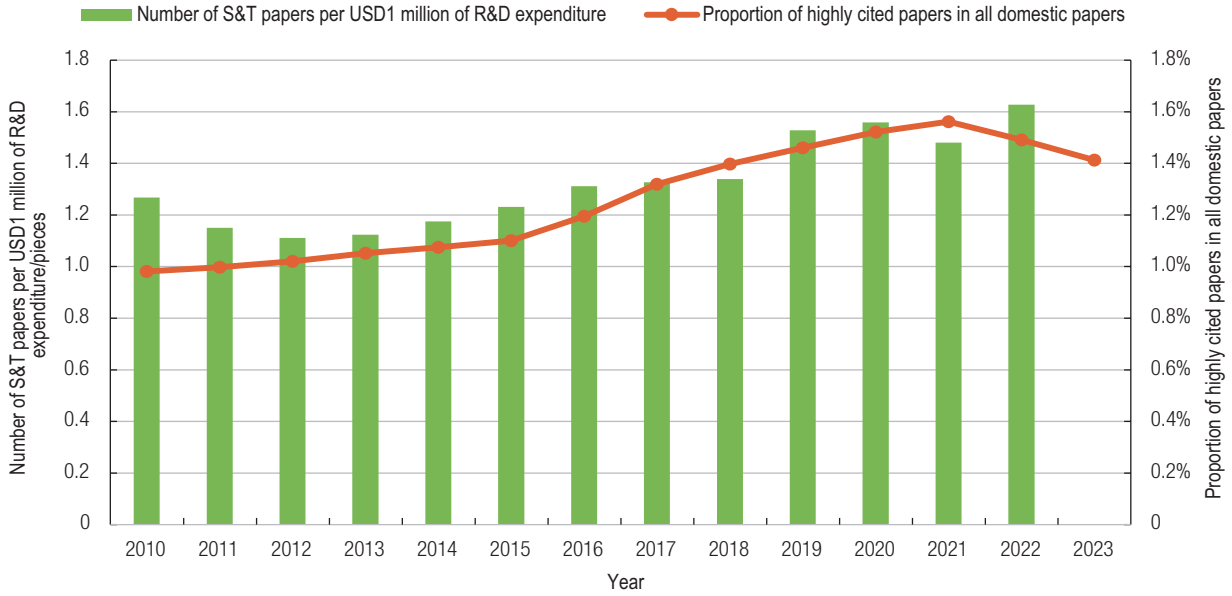


Figure 4-9 Changes in data on S&T-paper-related indicators

5

Enterprise Innovation

The US and Japan lead in enterprise innovation capability

The US and Israel have a clear advantage in the intensity of corporate R&D investment

Major S&T countries excel in intellectual property creation and conversion

China is in the first group on enterprise innovation capability

Enterprises are the main actors of innovation and feature importantly in the national innovation system. The scale and output efficiency of enterprise innovation represents, to a large extent, a country's innovation capability. The sub-index of enterprise innovation consists of nine second-level indicators, i.e. ratio of enterprise R&D expenditure to value-added, enterprise researchers as a share of total researchers, average R&D expenditure intensity of the top ten R&D-spending companies in the country, triadic patents as a share of the world's total, PCT applications per 10,000 enterprise researchers, proportion of intellectual property royalty income in service exports, economic growth rate, density of newly registered companies, and number of high-growth technology companies, which are used to measure the innovation activities of enterprises.

I. The US and Japan lead in enterprise innovation capability

In terms of the rankings on the enterprise innovation sub-index, there are significant gaps among the three groups. The first group includes the US, Japan, Switzerland, the Netherlands, the UK, Sweden, the ROK, Germany, China, Israel, Luxembourg, Australia, Iceland, France, and Finland. All these countries have scored over 40 points, with an average of 52.6 points. The second group consists of 15 countries, including Denmark, Poland, Canada, New Zealand, and Singapore, with scores ranging from 20 to 40 points and an average of 31.8 points. The remaining 10 countries belong to the third group, with an average score of 17.0 points (Figure 5-1). The US and Japan, ranking first and second among the 40 countries, have a clear advantage over the other countries. Switzerland, the third on the ranking table, has a score of only 55.9 points, trailing far behind the US and Japan.

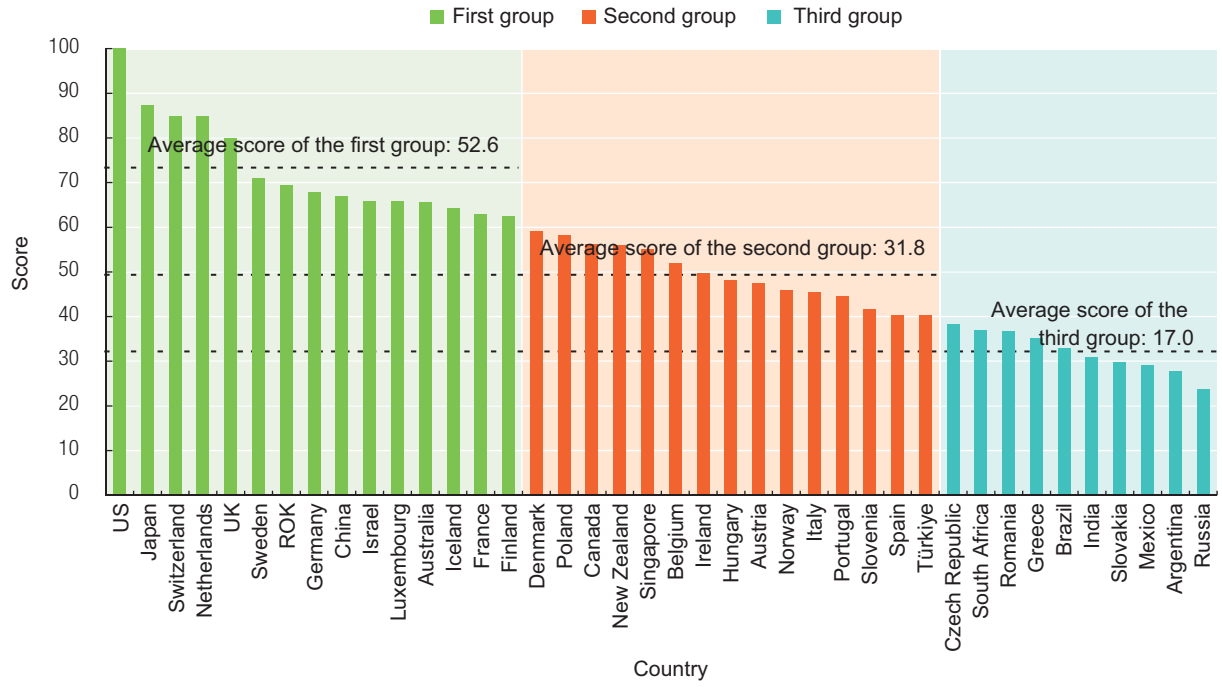


Figure 5-1 Global rankings and scores of countries on the enterprise innovation sub-index

II. The US and Israel have a clear advantage in the intensity of corporate R&D investment

The innovation capability of enterprises is an important source of market competitiveness, and the intensity of R&D investment is a significant indicator of an enterprise's innovation capability. Measured by the ratio of enterprise R&D expenditure to value-added, Israel has the most active enterprise R&D activities, far ahead of other countries. The US, the ROK, Belgium, the UK, Sweden, and Japan also have relatively high levels of R&D expenditure intensity in their corporate sector. Typically, leading enterprises that invest the most in R&D are also major innovation entities with strong innovation capabilities in the country. Looking at the average R&D expenditure among the top ten enterprises in each country, Poland, the US, Argentina, Denmark, Israel, and Switzerland all exceed 10%, placing them in relatively leading positions (Figure 5-2).

"Enterprise researchers as a share of total researchers" reflects the status of enterprise innovation activities in the society. The ROK has the highest proportion of enterprise researchers in the total number of researchers, reaching 82.6%, followed by the US at 81.3%. Israel, Japan, Sweden, and the Netherlands are in the range of 70%-80%. Austria, Canada, Belgium, France, Türkiye, Germany, Denmark, Finland, and Hungary also perform well, with proportions between 60% and 70%. Brazil, India, Argentina, and South Africa have proportions of less than 30%.

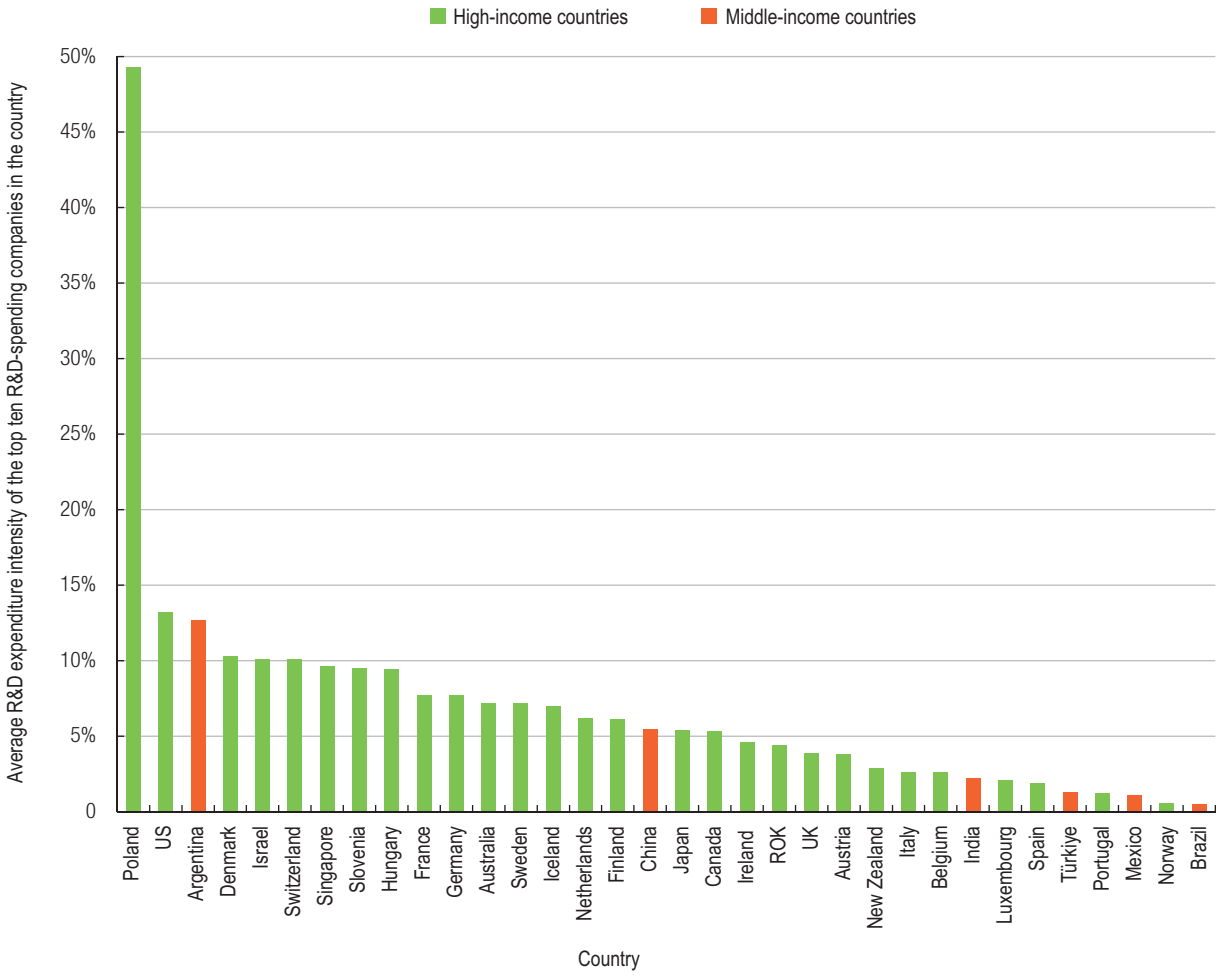


Figure 5-2 Average R&D expenditure intensity of the top ten R&D-spending companies in the country

III. Major S&T countries excel in intellectual property creation and conversion

The overseas patent layout of enterprises reflects the influence and competitiveness of their technology and products in the international market. The number of triadic patents and the volume of national phase PCT authorizations are key indicators for measuring the internationalization of enterprise patents. Japan and the US have a clear advantage in the number of triadic patents, with 16,000 and 13,400 respectively, accounting for more than half of the global total. China, Germany, and the ROK follow closely, with 6,106, 4,364, and 3,663 triadic patents respectively, representing 10.6%, 7.5%, and 6.3% of the global total. Other countries with over 1,000 triadic patents include France, the UK, and Switzerland.

PCT applications per 10,000 enterprise researchers can be used to measure the enterprise's efficiency in producing international patents. The US, Japan, China, the ROK, and Germany all

have over 20,000 national phase PCT authorizations. However, in terms of the output efficiency of enterprise researchers, Luxembourg and Switzerland have a clear advantage, both exceeding 5,000 patents. Other countries with more than 1,000 PCT patents per 10,000 enterprise researchers include South Africa, Japan, Sweden, the Netherlands, Finland, Germany, Ireland, Denmark, Italy, and Norway (Figure 5-3). Japan and Germany rank high in both the scale and efficiency of national phase PCT authorization.

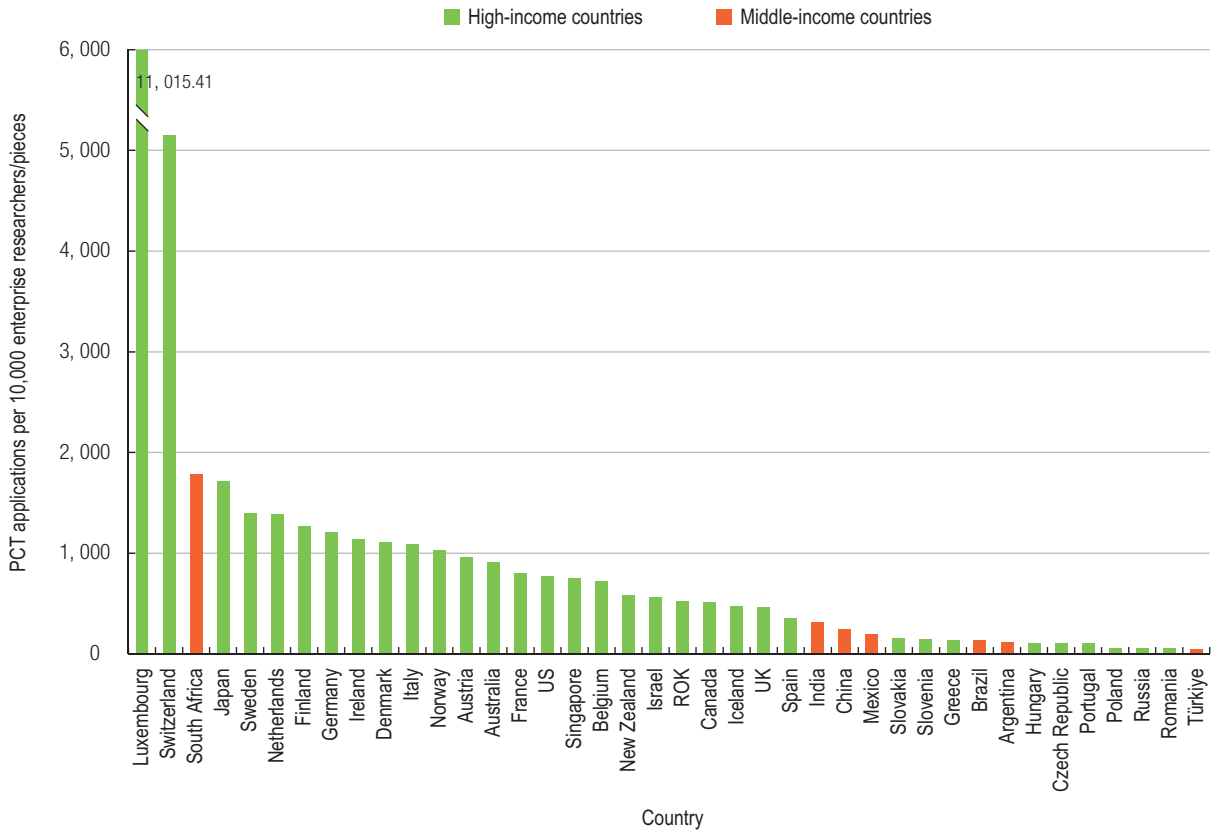


Figure 5-3 PCT applications per 10,000 enterprise researchers

The intellectual property (IP) royalty income reflects a country's ability to export technology and its international competitiveness. In 2023, ten countries had IP royalty income exceeding USD10 billion, namely the US, Japan, Germany, the Netherlands, the UK, Switzerland, France, Ireland, Singapore, and China. Among them, Japan, Switzerland, the Netherlands, the US, and Germany also had a relatively high proportion of IP royalty income in their service exports, all surpassing 10%. Among the 40 countries, half had IP royalty income accounting for more than 3% of their service exports, while eight countries had less than 1% (Figure 5-4).

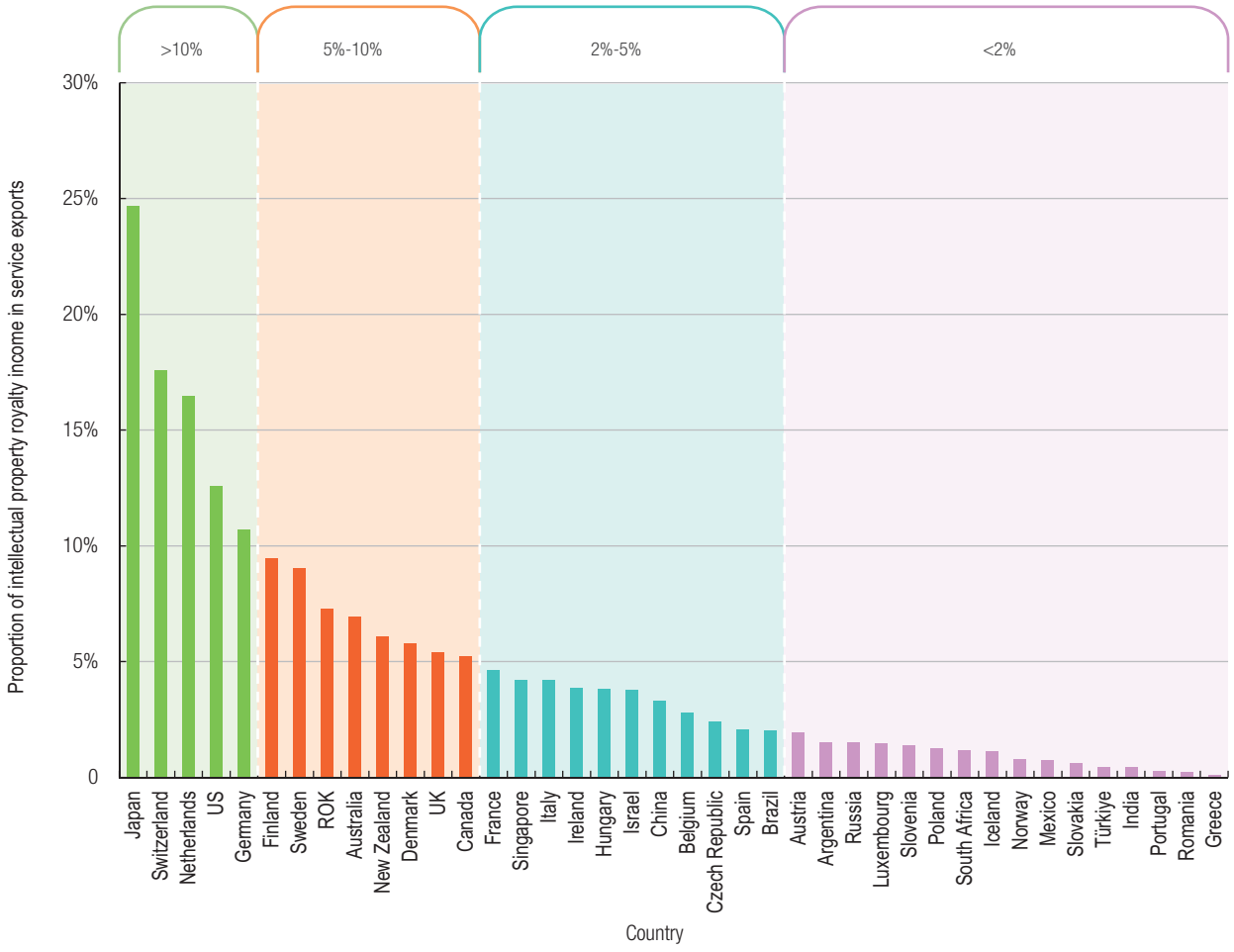


Figure 5-4 Proportion of intellectual property royalty income in service exports

IV. China is in the first group on enterprise innovation capability

The US, Japan, Switzerland, the Netherlands, and the UK are the top five countries on the enterprise innovation sub-index. China has scored 46.1 points on the sub-index, ranking ninth among the 40 countries. As its performance on the nine second-level indicators suggests, there is still a gap of varying degrees between China and the top five countries.

China has relative advantages in terms of the indicators of number of high-growth technology enterprises, enterprise researchers as a share of total researchers, and triadic patents as a share of the world's total. On the number of high-growth technology enterprises, China ranks second, next only to the US. On enterprise researchers as a share of total researchers, China has the highest score of over 70 points among the nine indicators, but remains at the middle of the ranking table. On triadic patents as a share of the world's total, China has a relatively low score of 37.9 points, but still ranks 3rd globally.

On indicators such as ratio of enterprise R&D expenditure to value-added, average R&D expenditure intensity of the top ten R&D-spending companies in the country, and proportion of intellectual property royalty income in service exports, China is at a relatively disadvantaged position, with scores below 20 points, and stands at the middle or slightly below the middle of the ranking table (Figure 5-5, Figure 5-6). To further lift its rankings on the enterprise innovation sub-index, China needs to increase the intensity of R&D expenditure and focus on enhancing the ability of enterprises to create and protect intellectual property overseas.

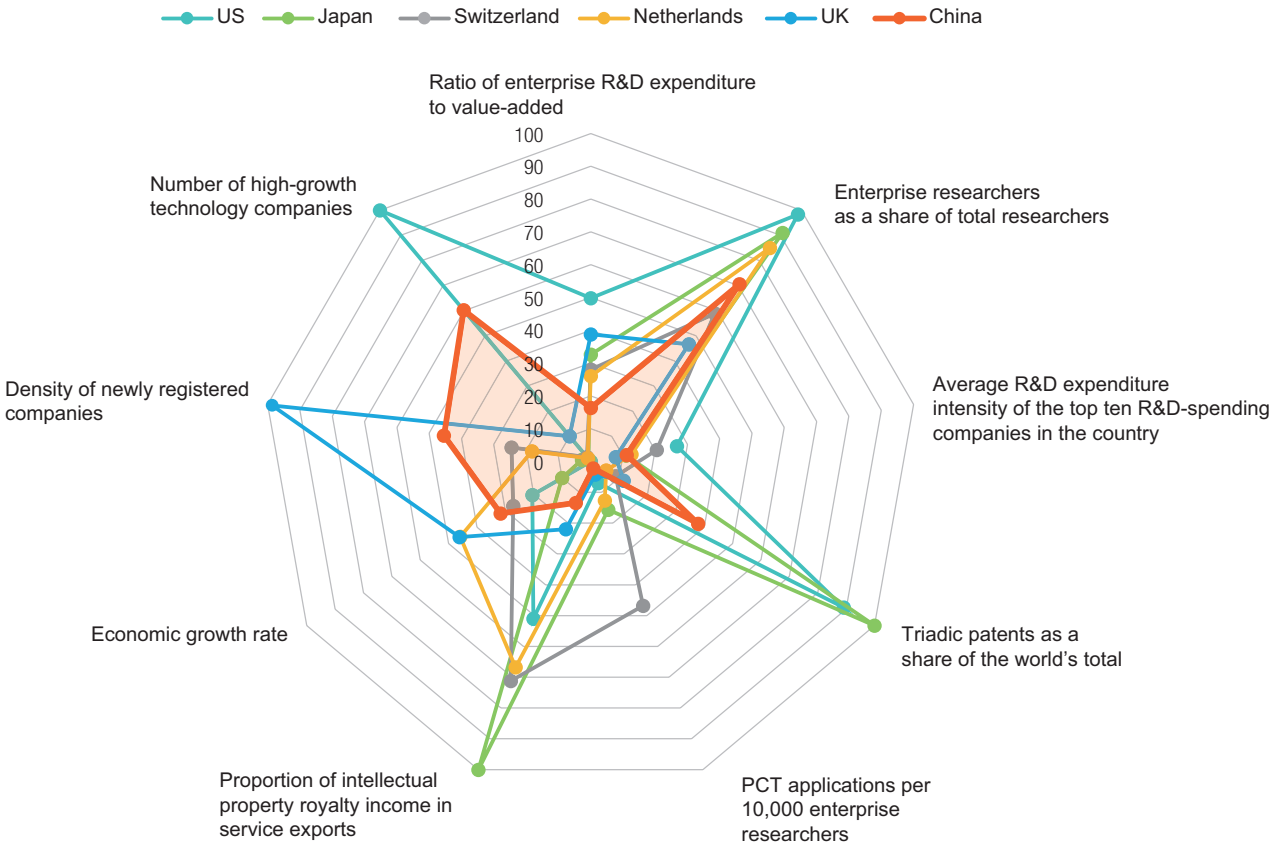


Figure 5-5 China and the top five countries on the enterprise innovation sub-index

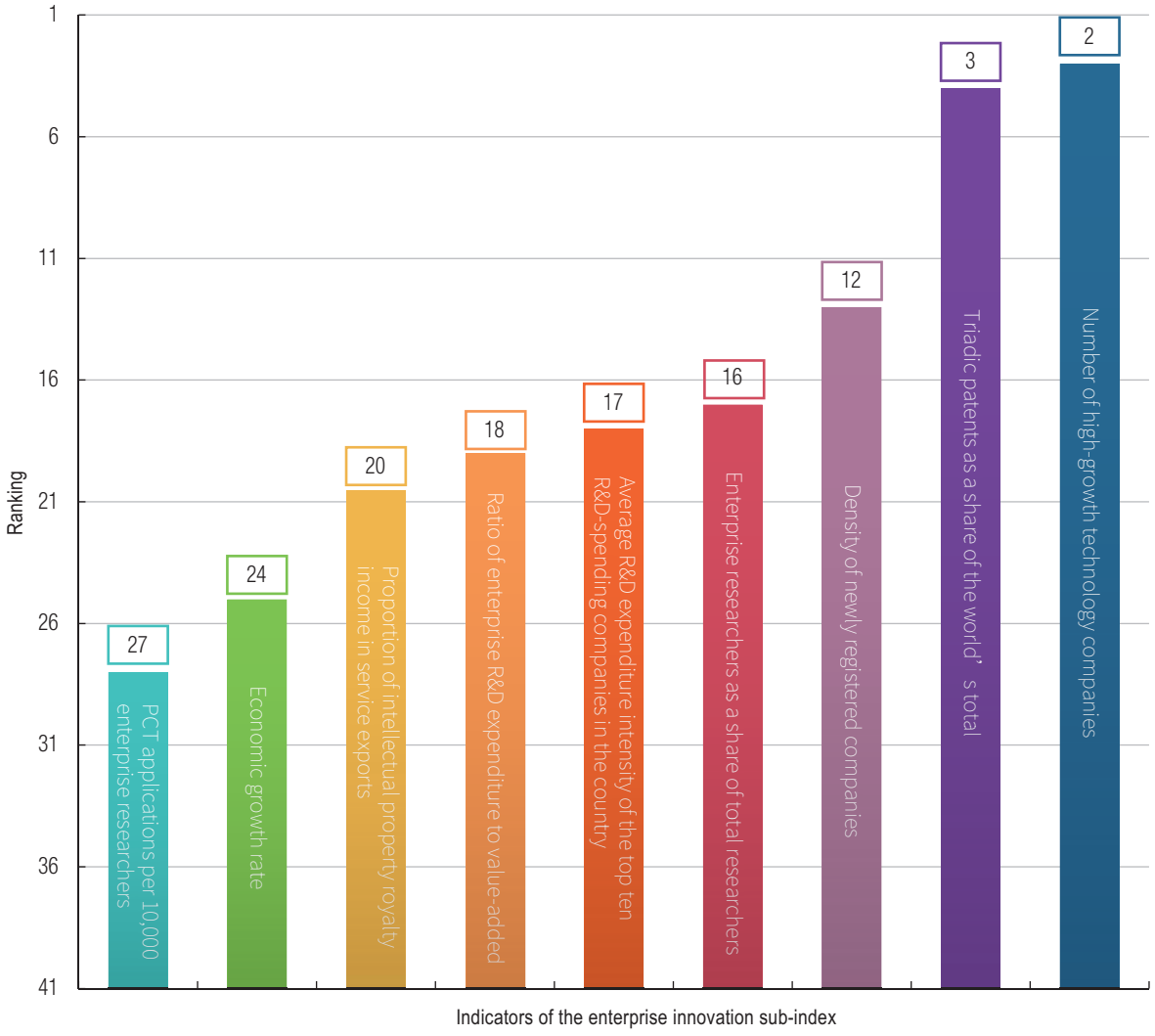


Figure 5-6 China's global rankings on the indicators of the enterprise innovation sub-index

6

Innovation Performance

Countries exhibit a gradient pattern of distribution on innovation performance

There are significant differences in the innovation levels between manufacturing and service industries across countries

Developed countries have a clear advantage in green and low-carbon development

China is in the middle of the second group on innovation performance

Innovation performance refers to the various outcomes generated by innovation activities, as well as their direct and indirect impacts on the economy and society. The innovation performance sub-index consists of six indicators, i.e. proportion of knowledge-intensive service industries in the total value-added of the service sector, proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector, proportion of high-tech products in total manufacturing exports, labor productivity, economic output per unit of energy consumption, and economic output per unit of CO_2 emission. These are used to measure and evaluate the output level of innovation activities and their contribution to the economy.

I. Countries exhibit a gradient pattern of distribution on innovation performance

As the scores of the innovation performance sub-index suggest, there is a notable gradient distribution among the 40 countries. Countries in the first group have all scored over 60 points, with an average of 73.3 points; countries in the second group have scored between 40 and 60 points, with an average of 49.3 points; countries in the third group have scored between 20 and 40 points, with an average of 32.1 points (Figure 6-1). Within each group, the differences between adjacent countries are less than significant.

The top ten countries in terms of innovation performance are Switzerland, Ireland, Singapore, Norway, Sweden, Denmark, the UK, France, Israel, and Belgium. Being the only country with a score of over 90 points, Switzerland has established a notable lead on the index. Ireland, Singapore, Norway, and Sweden also excel in performance, with scores above 80 points. Germany and the US are at the lower end of the first group. India, Russia, Brazil, and most other middle-income countries are in the third group.

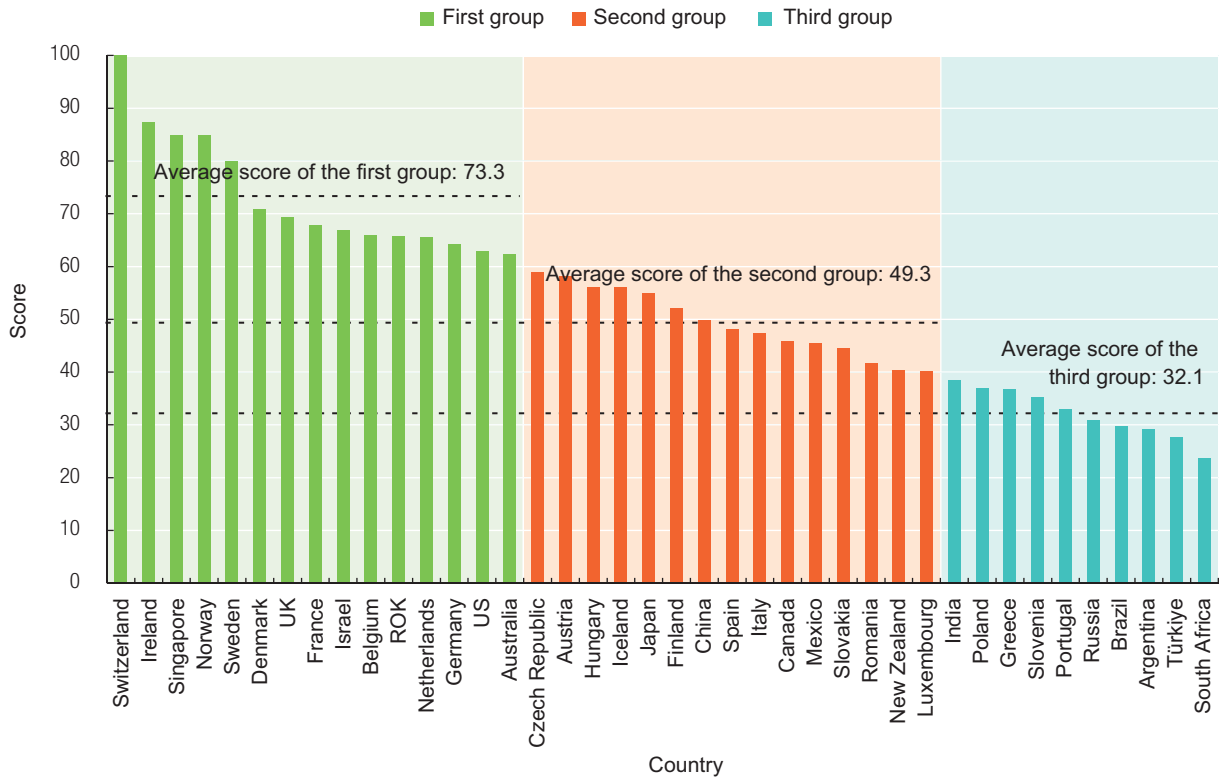


Figure 6-1 Global rankings and scores of countries on the innovation performance sub-index

II. There are significant differences in the innovation levels between manufacturing and service industries across countries

The status and contribution of knowledge-intensive and high-tech industries in a country's economy reflect the role of STI in driving economic growth. Measured by the proportion of knowledge-intensive service industries in the total value-added of the service sector, the top three countries are Ireland, Sweden, and the ROK, with proportions as high as 18.3%, 13.5%, and 11.1%, respectively. The countries ranking from fourth to 10th are Finland, India, Israel, France, Australia, Hungary, and the Czech Republic, with proportions ranging from 6.5% to 9.0%. In the third group of countries, the proportion of knowledge-intensive service industries in the total value-added of the service sector is mostly below 3% (Figure 6-2).

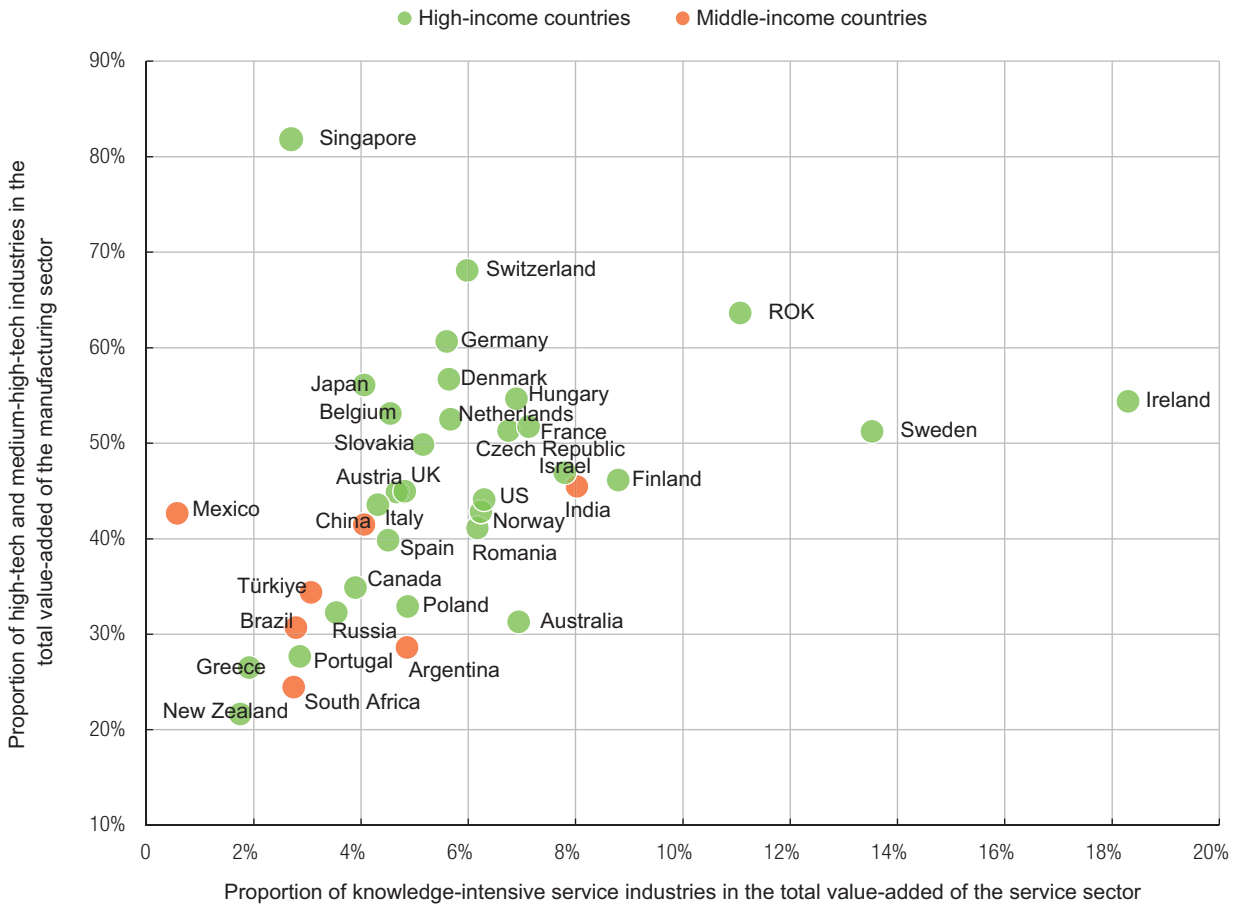


Figure 6-2 Development of knowledge and technology-intensive industries

Note: Data of Iceland, Luxembourg and Slovenia are not available.

In terms of the development level of high-tech industries in the manufacturing sector, Singapore has the highest proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector, at 81.8%. Switzerland, the ROK, and Germany also have high proportions, at 68.1%, 63.6%, and 60.6%, respectively. Other countries with a proportion exceeding 50% in the value added of high-tech and medium-high-tech industries relative to the total manufacturing value added include Denmark, Japan, Hungary, Ireland, Belgium, the Netherlands, France, the Czech Republic, and Sweden. In third-group countries, such as Argentina, Portugal, Greece, South Africa, and New Zealand, the proportion is below 30%.

III. Developed countries have a clear advantage in green and low-carbon development

STI provides a strong underpinning for green and low-carbon development. In terms of economic output per unit of energy consumption, most developed countries are at a relatively high level, while developing countries are comparatively lower. Among the 40 countries, the majority of developed countries have economic output per unit of energy consumption exceeding USD30,000 per petajoule (PJ), while most middle-income countries are in the third group, with economic output per unit of energy consumption below USD20,000 per PJ.

Ireland and Switzerland lead in economic output per unit of energy consumption, with USD109,000 per PJ and USD107,000 per PJ, respectively. The countries ranking from third to 10th are Israel, Denmark, the UK, Luxembourg, Norway, Singapore, Australia, and France, with economic output per unit of energy consumption ranging from USD450,000 to USD80,000 per PJ. China, Brazil, Türkiye, the ROK, and India lag behind, with economic output per unit of energy consumption below USD20,000 per PJ (Figure 6-3).

The carbon emissions associated with economic output reflect a country's industrial structure and economic development model, as well as the impact of STI on the environment. Measured by economic output per unit of CO_2 emission, Nordic countries have a clear advantage. Sweden, Switzerland, and Norway are the top three, with economic output per unit of CO_2 emission exceeding USD20,000 per ton. The countries ranking from fourth to 10th are Denmark, France, Ireland, Iceland, New Zealand, Luxembourg, and Singapore, with economic output per unit of CO_2 emission ranging from USD10,000 to USD15,000 per ton. The US, Japan, and Germany have economic output per unit of CO_2 emission between USD5,000 and USD7,000 per ton. Most middle-income countries are in the third group, with economic output per unit of CO_2 emission generally below USD3,000 per ton.

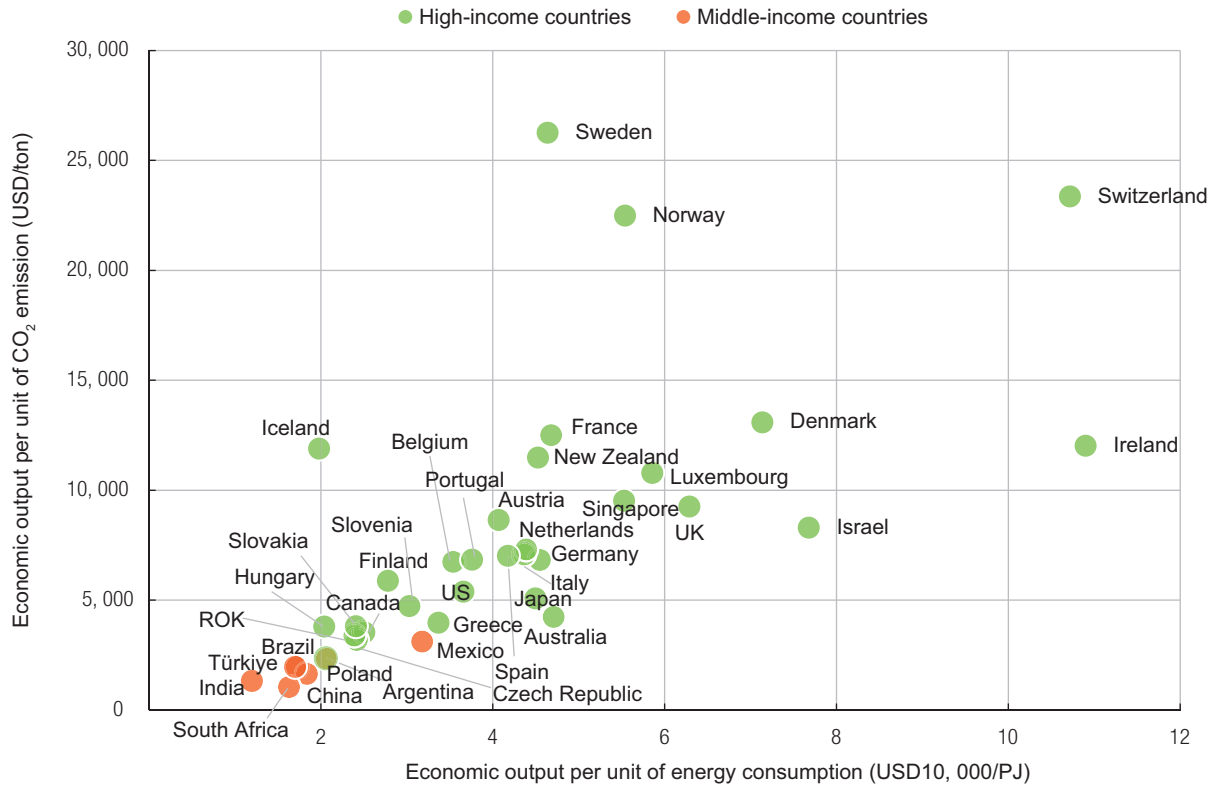


Figure 6-3 Energy consumption and CO_2 emissions

Note: Data of Romania and Russia are not available.

IV. China is in the middle of the second group on innovation performance

Switzerland, Ireland, Singapore, Norway, and Sweden are the top five countries on the innovation performance sub-index. China has scored 49.8 points on the innovation performance sub-index, ranking 22nd among the 40 countries, which is the lowest among the five first-level indicators. Among the six second-level indicators, China is in the first group on only one indicator, the second group on two indicators, and the third group on the remaining three.

China holds a relative advantage in the indicator of the proportion of high-tech products in total manufacturing exports. It ranks eighth with a score of 56.8 points, the highest among the six indicators, and is comparable to Singapore and Norway, both of which are in the top five on the sub-index. Another indicator where China has scored over 50 points is the proportion of high-tech and medium-high-tech industries in the total value added of the manufacturing sector, which is comparable to that of Norway. Nevertheless, China still ranks only 24th globally, placing it in the middle of the second group (Figure 6-4, Figure 6-5).

The three indicators where China performs poorly are labor productivity, economic output per unit of energy consumption, and economic output per unit of CO_2 emission, all scoring below 20 points and ranking at the lower end (Figure 6-4, Figure 6-5). In recent years, China has vigorously promoted green innovation and sustainable development, achieving significant progress in driving high-quality economic development through innovation. However, compared to smaller economies, there is still a considerable gap in overall innovation performance. Therefore, while building a strong science and technology nation, China must continue to advance energy conservation, emission reduction, and carbon reduction, and pursue green development through STI applications.

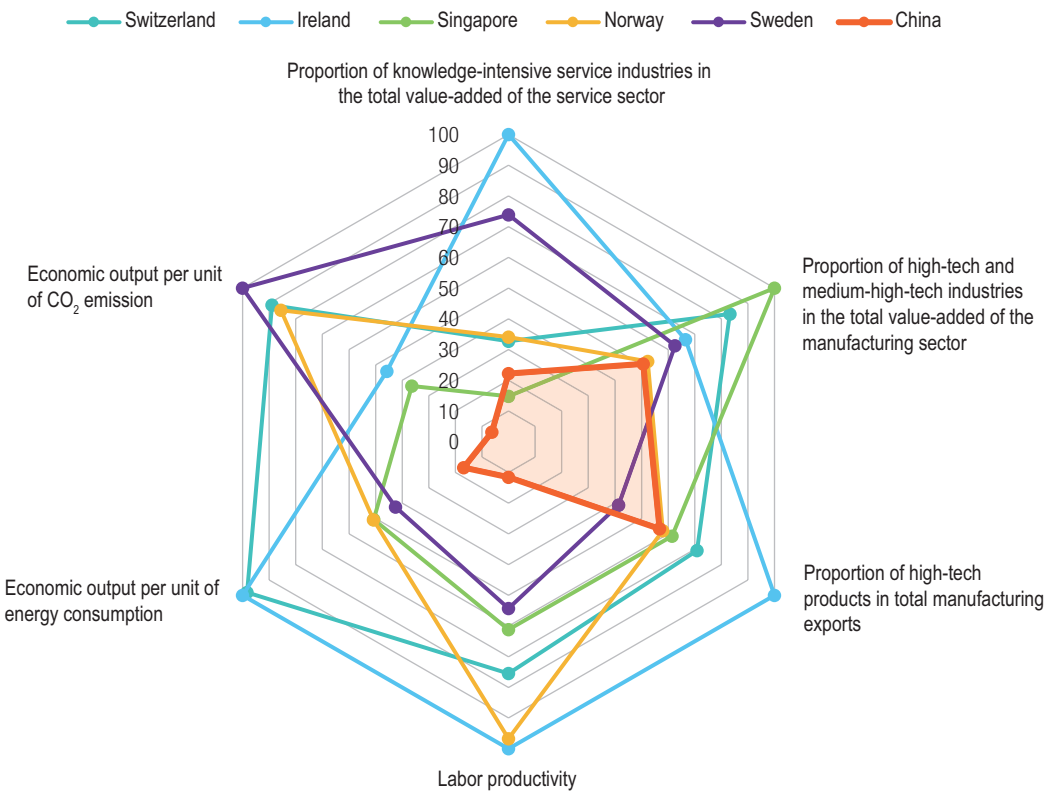


Figure 6-4 China and the top five countries on the innovation performance sub-index

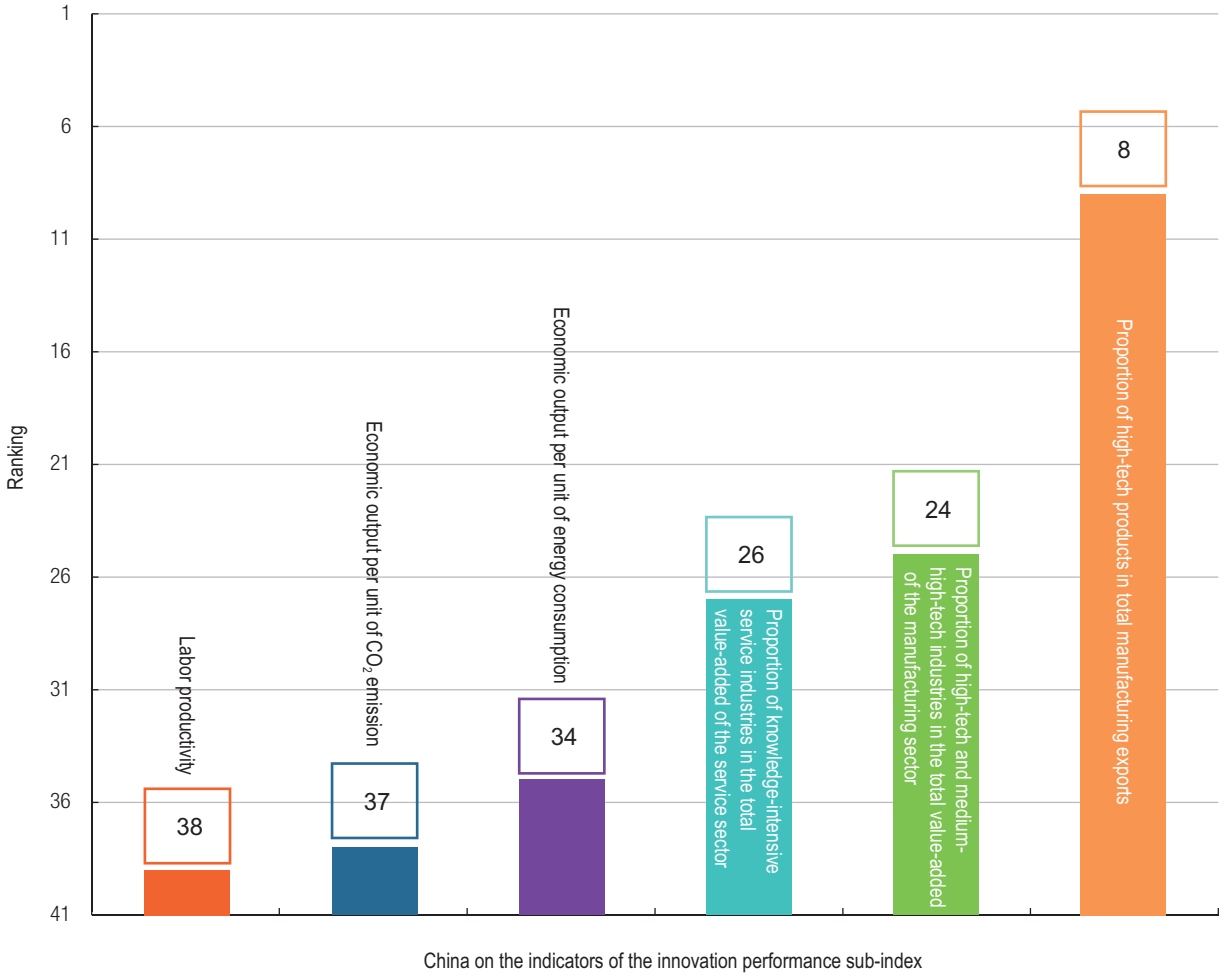


Figure 6-5 China's global rankings on the indicators of the innovation performance sub-index

7

Innovation Environment

Economically advanced countries in Europe and America lead the ranking table

Smaller countries like Switzerland and Finland have a more favorable policy environment

Countries like the US and Israel have more flexible and efficient market mechanisms

Countries like the Netherlands and Singapore have a vibrant entrepreneurial climate

China needs further improvement on innovation environment

Innovation environment provides an important guarantee for countries to improve their innovation capacity. The elements of an innovation ecosystem, including policy, system, economy, culture, and society, have a direct and comprehensive impact on innovation activities and innovation actors. The innovation environment sub-index consists of nine second-level indicators, i.e. rule-of-law environment, policy environment for doing business, e-government services, IT application, availability of venture capital, business-university collaboration in R&D, proportion of international co-authored papers in all domestic papers, ratio of international investment to GDP, and entrepreneurial culture, which are used to measure the environment and atmosphere of innovation activities from different angles.

I. Economically advanced countries in Europe and America lead the ranking table

In terms of the rankings on the innovation environment sub-index, economically advanced countries in Europe and America are at the front. Singapore ranks first, followed by Denmark, Finland, the Netherlands, Sweden, Switzerland, and the US, ranking second to seventh. These countries have all scored over 80 points, with Singapore and Denmark exceeding 90 points. Canada, Norway, Australia, Belgium, the ROK, Luxembourg, the UK, and Israel are all in the first group, with scores clustered between 77 and 79 points. Germany, France, China, Japan, India, and Italy are in the second group. Among them, only China and India are middle-income countries. Slovakia, Greece, Brazil, and other countries are in the third group, with scores ranging from 52 to 61 points (Figure 7-1).

Compared to the previous year, several countries have seen notable shifts in their rankings. Australia has made the biggest advance in ranking, followed by the ROK, moving up by ten and nine positions, respectively. Both countries have jumped from the second group into the first group. Portugal has improved by seven positions, while Denmark, Finland, and Belgium have each advanced by five positions. Denmark, in particular, has moved from seventh last year to second this year. New Zealand experienced the most significant decline, plummeting 15 positions and falling from the first group to the second group. Luxembourg also saw a substantial drop, sliding 11 positions from second to 13th within the first group.

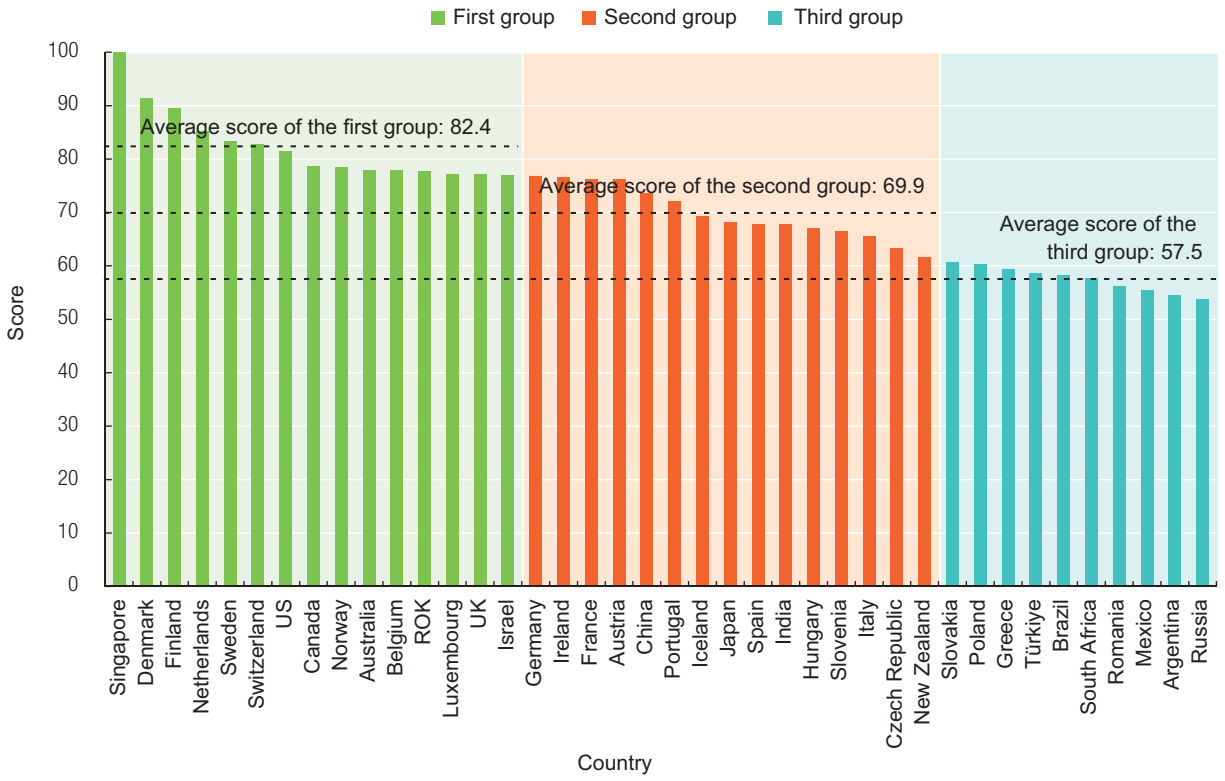


Figure 7-1 Global rankings and scores of countries on the innovation environment sub-index

II. Smaller countries like Switzerland and Finland have a more favorable policy environment

An efficient and excellent policy environment is a prerequisite for flexible and innovative entrepreneurship. On the indicator of policy environment for doing business (with a range of 1-100 points), there is a significant variation among countries. Switzerland ranks first globally, followed by Singapore and Luxembourg, with 97.5 and 95.8 points, respectively. Austria, the US, Finland, Ireland, the Netherlands, Denmark, Germany, Norway, and China have all scored between 80 and 90 points. Eight countries, including Iceland, Australia, Canada, Sweden, Belgium, the UK, Japan, and Israel, have scores ranging from 70 to 80 points. France, Italy, the ROK, the Czech Republic, and eight other countries have scores between 50 and 70 points. Romania, Brazil, Slovenia, Türkiye, and three other countries have scores between 20 and 60 points (Figure 7-2).

On the indicator of e-government services (with a range of 1-100 points), the scores are relatively balanced among countries. Finland has a full score, while the ROK and Denmark have scored around 99 points. Eight countries, including Singapore, New Zealand, Australia, the US, Japan, the Netherlands, Sweden, and Brazil, have scored above 90 points. China, Iceland, the UK, Austria, France, Israel, Slovenia, Italy, and six other countries have scores between 80 and 90 points. Norway, Portugal, India, Poland, Germany, Ireland, Greece, Switzerland, South Africa, and five other countries have scores between 60 and 80 points.

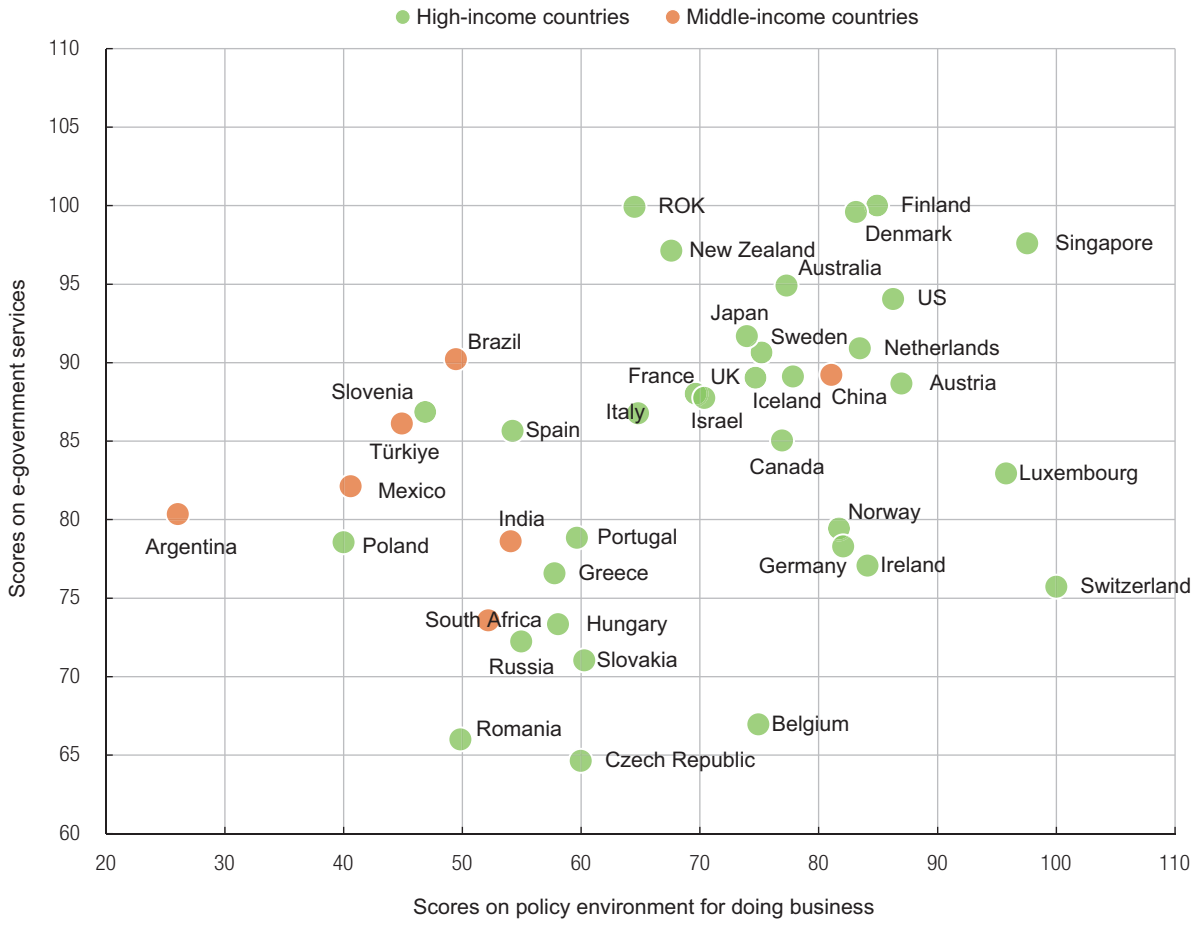


Figure 7-2 Policy environment

III. Countries like the US and Israel have more flexible and efficient market mechanisms

Smooth and flexible market mechanisms can maximize the vitality of innovation and entrepreneurship. On the indicator of business-university collaboration in R&D (with a range of 1-100 points), Israel ranks first globally, followed by the US, Switzerland, the Netherlands, and China, all scoring above 92 points. Canada, Singapore, Belgium, Sweden, the UK, Denmark, Finland, Ireland, Luxembourg, and Germany are also in the first group, with scores above 85 points. Italy, the ROK, Norway, the Czech Republic, Australia, Austria, Japan, Iceland, Portugal, South Africa, and Russia are in the second group, with scores ranging from 67 to 85 points. India, Spain, Türkiye, Brazil, Romania, Mexico, Argentina, Poland, Slovakia, and Greece are in the third group, with scores between 50 and 65 points.

On the indicator of IT application (with a range of 1-100 points), the scores among countries are relatively balanced. The US ranks first globally. Singapore, Finland, the Netherlands, and Sweden follow closely behind, all scoring above 98 points. The ROK, Denmark, Germany, the UK, Canada, Israel, Japan, Australia, and France are also in the first group, with scores around 92 points. Norway, Austria, Luxembourg, Ireland, China, Belgium, New Zealand, Iceland, and Spain are in the second group, with scores between 75 and 90 points. China is the only developing country in this group. Russia, Slovakia, Brazil, Türkiye, Greece, Romania, India, Argentina, Mexico, and South Africa are in the third group, with scores ranging from 60 to 75 points (Figure 7-3).

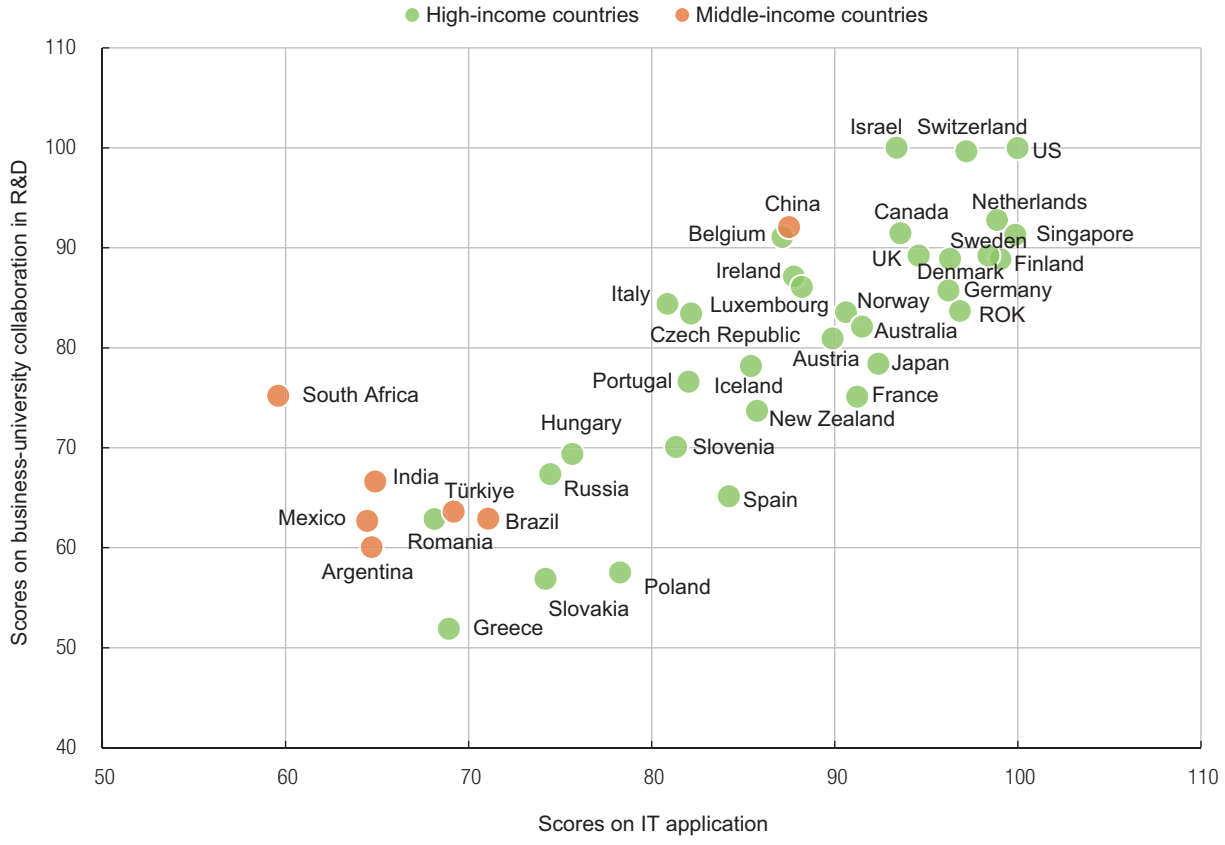


Figure 7-3 Market mechanisms

IV. Countries like the Netherlands and Singapore have a vibrant entrepreneurial climate

Innovation and entrepreneurship thrive on robust financial support, and the availability of venture capital is a key indicator of financial market activity. On the indicator of ratio of international investment to GDP (with a range of 1~100 points), Singapore has a full score, while Sweden ranks second with 47.6 points. The ROK, Australia, and Finland have scores between 20 and 30 points. Twelve countries, including Hungary, Israel, Canada, Brazil, Spain, Greece, the UK, Portugal, Poland, the Czech Republic, Romania, and Belgium, have scores between 10 and 20 points. Ten countries, including Germany, Slovenia, France, Slovakia, South Africa, Argentina, the US, New Zealand, Denmark, and Türkiye, have scores between five and 10 points. Other countries, such as India, China, and Japan, have all scored below five points.

On the indicator of entrepreneurial culture (with a range of 1-100 points), the Netherlands ranks first, followed closely by China with 95.2 points. Both countries hold significant advantages on this indicator. Finland, India, Norway, Switzerland, the ROK, the US, Ireland, and six other countries are all in the first group, all scoring above 80 points. Belgium, Austria, Australia, the UK, Spain, Sweden, and nine other countries are in the second group, with scores ranging from 63 to 80 points. Major innovative countries such as Japan and the UK also fall within this range. South Africa, Brazil, Slovakia, and six other countries have scored below 60 points (Figure 7-4).

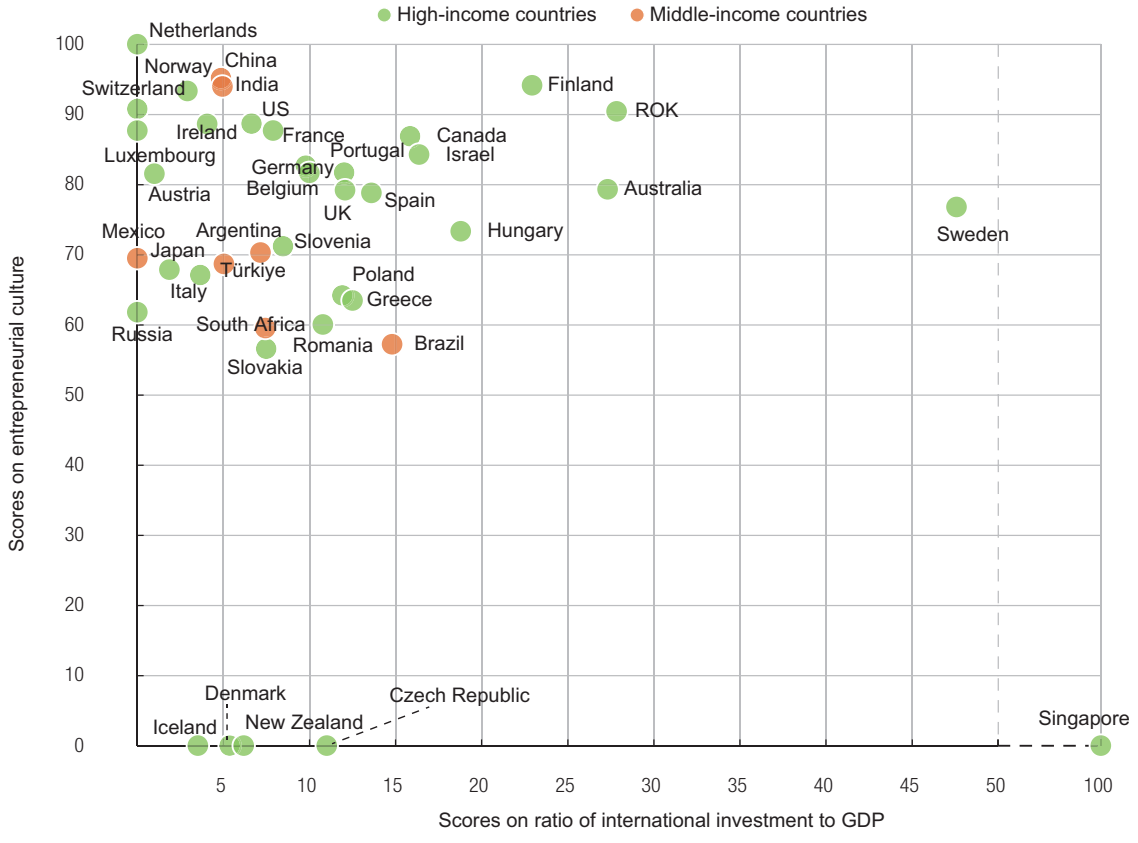


Figure 7-4 Innovation ecosystem

V. China needs further improvement on innovation environment

1. China has made progress on innovation environment ranking, but is still outside the first group

China has scored 73.6 points on innovation environment, ranking 20th globally, up three spots from the previous year. However, there remains a gap with the first group, mainly in two aspects: First, the average score of the first group is 82.4 points, while China still lags behind by about 10 points. Second, half of the countries in the first group have scored 80 points or above, with Singapore achieving a full score, Denmark scoring 91.5 points, and Finland scoring 89.5 points. All three countries have a significant advantage over China.

2.China's performance on second-level indicators is unbalanced, with strong performance in some indicators

Among the second-level indicators, China ranks 34th on the rule-of-law environment, and the last place, the 40th, on the proportion of international co-authored papers in all domestic papers, which point to the areas for future improvement (Figure 7-5). On indicators such as IT application, and ratio of international investment to GDP, China ranks 20th and 29th, respectively, placing it in the middle of the ranking table with substantial potential for growth. Notably, its ranking for the ratio of international investment to GDP has dropped significantly by 10 positions compared to the previous year, highlighting the need for further enhancement. On both indicators of policy environment for doing business and e-government services, China ranks 12th, which is in the upper-middle range globally with notable strengths. On the three indicators of entrepreneurial culture, business-university collaboration in R&D, and availability of venture capital, China ranks second, fifth, and eighth, respectively, demonstrating significant advantages. Among them, its ranking on entrepreneurial culture has improved by three positions compared to the previous year, which shows China's progress in fostering a market-oriented, law-based, and world-class business environment, and the growing innovation and entrepreneurship vitality of business entities.

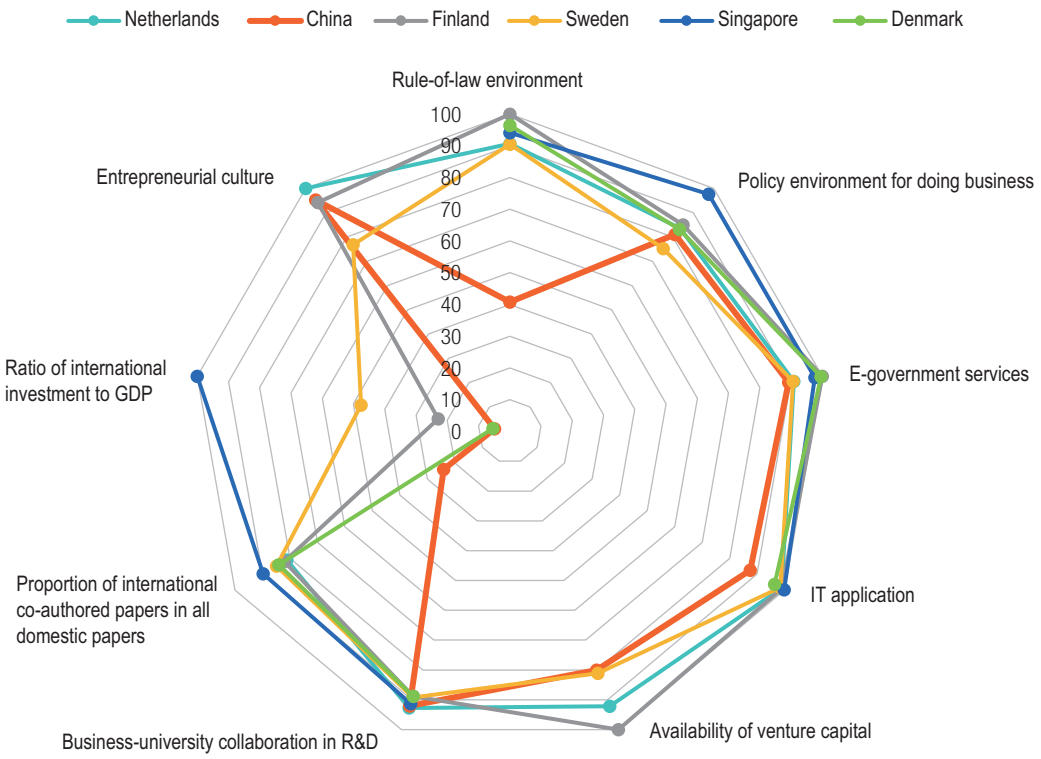


Figure 7-5 China and the top five countries on the innovation environment sub-index

Note: Data are not available for Singapore and Denmark on "availability of venture capital" and "entrepreneurial culture", and for the Netherlands on "ratio of international investment to GDP".

8

Country Profiles

Argentina

2024 Overall Index Ranking

37

Population/10,000 persons	4, 624
Area/10,000 square kilometers	278
GDP/USD100 million	6, 311.3
GDP per capita/USD	13, 650.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.1
R&D expenditure/USD100 million	34.7
R&D expenditure intensity	0.55%
SCI indexed papers/piece	10, 256
PCT patent applications/piece	29
Proportion of high-tech products in total manufacturing exports	4.8%

Innovation Resources 32

	Score	Ranking
1.1 R&D expenditure intensity	9.1	36
1.2 Share of global R&D expenditure	0.4	31
1.3 Proportion of basic research funding in total R&D expenditure	53.5	16
1.4 Number of top-tier research institutions	2.7	29
1.5 Proportion of STEM graduates in all college graduates	32.2	40
1.6 R&D personnel intensity	21.5	35
1.7 Number of highly cited scientists	0.1	35
1.8 Level of S&T human resource development	71.3	3
1.9 Average score of top three domestic universities in the world university rankings	69.2	13

Knowledge Creation 34

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	30.6	18
2.2 Invention patents in force per 10,000 employed individuals	0.2	35
2.3 Number of industrial design applications per USD100 million of industrial value-added	7.8	10
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	27.1	35
2.5 Proportion of highly cited papers in all domestic papers	50.2	30

Enterprise Innovation 39

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	2.9	37
3.2 Enterprise researchers as a share of total researchers	13.9	39
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	25.8	3
3.4 Triadic patents as a share of the world's total	0.1	37
3.5 PCT applications per 10,000 enterprise researchers	1.0	33
3.6 Proportion of intellectual property royalty income in service exports	6.2	26
3.7 Economic growth rate	52.5	10
3.8 Density of newly registered companies	1.1	38
3.9 Number of high-growth technology companies	0.1	29

Innovation Performance 38

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	26.6	20
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	34.9	34
4.3 Proportion of high-tech products in total manufacturing exports	11.7	39
4.4 Labor productivity	17.8	31
4.5 Economic output per unit of energy consumption	19.0	30
4.6 Economic output per unit of CO_2 emission	8.9	34

Innovation Environment 39

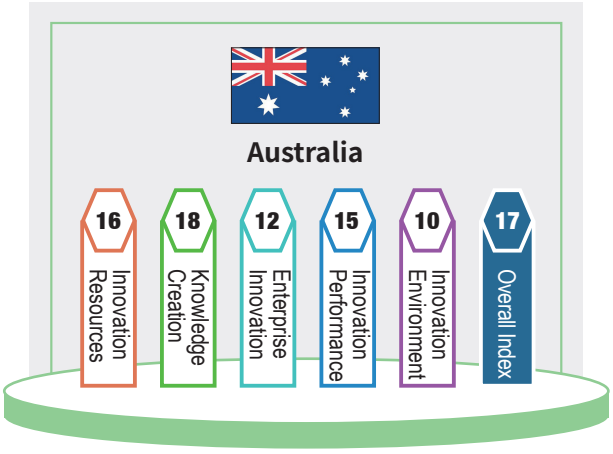
	Score	Ranking
5.1 Rule-of-law environment	26.2	38
5.2 Policy environment for doing business	26.1	40
5.3 E-government services	80.4	25
5.4 IT application	64.7	38
5.5 Availability of venture capital	49.5	35
5.6 Business-university collaboration in R&D	60.0	37
5.7 Proportion of international co-authored papers in all domestic papers	67.7	26
5.8 Ratio of international investment to GDP	7.2	23
5.9 Entrepreneurial culture	70.3	24

Australia

2024 Overall Index Ranking

17

Population/10,000 persons	2, 664
Area/10,000 square kilometers	762
GDP/USD100 million	16, 929.6
GDP per capita/USD	63, 551.8
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.7
R&D expenditure/USD100 million	268.8
R&D expenditure intensity	1.59%
SCI indexed papers/piece	85, 439
PCT patent applications/piece	1, 748
Proportion of high-tech products in total manufacturing exports	25.6%



Innovation Resources 16

		Score	Ranking
1.1	R&D expenditure intensity	26.4	21
1.2	Share of global R&D expenditure	2.9	11
1.3	Proportion of basic research funding in total R&D expenditure	60.1	10
1.4	Number of top-tier research institutions	14.7	9
1.5	Proportion of STEM graduates in all college graduates	41.0	34
1.6	R&D personnel intensity	42.9	30
1.7	Number of highly cited scientists	11.9	5
1.8	Level of S&T human resource development	70.7	4
1.9	Average score of top three domestic universities in the world university rankings	89.9	3

Knowledge Creation 18

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	32.9	16
2.2	Invention patents in force per 10,000 employed individuals	2.3	22
2.3	Number of industrial design applications per USD100 million of industrial value-added	4.2	17
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	53.0	19
2.5	Proportion of highly cited papers in all domestic papers	77.1	6

Enterprise Innovation 12

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	10.0	29
3.2	Enterprise researchers as a share of total researchers	49.3	29
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	14.5	12
3.4	Triadic patents as a share of the world's total	2.6	14
3.5	PCT applications per 10,000 enterprise researchers	8.3	14
3.6	Proportion of intellectual property royalty income in service exports	28.2	9
3.7	Economic growth rate	45.3	15
3.8	Density of newly registered companies	91.3	3
3.9	Number of high-growth technology companies	1.5	13

Innovation Performance 15

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	37.9	8
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	38.2	32
4.3	Proportion of high-tech products in total manufacturing exports	62.9	5
4.4	Labor productivity	58.0	9
4.5	Economic output per unit of energy consumption	43.3	9
4.6	Economic output per unit of CO_2 emission	16.1	25

Innovation Environment 10

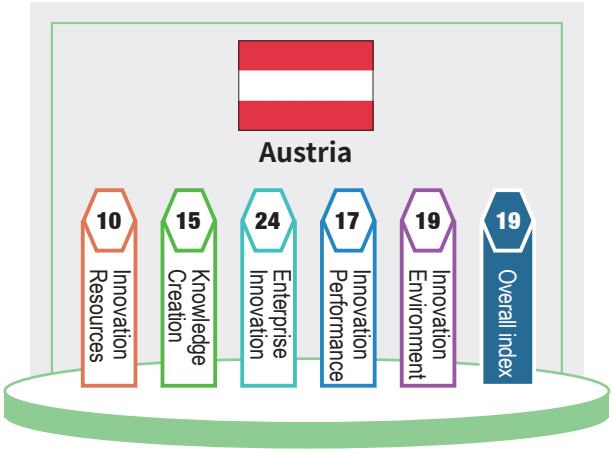
		Score	Ranking
5.1	Rule-of-law environment	88.8	12
5.2	Policy environment for doing business	77.3	14
5.3	E-government services	94.9	6
5.4	IT application	91.5	14
5.5	Availability of venture capital	73.4	19
5.6	Business-university collaboration in R&D	82.1	20
5.7	Proportion of international co-authored papers in all domestic papers	76.4	16
5.8	Ratio of international investment to GDP	27.3	4
5.9	Entrepreneurial culture	79.3	18

Austria

2024 Overall Index Ranking

19

Population/10,000 persons	904
Area/10,000 square kilometers	8
GDP/USD100 million	4, 709.4
GDP per capita/USD	52, 083.6
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.1
R&D expenditure/USD100 million	150.7
R&D expenditure intensity	3.20%
SCI indexed papers/piece	21, 795
PCT patent applications/piece	1, 421
Proportion of high-tech products in total manufacturing exports	17.1%



Innovation Resources 10

		Score	Ranking
1.1	R&D expenditure intensity	26.4	7
1.2	Share of global R&D expenditure	2.9	20
1.3	Proportion of basic research funding in total R&D expenditure	60.1	21
1.4	Number of top-tier research institutions	14.7	24
1.5	Proportion of STEM graduates in all college graduates	41.0	6
1.6	R&D personnel intensity	42.9	7
1.7	Number of highly cited scientists	11.9	18
1.8	Level of S&T human resource development	70.7	9
1.9	Average score of top three domestic universities in the world university rankings	89.9	25

Knowledge Creation 15

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	32.9	33
2.2	Invention patents in force per 10,000 employed individuals	2.3	9
2.3	Number of industrial design applications per USD100 million of industrial value-added	4.2	28
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	53.0	32
2.5	Proportion of highly cited papers in all domestic papers	77.1	10

Enterprise Innovation 24

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	10.0	12
3.2	Enterprise researchers as a share of total researchers	49.3	7
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	14.5	23
3.4	Triadic patents as a share of the world's total	2.6	17
3.5	PCT applications per 10,000 enterprise researchers	8.7	11
3.6	Proportion of intellectual property royalty income in service exports	28.2	25
3.7	Economic growth rate	45.3	11
3.8	Density of newly registered companies	91.3	35
3.9	Number of high-growth technology companies	1.5	22

Innovation Performance 17

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	37.9	22
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	38.2	19
4.3	Proportion of high-tech products in total manufacturing exports	62.9	17
4.4	Labor productivity	58.0	15
4.5	Economic output per unit of energy consumption	43.3	18
4.6	Economic output per unit of CO_2 emission	16.1	12

Innovation Environment 19

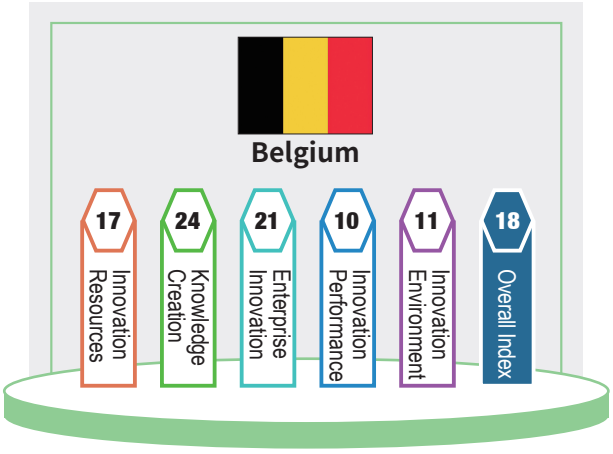
		Score	Ranking
5.1	Rule-of-law environment	88.8	7
5.2	Policy environment for doing business	77.3	4
5.3	E-government services	94.9	15
5.4	IT application	91.5	17
5.5	Availability of venture capital	73.4	18
5.6	Business-university collaboration in R&D	82.1	21
5.7	Proportion of international co-authored papers in all domestic papers	76.4	6
5.8	Ratio of international investment to GDP	27.3	35
5.9	Entrepreneurial culture	79.3	17

Belgium

2024 Overall Index Ranking

18

Population/10,000 persons	1, 169
Area/10,000 square kilometers	3
GDP/USD100 million	5, 836.1
GDP per capita/USD	49, 942.2
Economic output per unit of energy consumption/(USD10,000/petajoule)	3.5
R&D expenditure/USD100 million	198.7
R&D expenditure intensity	3.41%
SCI indexed papers/piece	28, 184
PCT patent applications/piece	1, 326
Proportion of high-tech products in total manufacturing exports	21.9%



Innovation Resources 17

		Score	Ranking
1.1	R&D expenditure intensity	56.6	5
1.2	Share of global R&D expenditure	2.2	16
1.3	Proportion of basic research funding in total R&D expenditure	22.7	32
1.4	Number of top-tier research institutions	6.7	17
1.5	Proportion of STEM graduates in all college graduates	39.8	35
1.6	R&D personnel intensity	100.0	1
1.7	Number of highly cited scientists	3.2	14
1.8	Level of S&T human resource development	55.1	15
1.9	Average score of top three domestic universities in the world university rankings	56.8	17

Knowledge Creation 24

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	14.7	34
2.2	Invention patents in force per 10,000 employed individuals	—	—
2.3	Number of industrial design applications per USD100 million of industrial value-added	4.9	15
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	42.7	26
2.5	Proportion of highly cited papers in all domestic papers	78.7	5

Enterprise Innovation 21

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	40.5	4
3.2	Enterprise researchers as a share of total researchers	75.0	9
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	5.2	26
3.4	Triadic patents as a share of the world's total	2.5	15
3.5	PCT applications per 10,000 enterprise researchers	6.5	17
3.6	Proportion of intellectual property royalty income in service exports	11.3	21
3.7	Economic growth rate	32.0	22
3.8	Density of newly registered companies	33.6	17
3.9	Number of high-growth technology companies	0.7	19

Innovation Performance 10

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	24.8	23
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	64.9	9
4.3	Proportion of high-tech products in total manufacturing exports	53.8	9
4.4	Labor productivity	54.7	11
4.5	Economic output per unit of energy consumption	32.5	21
4.6	Economic output per unit of CO_2 emission	25.6	19

Innovation Environment 11

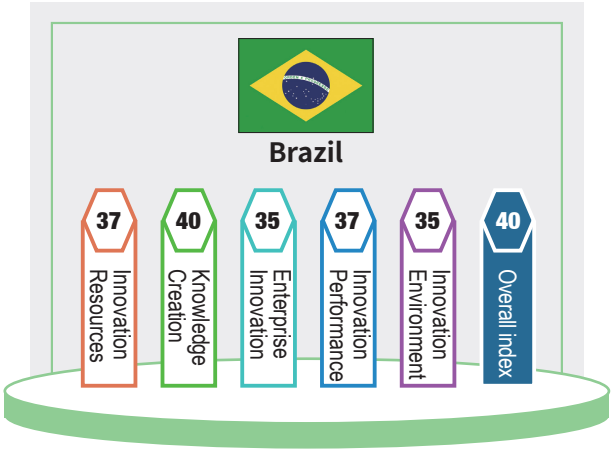
		Score	Ranking
5.1	Rule-of-law environment	78.6	19
5.2	Policy environment for doing business	74.9	17
5.3	E-government services	67.0	38
5.4	IT application	87.1	21
5.5	Availability of venture capital	89.4	3
5.6	Business-university collaboration in R&D	91.0	8
5.7	Proportion of international co-authored papers in all domestic papers	89.1	5
5.8	Ratio of international investment to GDP	10.0	17
5.9	Entrepreneurial culture	81.6	16

Brazil

2024 Overall Index Ranking

40

Population/10,000 persons	21, 531
Area/10,000 square kilometers	855
GDP/USD100 million	19, 519.2
GDP per capita/USD	9, 065.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	1.7
R&D expenditure/USD100 million	169.1
R&D expenditure intensity	0.87%
SCI indexed papers/piece	53, 516
PCT patent applications/piece	546
Proportion of high-tech products in total manufacturing exports	9.1%



Innovation Resources 37

	Score	Ranking
1.1 R&D expenditure intensity	14.4	34
1.2 Share of global R&D expenditure	1.8	18
1.3 Proportion of basic research funding in total R&D expenditure	—	—
1.4 Number of top-tier research institutions	5.8	18
1.5 Proportion of STEM graduates in all college graduates	37.4	38
1.6 R&D personnel intensity	10.3	38
1.7 Number of highly cited scientists	0.7	23
1.8 Level of S&T human resource development	40.2	30
1.9 Average score of top three domestic universities in the world university rankings	47.9	24

Knowledge Creation 40

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	35.8	15
2.2 Invention patents in force per 10,000 employed individuals	0.2	36
2.3 Number of industrial design applications per USD100 million of industrial value-added	8.3	9
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	27.9	33
2.5 Proportion of highly cited papers in all domestic papers	25.4	39

Enterprise Innovation 35

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	5.4	34
3.2 Enterprise researchers as a share of total researchers	31.7	37
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	0.9	34
3.4 Triadic patents as a share of the world's total	—	—
3.5 PCT applications per 10,000 enterprise researchers	1.5	29
3.6 Proportion of intellectual property royalty income in service exports	8.3	24
3.7 Economic growth rate	32.0	21
3.8 Density of newly registered companies	27.0	20
3.9 Number of high-growth technology companies	1.9	11

Innovation Performance 37

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	15.3	32
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	37.5	33
4.3 Proportion of high-tech products in total manufacturing exports	22.2	31
4.4 Labor productivity	7.5	39
4.5 Economic output per unit of energy consumption	15.8	35
4.6 Economic output per unit of CO_2 emission	7.5	36

Innovation Environment 35

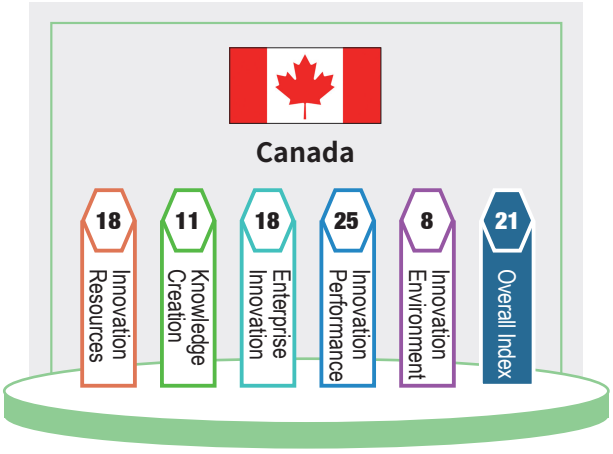
	Score	Ranking
5.1 Rule-of-law environment	31.5	36
5.2 Policy environment for doing business	49.5	35
5.3 E-government services	90.2	11
5.4 IT application	71.1	33
5.5 Availability of venture capital	63.9	29
5.6 Business-university collaboration in R&D	62.9	34
5.7 Proportion of international co-authored papers in all domestic papers	50.1	34
5.8 Ratio of international investment to GDP	14.8	9
5.9 Entrepreneurial culture	57.2	34

Canada

2024 Overall Index Ranking

21

Population/10,000 persons	3, 893
Area/10,000 square kilometers	999
GDP/USD100 million	21, 614.8
GDP per capita/USD	55, 522.3
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.5
R&D expenditure/USD100 million	370.0
R&D expenditure intensity	1.71%
SCI indexed papers/piece	80, 049
PCT patent applications/piece	2, 573
Proportion of high-tech products in total manufacturing exports	13.7%



Innovation Resources 18

		Score	Ranking
1.1	R&D expenditure intensity	28.4	19
1.2	Share of global R&D expenditure	4.0	8
1.3	Proportion of basic research funding in total R&D expenditure	—	—
1.4	Number of top-tier research institutions	13.4	13
1.5	Proportion of STEM graduates in all college graduates	56.0	16
1.6	R&D personnel intensity	58.6	19
1.7	Number of highly cited scientists	8.1	6
1.8	Level of S&T human resource development	51.8	21
1.9	Average score of top three domestic universities in the world university rankings	84.7	5

Knowledge Creation 11

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	24.5	23
2.2	Invention patents in force per 10,000 employed individuals	3.7	19
2.3	Number of industrial design applications per USD100 million of industrial value-added	1.8	30
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	39.6	29
2.5	Proportion of highly cited papers in all domestic papers	62.2	15

Enterprise Innovation 18

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	15.4	20
3.2	Enterprise researchers as a share of total researchers	76.0	8
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	10.7	19
3.4	Triadic patents as a share of the world's total	4.4	13
3.5	PCT applications per 10,000 enterprise researchers	4.7	21
3.6	Proportion of intellectual property royalty income in service exports	21.2	13
3.7	Economic growth rate	40.5	20
3.8	Density of newly registered companies	52.0	8
3.9	Number of high-growth technology companies	4.6	6

Innovation Performance 25

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	21.3	28
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	42.6	28
4.3	Proportion of high-tech products in total manufacturing exports	33.6	23
4.4	Labor productivity	51.8	13
4.5	Economic output per unit of energy consumption	23.0	26
4.6	Economic output per unit of CO_2 emission	13.4	29

Innovation Environment 8

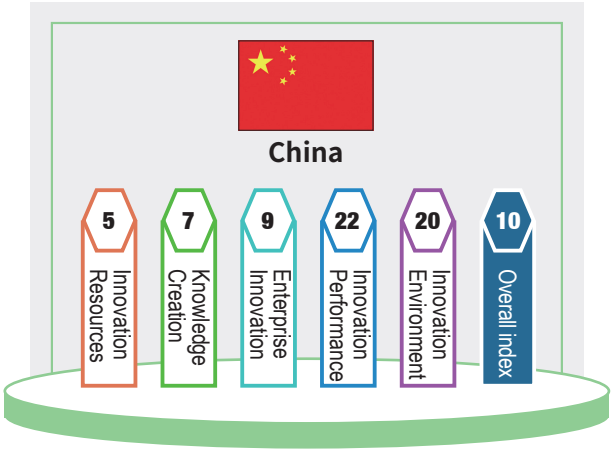
		Score	Ranking
5.1	Rule-of-law environment	87.4	13
5.2	Policy environment for doing business	76.9	15
5.3	E-government services	85.0	22
5.4	IT application	93.6	11
5.5	Availability of venture capital	76.2	15
5.6	Business-university collaboration in R&D	91.5	6
5.7	Proportion of international co-authored papers in all domestic papers	73.9	20
5.8	Ratio of international investment to GDP	15.8	8
5.9	Entrepreneurial culture	86.9	12

China

2024 Overall Index Ranking

10

Population/10,000 persons	141, 236
Area/10,000 square kilometers	960
GDP/USD100 million	178, 817.8
GDP per capita/USD	12, 662.6
Economic output per unit of energy consumption/(USD10,000/petajoule)	1.8
R&D expenditure/USD100 million	4, 569.1
R&D expenditure intensity	2.56%
SCI indexed papers/piece	728, 419
PCT patent applications/piece	70, 039
Proportion of high-tech products in total manufacturing exports	23.1%



Innovation Resources 5

		Score	Ranking
1.1	R&D expenditure intensity	42.5	14
1.2	Share of global R&D expenditure	49.5	2
1.3	Proportion of basic research funding in total R&D expenditure	15.8	34
1.4	Number of top-tier research institutions	49.6	2
1.5	Proportion of STEM graduates in all college graduates	100.0	1
1.6	R&D personnel intensity	35.0	34
1.7	Number of highly cited scientists	49.0	2
1.8	Level of S&T human resource development	39.7	31
1.9	Average score of top three domestic universities in the world university rankings	87.2	4

Knowledge Creation 7

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	16.8	31
2.2	Invention patents in force per 10,000 employed individuals	13.8	8
2.3	Number of industrial design applications per USD100 million of industrial value-added	100.0	1
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	51.0	21
2.5	Proportion of highly cited papers in all domestic papers	52.7	26

Enterprise Innovation 9

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	16.4	18
3.2	Enterprise researchers as a share of total researchers	70.6	16
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	11.2	17
3.4	Triadic patents as a share of the world's total	37.9	3
3.5	PCT applications per 10,000 enterprise researchers	2.2	27
3.6	Proportion of intellectual property royalty income in service exports	13.4	20
3.7	Economic growth rate	31.7	24
3.8	Density of newly registered companies	45.4	12
3.9	Number of high-growth technology companies	60.2	2

Innovation Performance 22

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	22.2	26
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	50.7	24
4.3	Proportion of high-tech products in total manufacturing exports	56.8	8
4.4	Labor productivity	11.6	38
4.5	Economic output per unit of energy consumption	16.9	34
4.6	Economic output per unit of CO_2 emission	6.3	37

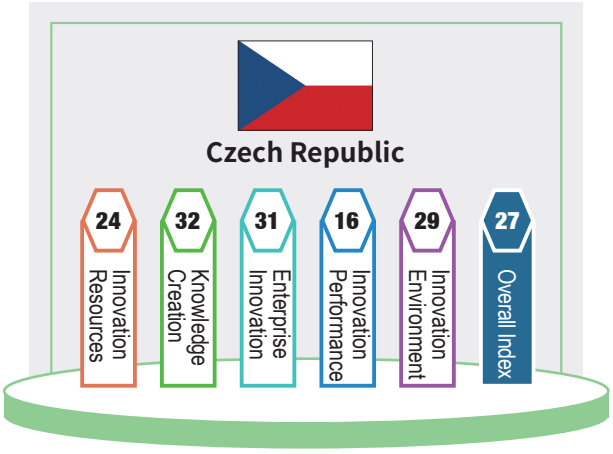
Innovation Environment 20

		Score	Ranking
5.1	Rule-of-law environment	40.8	34
5.2	Policy environment for doing business	81.1	12
5.3	E-government services	89.2	12
5.4	IT application	87.5	20
5.5	Availability of venture capital	80.0	8
5.6	Business-university collaboration in R&D	92.0	5
5.7	Proportion of international co-authored papers in all domestic papers	24.0	40
5.8	Ratio of international investment to GDP	4.9	29
5.9	Entrepreneurial culture	95.2	2

Czech Republic

2024 Overall Index Ranking
27

Population/10,000 persons	1, 051
Area/10,000 square kilometers	8
GDP/USD100 million	2, 905.7
GDP per capita/USD	27, 657.2
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.4
R&D expenditure/USD100 million	57.1
R&D expenditure intensity	1.96%
SCI indexed papers/piece	16, 579
PCT patent applications/piece	249
Proportion of high-tech products in total manufacturing exports	21.2%



Innovation Resources 24

	Score	Ranking
1.1 R&D expenditure intensity	32.6	18
1.2 Share of global R&D expenditure	0.6	27
1.3 Proportion of basic research funding in total R&D expenditure	60.9	8
1.4 Number of top-tier research institutions	1.8	33
1.5 Proportion of STEM graduates in all college graduates	54.5	19
1.6 R&D personnel intensity	64.0	16
1.7 Number of highly cited scientists	0.3	29
1.8 Level of S&T human resource development	46.0	28
1.9 Average score of top three domestic universities in the world university rankings	33.6	33

Knowledge Creation 32

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	31.3	17
2.2 Invention patents in force per 10,000 employed individuals	1.9	25
2.3 Number of industrial design applications per USD100 million of industrial value-added	2.0	29
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	54.8	15
2.5 Proportion of highly cited papers in all domestic papers	52.2	28

Enterprise Innovation 31

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	13.8	23
3.2 Enterprise researchers as a share of total researchers	64.9	20
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	—	—
3.4 Triadic patents as a share of the world's total	0.4	25
3.5 PCT applications per 10,000 enterprise researchers	8.1	35
3.6 Proportion of intellectual property royalty income in service exports	9.7	22
3.7 Economic growth rate	24.9	32
3.8 Density of newly registered companies	21.5	23
3.9 Number of high-growth technology companies	0.1	29

Innovation Performance 16

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	36.9	10
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	62.7	12
4.3 Proportion of high-tech products in total manufacturing exports	52.1	11
4.4 Labor productivity	25.5	26
4.5 Economic output per unit of energy consumption	22.2	27
4.6 Economic output per unit of CO_2 emission	12.1	31

Innovation Environment 29

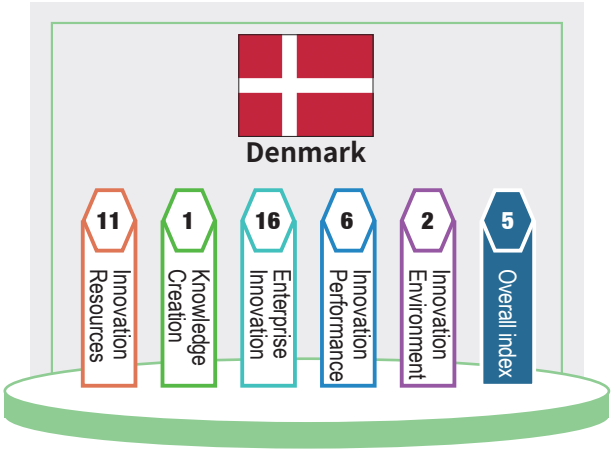
	Score	Ranking
5.1 Rule-of-law environment	72.7	23
5.2 Policy environment for doing business	60.0	26
5.3 E-government services	64.6	40
5.4 IT application	82.2	25
5.5 Availability of venture capital	—	—
5.6 Business-university collaboration in R&D	83.4	19
5.7 Proportion of international co-authored papers in all domestic papers	75.8	17
5.8 Ratio of international investment to GDP	11.0	15
5.9 Entrepreneurial culture	—	—

Denmark

2024 Overall Index Ranking

5

Population/10,000 persons	586
Area/10,000 square kilometers	4
GDP/USD100 million	4, 001.7
GDP per capita/USD	68, 322.9
Economic output per unit of energy consumption/(USD10,000/petajoule)	7.1
R&D expenditure/USD100 million	115.7
R&D expenditure intensity	2.89%
SCI indexed papers/piece	23, 866
PCT patent applications/piece	1, 499
Proportion of high-tech products in total manufacturing exports	15.8%



Innovation Resources 11

		Score	Ranking
1.1	R&D expenditure intensity	48.0	11
1.2	Share of global R&D expenditure	1.3	22
1.3	Proportion of basic research funding in total R&D expenditure	43.6	23
1.4	Number of top-tier research institutions	3.6	22
1.5	Proportion of STEM graduates in all college graduates	51.3	22
1.6	R&D personnel intensity	88.0	2
1.7	Number of highly cited scientists	2.1	17
1.8	Level of S&T human resource development	56.3	13
1.9	Average score of top three domestic universities in the world university rankings	58.5	15

Knowledge Creation 1

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	22.0	26
2.2	Invention patents in force per 10,000 employed individuals	6.6	15
2.3	Number of industrial design applications per USD100 million of industrial value-added	0.7	38
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	46.3	25
2.5	Proportion of highly cited papers in all domestic papers	89.7	2

Enterprise Innovation 16

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	29.3	8
3.2	Enterprise researchers as a share of total researchers	73.4	13
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	20.8	4
3.4	Triadic patents as a share of the world's total	2.0	19
3.5	PCT applications per 10,000 enterprise researchers	10.0	10
3.6	Proportion of intellectual property royalty income in service exports	23.5	11
3.7	Economic growth rate	29.0	26
3.8	Density of newly registered companies	38.6	13
3.9	Number of high-growth technology companies	0.3	24

Innovation Performance 6

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	30.8	16
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	69.3	5
4.3	Proportion of high-tech products in total manufacturing exports	38.8	21
4.4	Labor productivity	60.3	8
4.5	Economic output per unit of energy consumption	65.5	4
4.6	Economic output per unit of CO_2 emission	49.8	4

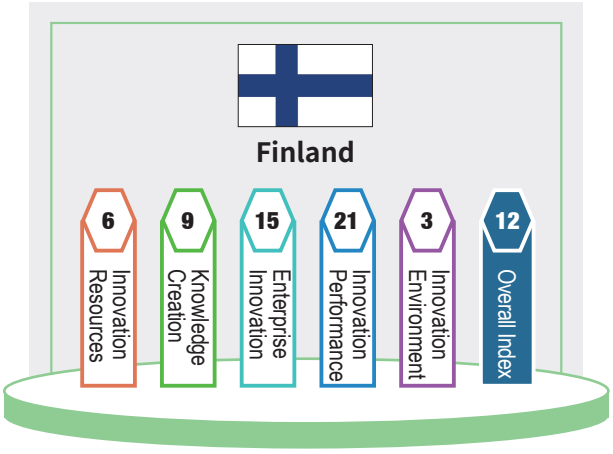
Innovation Environment 2

		Score	Ranking
5.1	Rule-of-law environment	96.4	3
5.2	Policy environment for doing business	83.1	9
5.3	E-government services	99.6	3
5.4	IT application	96.3	8
5.5	Availability of venture capital	—	—
5.6	Business-university collaboration in R&D	88.9	11
5.7	Proportion of international co-authored papers in all domestic papers	84.0	8
5.8	Ratio of international investment to GDP	5.4	26
5.9	Entrepreneurial culture	—	—

Finland

2024 Overall Index Ranking
12

Population/10,000 persons	554
Area/10,000 square kilometers	34
GDP/USD100 million	2, 818.9
GDP per capita/USD	50, 873.0
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.8
R&D expenditure/USD100 million	83.6
R&D expenditure intensity	2.96%
SCI indexed papers/piece	15, 968
PCT patent applications/piece	1, 768
Proportion of high-tech products in total manufacturing exports	8.1%



Innovation Resources 6

		Score	Ranking
1.1	R&D expenditure intensity	49.3	10
1.2	Share of global R&D expenditure	0.9	25
1.3	Proportion of basic research funding in total R&D expenditure	—	—
1.4	Number of top-tier research institutions	4.0	20
1.5	Proportion of STEM graduates in all college graduates	62.9	9
1.6	R&D personnel intensity	83.5	5
1.7	Number of highly cited scientists	0.6	26
1.8	Level of S&T human resource development	69.9	5
1.9	Average score of top three domestic universities in the world university rankings	50.5	23

Knowledge Creation 9

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	21.6	27
2.2	Invention patents in force per 10,000 employed individuals	9.5	10
2.3	Number of industrial design applications per USD100 million of industrial value-added	0.8	37
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	49.2	22
2.5	Proportion of highly cited papers in all domestic papers	61.2	17

Enterprise Innovation 15

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	26.0	13
3.2	Enterprise researchers as a share of total researchers	73.1	14
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	12.4	16
3.4	Triadic patents as a share of the world's total	2.0	18
3.5	PCT applications per 10,000 enterprise researchers	11.5	7
3.6	Proportion of intellectual property royalty income in service exports	38.4	6
3.7	Economic growth rate	14.2	38
3.8	Density of newly registered companies	32.3	18
3.9	Number of high-growth technology companies	0.6	21

Innovation Performance 21

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	48.1	4
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	56.4	16
4.3	Proportion of high-tech products in total manufacturing exports	20.0	35
4.4	Labor productivity	48.8	14
4.5	Economic output per unit of energy consumption	25.5	25
4.6	Economic output per unit of CO_2 emission	22.4	20

Innovation Environment 3

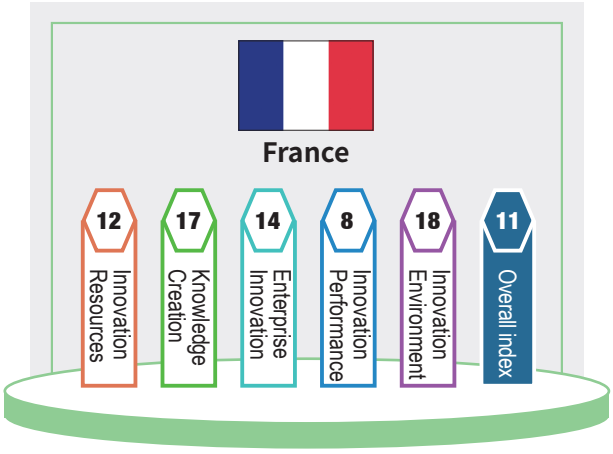
		Score	Ranking
5.1	Rule-of-law environment	100.0	1
5.2	Policy environment for doing business	84.9	6
5.3	E-government services	100.0	1
5.4	IT application	99.1	3
5.5	Availability of venture capital	100.0	1
5.6	Business-university collaboration in R&D	88.9	12
5.7	Proportion of international co-authored papers in all domestic papers	82.0	12
5.8	Ratio of international investment to GDP	22.9	5
5.9	Entrepreneurial culture	94.1	3

France

2024 Overall Index Ranking

11

Population/10,000 persons	6, 797
Area/10,000 square kilometers	67
GDP/USD100 million	27, 790.9
GDP per capita/USD	40, 886.4
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.7
R&D expenditure/USD100 million	604.6
R&D expenditure intensity	2.18%
SCI indexed papers/piece	83, 380
PCT patent applications/piece	7, 746
Proportion of high-tech products in total manufacturing exports	20.8%



Innovation Resources 12

		Score	Ranking
1.1	R&D expenditure intensity	36.1	16
1.2	Share of global R&D expenditure	6.5	7
1.3	Proportion of basic research funding in total R&D expenditure	55.1	12
1.4	Number of top-tier research institutions	20.1	7
1.5	Proportion of STEM graduates in all college graduates	54.7	18
1.6	R&D personnel intensity	69.0	13
1.7	Number of highly cited scientists	5.2	8
1.8	Level of S&T human resource development	47.1	27
1.9	Average score of top three domestic universities in the world university rankings	79.4	7

Knowledge Creation 17

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	14.3	35
2.2	Invention patents in force per 10,000 employed individuals	17.5	5
2.3	Number of industrial design applications per USD100 million of industrial value-added	11.7	6
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	26.6	37
2.5	Proportion of highly cited papers in all domestic papers	57.7	20

Enterprise Innovation 14

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	27.6	11
3.2	Enterprise researchers as a share of total researchers	74.7	10
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	15.7	10
3.4	Triadic patents as a share of the world's total	12.4	6
3.5	PCT applications per 10,000 enterprise researchers	7.2	15
3.6	Proportion of intellectual property royalty income in service exports	18.8	14
3.7	Economic growth rate	26.0	31
3.8	Density of newly registered companies	35.5	15
3.9	Number of high-growth technology companies	4.2	8

Innovation Performance 8

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	39.0	7
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	63.2	11
4.3	Proportion of high-tech products in total manufacturing exports	51.0	12
4.4	Labor productivity	44.2	18
4.5	Economic output per unit of energy consumption	43.0	10
4.6	Economic output per unit of CO_2 emission	47.6	5

Innovation Environment 18

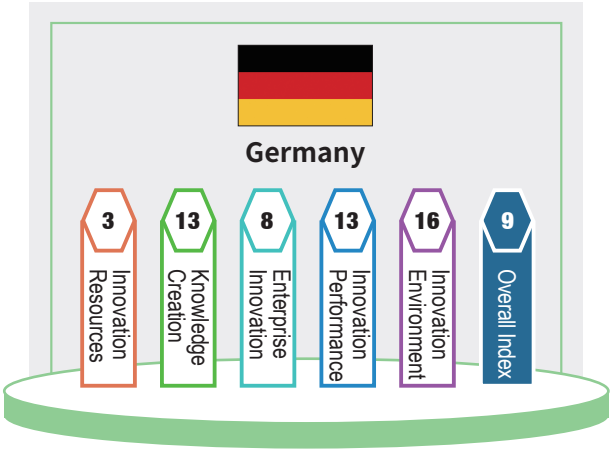
		Score	Ranking
5.1	Rule-of-law environment	77.5	20
5.2	Policy environment for doing business	69.6	21
5.3	E-government services	88.0	16
5.4	IT application	91.2	15
5.5	Availability of venture capital	79.9	9
5.6	Business-university collaboration in R&D	75.1	26
5.7	Proportion of international co-authored papers in all domestic papers	75.7	18
5.8	Ratio of international investment to GDP	7.9	20
5.9	Entrepreneurial culture	87.7	10

Germany

2024 Overall Index Ranking

9

Population/10,000 persons	8, 380
Area/10,000 square kilometers	36
GDP/USD100 million	40, 824.7
GDP per capita/USD	48, 718.0
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.6
R&D expenditure/USD100 million	1, 278.8
R&D expenditure intensity	3.13%
SCI indexed papers/piece	132, 592
PCT patent applications/piece	17, 459
Proportion of high-tech products in total manufacturing exports	16.0%



Innovation Resources 3

		Score	Ranking
1.1	R&D expenditure intensity	52.0	9
1.2	Share of global R&D expenditure	13.9	4
1.3	Proportion of basic research funding in total R&D expenditure	—	—
1.4	Number of top-tier research institutions	21.9	6
1.5	Proportion of STEM graduates in all college graduates	76.9	3
1.6	R&D personnel intensity	69.5	11
1.7	Number of highly cited scientists	12.8	4
1.8	Level of S&T human resource development	50.4	22
1.9	Average score of top three domestic universities in the world university rankings	74.6	10

Knowledge Creation 13

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	10.7	36
2.2	Invention patents in force per 10,000 employed individuals	15.9	7
2.3	Number of industrial design applications per USD100 million of industrial value-added	3.6	22
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	21.6	38
2.5	Proportion of highly cited papers in all domestic papers	56.1	24

Enterprise Innovation 8

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	25.4	15
3.2	Enterprise researchers as a share of total researchers	74.4	12
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	15.6	11
3.4	Triadic patents as a share of the world's total	27.1	4
3.5	PCT applications per 10,000 enterprise researchers	11.0	8
3.6	Proportion of intellectual property royalty income in service exports	43.3	5
3.7	Economic growth rate	19.1	36
3.8	Density of newly registered companies	7.4	34
3.9	Number of high-growth technology companies	6.0	5

Innovation Performance 13

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	30.6	17
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	74.1	4
4.3	Proportion of high-tech products in total manufacturing exports	39.3	20
4.4	Labor productivity	42.8	19
4.5	Economic output per unit of energy consumption	41.8	12
4.6	Economic output per unit of CO_2 emission	26.0	18

Innovation Environment 16

		Score	Ranking
5.1	Rule-of-law environment	86.8	14
5.2	Policy environment for doing business	82.1	10
5.3	E-government services	78.3	30
5.4	IT application	96.2	9
5.5	Availability of venture capital	77.9	11
5.6	Business-university collaboration in R&D	85.7	15
5.7	Proportion of international co-authored papers in all domestic papers	71.6	23
5.8	Ratio of international investment to GDP	9.8	18
5.9	Entrepreneurial culture	82.7	14

Greece

2024 Overall Index Ranking

28

Population/10,000 persons	1, 040
Area/10,000 square kilometers	13
GDP/USD100 million	2, 175.8
GDP per capita/USD	20, 867.1
Economic output per unit of energy consumption/(USD10,000/petajoule)	3.4
R&D expenditure/USD100 million	32.5
R&D expenditure intensity	1.49%
SCI indexed papers/piece	15, 524
PCT patent applications/piece	134
Proportion of high-tech products in total manufacturing exports	14.3%

Innovation Resources 15

	Score	Ranking
1.1 R&D expenditure intensity	24.8	24
1.2 Share of global R&D expenditure	0.4	33
1.3 Proportion of basic research funding in total R&D expenditure	89.6	3
1.4 Number of top-tier research institutions	5.4	19
1.5 Proportion of STEM graduates in all college graduates	58.8	14
1.6 R&D personnel intensity	57.0	20
1.7 Number of highly cited scientists	0.5	27
1.8 Level of S&T human resource development	100.0	1
1.9 Average score of top three domestic universities in the world university rankings	32.8	35

Knowledge Creation 14

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	49.4	6
2.2 Invention patents in force per 10,000 employed individuals	1.8	26
2.3 Number of industrial design applications per USD100 million of industrial value-added	2.8	24
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	71.7	8
2.5 Proportion of highly cited papers in all domestic papers	61.9	16

Enterprise Innovation 34

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	14.1	22
3.2 Enterprise researchers as a share of total researchers	36.7	36
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	—	—
3.4 Triadic patents as a share of the world's total	0.1	32
3.5 PCT applications per 10,000 enterprise researchers	1.2	31
3.6 Proportion of intellectual property royalty income in service exports	0.4	40
3.7 Economic growth rate	58.9	8
3.8 Density of newly registered companies	11.1	33
3.9 Number of high-growth technology companies	0.2	26

Innovation Performance 33

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	10.5	35
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	32.3	36
4.3 Proportion of high-tech products in total manufacturing exports	35.0	22
4.4 Labor productivity	21.6	29
4.5 Economic output per unit of energy consumption	30.9	22
4.6 Economic output per unit of CO_2 emission	15.1	26

Innovation Environment 33

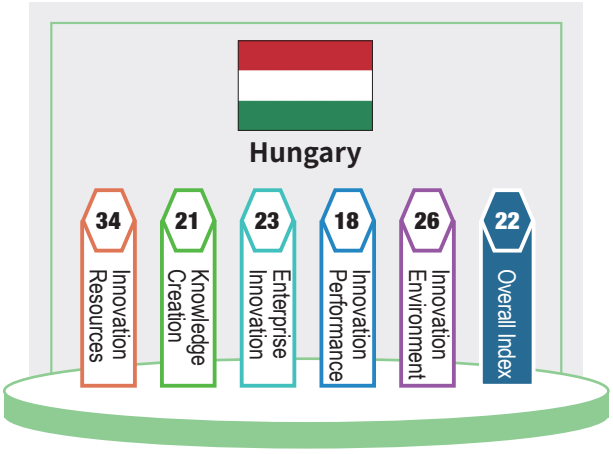
	Score	Ranking
5.1 Rule-of-law environment	50.0	31
5.2 Policy environment for doing business	57.7	29
5.3 E-government services	76.6	32
5.4 IT application	68.9	35
5.5 Availability of venture capital	60.2	30
5.6 Business-university collaboration in R&D	51.9	40
5.7 Proportion of international co-authored papers in all domestic papers	69.9	24
5.8 Ratio of international investment to GDP	12.5	11
5.9 Entrepreneurial culture	63.5	30

Hungary

2024 Overall Index Ranking

22

Population/10,000 persons	964
Area/10,000 square kilometers	9
GDP/USD100 million	1, 770.1
GDP per capita/USD	18, 356.2
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.0
R&D expenditure/USD100 million	24.7
R&D expenditure intensity	1.39%
SCI indexed papers/piece	9, 880
PCT patent applications/piece	137
Proportion of high-tech products in total manufacturing exports	17.7%



Innovation Resources 34

		Score	Ranking
1.1	R&D expenditure intensity	23.1	27
1.2	Share of global R&D expenditure	0.3	34
1.3	Proportion of basic research funding in total R&D expenditure	55.0	13
1.4	Number of top-tier research institutions	1.3	34
1.5	Proportion of STEM graduates in all college graduates	46.2	28
1.6	R&D personnel intensity	52.9	24
1.7	Number of highly cited scientists	0.1	34
1.8	Level of S&T human resource development	37.6	34
1.9	Average score of top three domestic universities in the world university rankings	—	—

Knowledge Creation 21

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	41.4	11
2.2	Invention patents in force per 10,000 employed individuals	0.6	32
2.3	Number of industrial design applications per USD100 million of industrial value-added	1.2	34
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	89.3	5
2.5	Proportion of highly cited papers in all domestic papers	58.8	19

Enterprise Innovation 23

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	13.2	24
3.2	Enterprise researchers as a share of total researchers	73.1	15
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	19.0	9
3.4	Triadic patents as a share of the world's total	0.3	29
3.5	PCT applications per 10,000 enterprise researchers	1.0	34
3.6	Proportion of intellectual property royalty income in service exports	15.6	18
3.7	Economic growth rate	48.6	12
3.8	Density of newly registered companies	22.8	22
3.9	Number of high-growth technology companies	—	—

Innovation Performance 18

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	37.7	9
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	66.8	7
4.3	Proportion of high-tech products in total manufacturing exports	43.5	16
4.4	Labor productivity	17.7	32
4.5	Economic output per unit of energy consumption	18.7	32
4.6	Economic output per unit of CO_2 emission	14.5	28

Innovation Environment 26

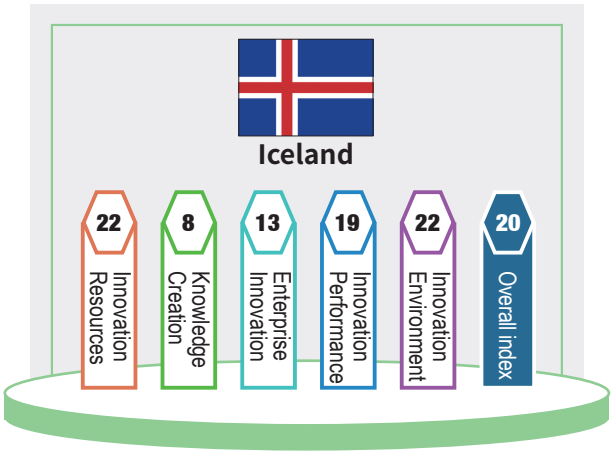
		Score	Ranking
5.1	Rule-of-law environment	55.3	28
5.2	Policy environment for doing business	58.1	28
5.3	E-government services	73.3	35
5.4	IT application	75.7	30
5.5	Availability of venture capital	72.6	20
5.6	Business-university collaboration in R&D	69.4	29
5.7	Proportion of international co-authored papers in all domestic papers	68.8	25
5.8	Ratio of international investment to GDP	18.8	6
5.9	Entrepreneurial culture	73.3	22

Iceland

2024 Overall Index Ranking

20

Population/10,000 persons	38
Area/10,000 square kilometers	10
GDP/USD100 million	287.0
GDP per capita/USD	75, 130.9
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.0
R&D expenditure/USD100 million	7.5
R&D expenditure intensity	2.66%
SCI indexed papers/piece	1, 533
PCT patent applications/piece	39
Proportion of high-tech products in total manufacturing exports	33.3%



Innovation Resources 22

		Score	Ranking
1.1	R&D expenditure intensity	44.2	12
1.2	Share of global R&D expenditure	0.1	40
1.3	Proportion of basic research funding in total R&D expenditure	39.1	27
1.4	Number of top-tier research institutions	0.4	38
1.5	Proportion of STEM graduates in all college graduates	36.5	39
1.6	R&D personnel intensity	85.2	4
1.7	Number of highly cited scientists	0.1	35
1.8	Level of S&T human resource development	57.6	12
1.9	Average score of top three domestic universities in the world university rankings	—	—

Knowledge Creation 8

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	21.2	28
2.2	Invention patents in force per 10,000 employed individuals	1.2	28
2.3	Number of industrial design applications per USD100 million of industrial value-added	1.1	36
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	60.3	12
2.5	Proportion of highly cited papers in all domestic papers	72.6	9

Enterprise Innovation 13

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	28.5	9
3.2	Enterprise researchers as a share of total researchers	64.2	21
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	14.2	14
3.4	Triadic patents as a share of the world's total	0.1	36
3.5	PCT applications per 10,000 enterprise researchers	4.3	23
3.6	Proportion of intellectual property royalty income in service exports	4.5	32
3.7	Economic growth rate	94.2	2
3.8	Density of newly registered companies	63.9	5
3.9	Number of high-growth technology companies	—	—

Innovation Performance 19

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	—	—
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	17.0	40
4.3	Proportion of high-tech products in total manufacturing exports	81.8	2
4.4	Labor productivity	65.5	6
4.5	Economic output per unit of energy consumption	18.2	33
4.6	Economic output per unit of CO_2 emission	45.3	7

Innovation Environment 22

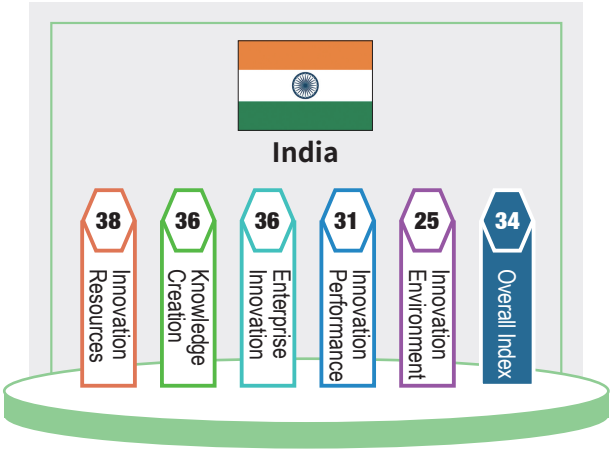
		Score	Ranking
5.1	Rule-of-law environment	91.1	9
5.2	Policy environment for doing business	77.8	13
5.3	E-government services	89.1	13
5.4	IT application	85.4	23
5.5	Availability of venture capital	—	—
5.6	Business-university collaboration in R&D	78.2	23
5.7	Proportion of international co-authored papers in all domestic papers	100.0	1
5.8	Ratio of international investment to GDP	3.5	32
5.9	Entrepreneurial culture	—	—

India

2024 Overall Index Ranking

34

Population/10,000 persons	141, 717
Area/10,000 square kilometers	298
GDP/USD100 million	33, 534.7
GDP per capita/USD	2, 366.3
Economic output per unit of energy consumption/(USD10,000/petajoule)	1.2
R&D expenditure/USD100 million	162.1
R&D expenditure intensity	0.48%
SCI indexed papers/piece	124, 572
PCT patent applications/piece	2, 560
Proportion of high-tech products in total manufacturing exports	12.5%



Innovation Resources 38

		Score	Ranking
1.1	R&D expenditure intensity	8.0	38
1.2	Share of global R&D expenditure	1.8	19
1.3	Proportion of basic research funding in total R&D expenditure	—	—
1.4	Number of top-tier research institutions	16.1	8
1.5	Proportion of STEM graduates in all college graduates	62.8	10
1.6	R&D personnel intensity	2.7	40
1.7	Number of highly cited scientists	0.6	25
1.8	Level of S&T human resource development	21.8	38
1.9	Average score of top three domestic universities in the world university rankings	52.4	21

Knowledge Creation 36

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	79.5	3
2.2	Invention patents in force per 10,000 employed individuals	0.1	38
2.3	Number of industrial design applications per USD100 million of industrial value-added	18.1	4
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	48.7	23
2.5	Proportion of highly cited papers in all domestic papers	34.0	37

Enterprise Innovation 36

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	0.2	40
3.2	Enterprise researchers as a share of total researchers	25.2	38
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	4.5	27
3.4	Triadic patents as a share of the world's total	0.0	39
3.5	PCT applications per 10,000 enterprise researchers	2.8	26
3.6	Proportion of intellectual property royalty income in service exports	1.8	37
3.7	Economic growth rate	74.1	3
3.8	Density of newly registered companies	1.0	39
3.9	Number of high-growth technology companies	12.5	3

Innovation Performance 31

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	43.9	5
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	55.6	17
4.3	Proportion of high-tech products in total manufacturing exports	30.7	25
4.4	Labor productivity	2.3	40
4.5	Economic output per unit of energy consumption	11.0	38
4.6	Economic output per unit of CO_2 emission	5.0	39

Innovation Environment 25

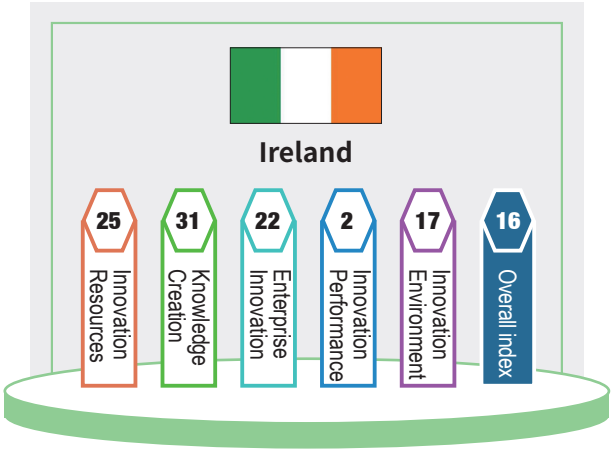
		Score	Ranking
5.1	Rule-of-law environment	37.3	35
5.2	Policy environment for doing business	54.1	32
5.3	E-government services	78.6	28
5.4	IT application	64.9	37
5.5	Availability of venture capital	85.5	5
5.6	Business-university collaboration in R&D	66.6	31
5.7	Proportion of international co-authored papers in all domestic papers	41.9	36
5.8	Ratio of international investment to GDP	4.9	28
5.9	Entrepreneurial culture	94.0	4

Ireland

2024 Overall Index Ranking

16

Population/10,000 persons	513
Area/10,000 square kilometers	7
GDP/USD100 million	5, 331.4
GDP per capita/USD	103, 986.7
Economic output per unit of energy consumption/(USD10,000/petajoule)	10.9
R&D expenditure/USD100 million	51.3
R&D expenditure intensity	0.96%
SCI indexed papers/piece	12, 535
PCT patent applications/piece	790
Proportion of high-tech products in total manufacturing exports	40.7%



Innovation Resources 25

		Score	Ranking
1.1	R&D expenditure intensity	16.0	33
1.2	Share of global R&D expenditure	0.6	28
1.3	Proportion of basic research funding in total R&D expenditure	48.2	17
1.4	Number of top-tier research institutions	1.3	34
1.5	Proportion of STEM graduates in all college graduates	55.3	17
1.6	R&D personnel intensity	63.7	17
1.7	Number of highly cited scientists	1.4	20
1.8	Level of S&T human resource development	52.4	20
1.9	Average score of top three domestic universities in the world university rankings	53.3	20

Knowledge Creation 31

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	25.3	22
2.2	Invention patents in force per 10,000 employed individuals	—	—
2.3	Number of industrial design applications per USD100 million of industrial value-added	0.2	40
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	93.8	3
2.5	Proportion of highly cited papers in all domestic papers	79.2	4

Enterprise Innovation 22

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	6.0	32
3.2	Enterprise researchers as a share of total researchers	53.7	27
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	9.4	20
3.4	Triadic patents as a share of the world's total	1.0	21
3.5	PCT applications per 10,000 enterprise researchers	10.3	9
3.6	Proportion of intellectual property royalty income in service exports	15.7	17
3.7	Economic growth rate	100.0	1
3.8	Density of newly registered companies	33.9	16
3.9	Number of high-growth technology companies	0.7	19

Innovation Performance 2

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	100.0	1
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	66.5	8
4.3	Proportion of high-tech products in total manufacturing exports	100.0	1
4.4	Labor productivity	100.0	1
4.5	Economic output per unit of energy consumption	100.0	1
4.6	Economic output per unit of CO_2 emission	45.8	6

Innovation Environment 17

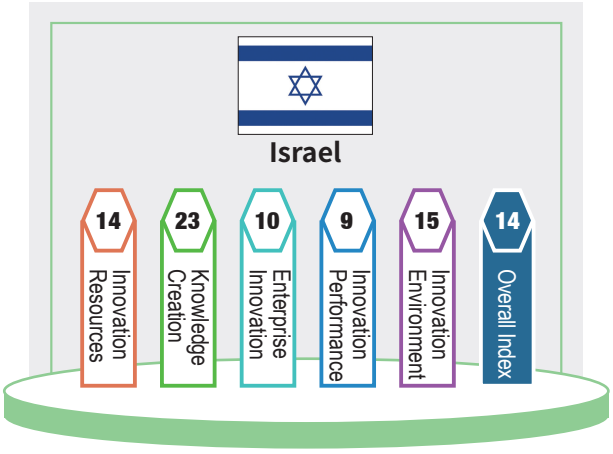
		Score	Ranking
5.1	Rule-of-law environment	84.5	16
5.2	Policy environment for doing business	84.1	7
5.3	E-government services	77.1	31
5.4	IT application	87.8	19
5.5	Availability of venture capital	74.1	17
5.6	Business-university collaboration in R&D	87.1	13
5.7	Proportion of international co-authored papers in all domestic papers	83.8	10
5.8	Ratio of international investment to GDP	4.1	30
5.9	Entrepreneurial culture	88.6	9

Israel

2024 Overall Index Ranking

14

Population/10,000 persons	956
Area/10,000 square kilometers	3
GDP/USD100 million	5, 250.0
GDP per capita/USD	54, 927.8
Economic output per unit of energy consumption/(USD10,000/petajoule)	7.7
R&D expenditure/USD100 million	316
R&D expenditure intensity	6.02%
SCI indexed papers/piece	18, 626
PCT patent applications/piece	1, 968
Proportion of high-tech products in total manufacturing exports	21.8%



Innovation Resources 14

		Score	Ranking
1.1	R&D expenditure intensity	100.0	1
1.2	Share of global R&D expenditure	3.4	9
1.3	Proportion of basic research funding in total R&D expenditure	19.3	33
1.4	Number of top-tier research institutions	3.1	24
1.5	Proportion of STEM graduates in all college graduates	58.8	15
1.6	R&D personnel intensity	69.3	12
1.7	Number of highly cited scientists	1.5	19
1.8	Level of S&T human resource development	39.3	32
1.9	Average score of top three domestic universities in the world university rankings	38.1	30

Knowledge Creation 23

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	6.1	39
2.2	Invention patents in force per 10,000 employed individuals	4.5	18
2.3	Number of industrial design applications per USD100 million of industrial value-added	4.6	16
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	48.7	24
2.5	Proportion of highly cited papers in all domestic papers	65.6	13

Enterprise Innovation 10

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	100.0	1
3.2	Enterprise researchers as a share of total researchers	95.5	3
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	20.5	5
3.4	Triadic patents as a share of the world's total	4.7	12
3.5	PCT applications per 10,000 enterprise researchers	5.1	20
3.6	Proportion of intellectual property royalty income in service exports	15.3	19
3.7	Economic growth rate	72.4	4
3.8	Density of newly registered companies	16.2	27
3.9	Number of high-growth technology companies	4.3	7

Innovation Performance 9

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	42.6	6
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	57.3	15
4.3	Proportion of high-tech products in total manufacturing exports	53.7	10
4.4	Labor productivity	55.7	10
4.5	Economic output per unit of energy consumption	70.5	3
4.6	Economic output per unit of CO_2 emission	31.6	13

Innovation Environment 15

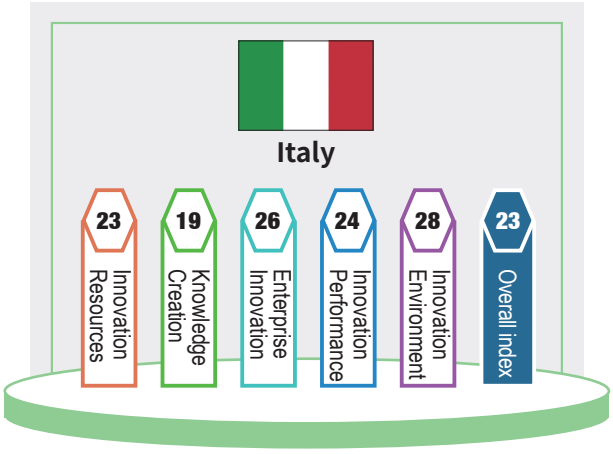
		Score	Ranking
5.1	Rule-of-law environment	67.3	25
5.2	Policy environment for doing business	70.4	20
5.3	E-government services	87.7	17
5.4	IT application	93.4	12
5.5	Availability of venture capital	77.5	12
5.6	Business-university collaboration in R&D	100.0	1
5.7	Proportion of international co-authored papers in all domestic papers	62.6	29
5.8	Ratio of international investment to GDP	16.4	7
5.9	Entrepreneurial culture	84.3	13

Italy

2024 Overall Index Ranking

23

Population/10,000 persons	5, 894
Area/10,000 square kilometers	30
GDP/USD100 million	20, 669.7
GDP per capita/USD	35, 069.1
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.4
R&D expenditure/USD100 million	272.9
R&D expenditure intensity	1.32%
SCI indexed papers/piece	97, 532
PCT patent applications/piece	3, 314
Proportion of high-tech products in total manufacturing exports	8.8%



Innovation Resources 23

	Score	Ranking
1.1 R&D expenditure intensity	21.9	30
1.2 Share of global R&D expenditure	3.0	10
1.3 Proportion of basic research funding in total R&D expenditure	56.4	11
1.4 Number of top-tier research institutions	14.7	9
1.5 Proportion of STEM graduates in all college graduates	51.1	23
1.6 R&D personnel intensity	50.9	27
1.7 Number of highly cited scientists	4.4	9
1.8 Level of S&T human resource development	47.5	26
1.9 Average score of top three domestic universities in the world university rankings	56.8	16

Knowledge Creation 19

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	37.0	14
2.2 Invention patents in force per 10,000 employed individuals	23.0	4
2.3 Number of industrial design applications per USD100 million of industrial value-added	2.0	27
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	60.7	11
2.5 Proportion of highly cited papers in all domestic papers	55.4	25

Enterprise Innovation 26

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	10.7	28
3.2 Enterprise researchers as a share of total researchers	53.2	28
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	5.3	25
3.4 Triadic patents as a share of the world's total	5.7	9
3.5 PCT applications per 10,000 enterprise researchers	9.9	11
3.6 Proportion of intellectual property royalty income in service exports	17.1	16
3.7 Economic growth rate	42.3	17
3.8 Density of newly registered companies	15.1	28
3.9 Number of high-growth technology companies	0.4	22

Innovation Performance 24

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	23.6	25
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	53.2	21
4.3 Proportion of high-tech products in total manufacturing exports	21.6	32
4.4 Labor productivity	38.5	21
4.5 Economic output per unit of energy consumption	40.1	16
4.6 Economic output per unit of CO_2 emission	26.9	15

Innovation Environment 28

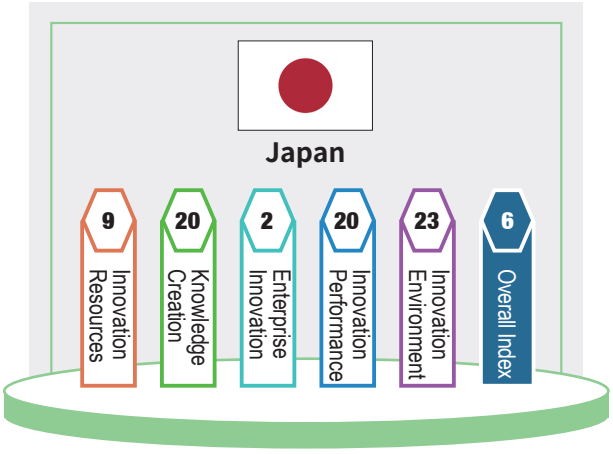
	Score	Ranking
5.1 Rule-of-law environment	47.6	32
5.2 Policy environment for doing business	64.8	23
5.3 E-government services	86.8	19
5.4 IT application	80.9	28
5.5 Availability of venture capital	67.6	26
5.6 Business-university collaboration in R&D	84.4	16
5.7 Proportion of international co-authored papers in all domestic papers	63.6	28
5.8 Ratio of international investment to GDP	3.7	31
5.9 Entrepreneurial culture	67.1	28

Japan

2024 Overall Index Ranking

6

Population/10,000 persons	12, 513
Area/10,000 square kilometers	38
GDP/USD100 million	42, 564.1
GDP per capita/USD	34, 017.3
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.5
R&D expenditure/USD100 million	1, 449.5
R&D expenditure intensity	3.41%
SCI indexed papers/piece	93, 981
PCT patent applications/piece	50, 516
Proportion of high-tech products in total manufacturing exports	13.4%



Innovation Resources 9

		Score	Ranking
1.1	R&D expenditure intensity	56.6	6
1.2	Share of global R&D expenditure	15.7	3
1.3	Proportion of basic research funding in total R&D expenditure	28.7	31
1.4	Number of top-tier research institutions	24.1	4
1.5	Proportion of STEM graduates in all college graduates	66.5	5
1.6	R&D personnel intensity	55.6	22
1.7	Number of highly cited scientists	3.2	13
1.8	Level of S&T human resource development	42.1	29
1.9	Average score of top three domestic universities in the world university rankings	75.7	9

Knowledge Creation 20

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	6.7	38
2.2	Invention patents in force per 10,000 employed individuals	72.4	2
2.3	Number of industrial design applications per USD100 million of industrial value-added	17.4	5
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	16.2	39
2.5	Proportion of highly cited papers in all domestic papers	36.9	35

Enterprise Innovation 2

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	32.6	7
3.2	Enterprise researchers as a share of total researchers	91.0	4
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	11.0	18
3.4	Triadic patents as a share of the world's total	100.0	1
3.5	PCT applications per 10,000 enterprise researchers	15.6	4
3.6	Proportion of intellectual property royalty income in service exports	100.0	1
3.7	Economic growth rate	10.1	39
3.8	Density of newly registered companies	2.7	37
3.9	Number of high-growth technology companies	1.1	15

Innovation Performance 20

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	22.2	27
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	68.5	6
4.3	Proportion of high-tech products in total manufacturing exports	32.9	24
4.4	Labor productivity	29.8	23
4.5	Economic output per unit of energy consumption	41.3	14
4.6	Economic output per unit of CO_2 emission	19.4	23

Innovation Environment 23

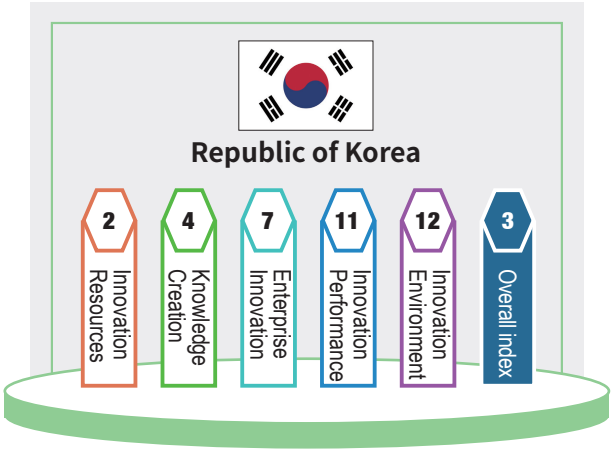
		Score	Ranking
5.1	Rule-of-law environment	86.0	15
5.2	Policy environment for doing business	74.0	19
5.3	E-government services	91.7	8
5.4	IT application	92.4	13
5.5	Availability of venture capital	71.2	21
5.6	Business-university collaboration in R&D	78.4	22
5.7	Proportion of international co-authored papers in all domestic papers	41.5	38
5.8	Ratio of international investment to GDP	1.9	34
5.9	Entrepreneurial culture	67.8	27

Republic of Korea

2024 Overall Index Ranking

3

Population/10,000 persons	5, 171
Area/10,000 square kilometers	10
GDP/USD100 million	16, 739.2
GDP per capita/USD	32, 422.6
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.4
R&D expenditure/USD100 million	872.3
R&D expenditure intensity	5.21%
SCI indexed papers/piece	78, 308
PCT patent applications/piece	22, 014
Proportion of high-tech products in total manufacturing exports	17.0%



Innovation Resources 2

	Score	Ranking
1.1 R&D expenditure intensity	86.6	2
1.2 Share of global R&D expenditure	9.4	5
1.3 Proportion of basic research funding in total R&D expenditure	36.0	28
1.4 Number of top-tier research institutions	14.3	11
1.5 Proportion of STEM graduates in all college graduates	65.1	7
1.6 R&D personnel intensity	86.6	3
1.7 Number of highly cited scientists	2.4	15
1.8 Level of S&T human resource development	68.8	6
1.9 Average score of top three domestic universities in the world university rankings	78.8	8

Knowledge Creation 4

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	9.3	37
2.2 Invention patents in force per 10,000 employed individuals	100.0	1
2.3 Number of industrial design applications per USD100 million of industrial value-added	88.6	2
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	27.5	34
2.5 Proportion of highly cited papers in all domestic papers	42.2	34

Enterprise Innovation 7

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	42.3	3
3.2 Enterprise researchers as a share of total researchers	100.0	1
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	9.0	21
3.4 Triadic patents as a share of the world's total	22.8	5
3.5 PCT applications per 10,000 enterprise researchers	4.7	21
3.6 Proportion of intellectual property royalty income in service exports	29.5	8
3.7 Economic growth rate	27.7	28
3.8 Density of newly registered companies	16.4	25
3.9 Number of high-growth technology companies	3.0	9

Innovation Performance 11

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	60.5	3
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	77.7	3
4.3 Proportion of high-tech products in total manufacturing exports	41.7	18
4.4 Labor productivity	28.5	24
4.5 Economic output per unit of energy consumption	21.9	29
4.6 Economic output per unit of CO_2 emission	12.9	30

Innovation Environment 12

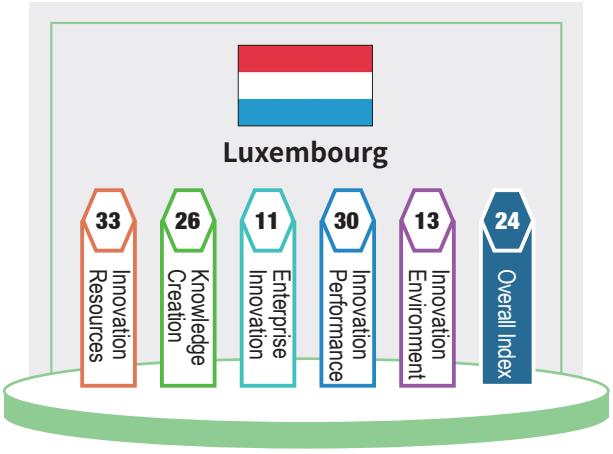
	Score	Ranking
5.1 Rule-of-law environment	72.7	22
5.2 Policy environment for doing business	64.5	24
5.3 E-government services	99.9	2
5.4 IT application	96.8	7
5.5 Availability of venture capital	77.5	13
5.6 Business-university collaboration in R&D	83.7	17
5.7 Proportion of international co-authored papers in all domestic papers	41.8	37
5.8 Ratio of international investment to GDP	27.8	3
5.9 Entrepreneurial culture	90.4	7

Luxembourg

2024 Overall Index Ranking

24

Population/10,000 persons	67
Area/10,000 square kilometers	0.3
GDP/USD100 million	816.4
GDP per capita/USD	125, 006.0
Economic output per unit of energy consumption/(USD10,000/petajoule)	5.9
R&D expenditure/USD100 million	8.0
R&D expenditure intensity	0.98%
SCI indexed papers/piece	1, 960
PCT patent applications/piece	291
Proportion of high-tech products in total manufacturing exports	5.9%



Innovation Resources 33

		Score	Ranking
1.1	R&D expenditure intensity	16.2	32
1.2	Share of global R&D expenditure	0.1	39
1.3	Proportion of basic research funding in total R&D expenditure	100.0	1
1.4	Number of top-tier research institutions	14.3	11
1.5	Proportion of STEM graduates in all college graduates	49.0	25
1.6	R&D personnel intensity	46.3	28
1.7	Number of highly cited scientists	0.2	33
1.8	Level of S&T human resource development	13.8	40
1.9	Average score of top three domestic universities in the world university rankings	32.9	34

Knowledge Creation 26

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	25.4	21
2.2	Invention patents in force per 10,000 employed individuals	7.2	12
2.3	Number of industrial design applications per USD100 million of industrial value-added	9.9	7
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	39.7	28
2.5	Proportion of highly cited papers in all domestic papers	69.0	12

Enterprise Innovation 11

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	15.5	19
3.2	Enterprise researchers as a share of total researchers	40.1	33
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	4.3	28
3.4	Triadic patents as a share of the world's total	0.2	30
3.5	PCT applications per 10,000 enterprise researchers	100.0	1
3.6	Proportion of intellectual property royalty income in service exports	6.0	28
3.7	Economic growth rate	14.6	37
3.8	Density of newly registered companies	100.0	1
3.9	Number of high-growth technology companies	0.1	29

Innovation Performance 30

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	—	—
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	27.4	38
4.3	Proportion of high-tech products in total manufacturing exports	14.5	37
4.4	Labor productivity	77.8	3
4.5	Economic output per unit of energy consumption	53.8	6
4.6	Economic output per unit of CO_2 emission	41.0	9

Innovation Environment 13

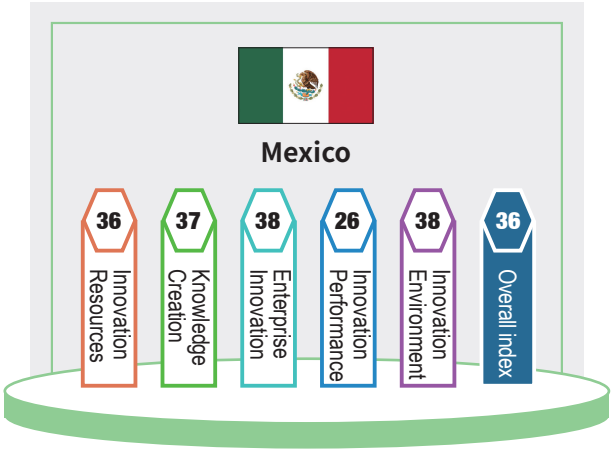
		Score	Ranking
5.1	Rule-of-law environment	92.1	8
5.2	Policy environment for doing business	95.8	3
5.3	E-government services	83.0	23
5.4	IT application	88.2	18
5.5	Availability of venture capital	65.6	28
5.6	Business-university collaboration in R&D	86.1	14
5.7	Proportion of international co-authored papers in all domestic papers	99.8	2
5.8	Ratio of international investment to GDP	—	—
5.9	Entrepreneurial culture	87.7	7

Mexico

2024 Overall Index Ranking

36

Population/10,000 persons	12, 846
Area/10,000 square kilometers	196
GDP/USD100 million	14, 633.2
GDP per capita/USD	11, 476.7
Economic output per unit of energy consumption/(USD10,000/petajoule)	3.2
R&D expenditure/USD100 million	35.8
R&D expenditure intensity	0.24%
SCI indexed papers/piece	20, 951
PCT patent applications/piece	190
Proportion of high-tech products in total manufacturing exports	19.3%



Innovation Resources 36

		Score	Ranking
1.1	R&D expenditure intensity	4.1	40
1.2	Share of global R&D expenditure	0.4	30
1.3	Proportion of basic research funding in total R&D expenditure	73.5	6
1.4	Number of top-tier research institutions	1.3	34
1.5	Proportion of STEM graduates in all college graduates	52.1	21
1.6	R&D personnel intensity	4.6	39
1.7	Number of highly cited scientists	0.1	35
1.8	Level of S&T human resource development	30.9	37
1.9	Average score of top three domestic universities in the world university rankings	56.1	18

Knowledge Creation 37

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	60.6	4
2.2	Invention patents in force per 10,000 employed individuals	0.3	34
2.3	Number of industrial design applications per USD100 million of industrial value-added	1.3	32
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	38.1	30
2.5	Proportion of highly cited papers in all domestic papers	34.2	36

Enterprise Innovation 38

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	0.5	39
3.2	Enterprise researchers as a share of total researchers	47.2	31
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	2.3	32
3.4	Triadic patents as a share of the world's total	0.1	33
3.5	PCT applications per 10,000 enterprise researchers	1.7	28
3.6	Proportion of intellectual property royalty income in service exports	3.1	34
3.7	Economic growth rate	41.9	18
3.8	Density of newly registered companies	4.6	36
3.9	Number of high-growth technology companies	0.9	16

Innovation Performance 26

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	3.2	37
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	52.1	23
4.3	Proportion of high-tech products in total manufacturing exports	47.5	14
4.4	Labor productivity	12.3	37
4.5	Economic output per unit of energy consumption	29.2	23
4.6	Economic output per unit of CO_2 emission	11.8	32

Innovation Environment 38

		Score	Ranking
5.1	Rule-of-law environment	16.3	39
5.2	Policy environment for doing business	40.6	38
5.3	E-government services	82.1	24
5.4	IT application	64.5	39
5.5	Availability of venture capital	58.9	32
5.6	Business-university collaboration in R&D	62.7	36
5.7	Proportion of international co-authored papers in all domestic papers	54.6	31
5.8	Ratio of international investment to GDP	—	—
5.9	Entrepreneurial culture	69.5	25

Netherlands

2024 Overall Index Ranking

8

Population/10,000 persons	1, 788
Area/10,000 square kilometers	4
GDP/USD100 million	10, 094.0
GDP per capita/USD	57, 025.0
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.4
R&D expenditure/USD100 million	231.8
R&D expenditure intensity	2.30%
SCI indexed papers/piece	50, 786
PCT patent applications/piece	4, 012
Proportion of high-tech products in total manufacturing exports	20.6%

Innovation Resources 13

		Score	Ranking
1.1	R&D expenditure intensity	38.1	15
1.2	Share of global R&D expenditure	2.5	13
1.3	Proportion of basic research funding in total R&D expenditure	60.8	9
1.4	Number of top-tier research institutions	8.9	15
1.5	Proportion of STEM graduates in all college graduates	43.0	31
1.6	R&D personnel intensity	74.4	8
1.7	Number of highly cited scientists	7.3	7
1.8	Level of S&T human resource development	59.2	11
1.9	Average score of top three domestic universities in the world university rankings	71.6	11

Knowledge Creation 5

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	22.7	24
2.2	Invention patents in force per 10,000 employed individuals	6.8	14
2.3	Number of industrial design applications per USD100 million of industrial value-added	5.5	13
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	54.0	17
2.5	Proportion of highly cited papers in all domestic papers	72.8	8

Enterprise Innovation 4

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	26.0	14
3.2	Enterprise researchers as a share of total researchers	85.0	6
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	12.6	15
3.4	Triadic patents as a share of the world's total	5.5	10
3.5	PCT applications per 10,000 enterprise researchers	12.6	6
3.6	Proportion of intellectual property royalty income in service exports	66.8	3
3.7	Economic growth rate	45.9	14
3.8	Density of newly registered companies	18.2	24
3.9	Number of high-growth technology companies	1.3	14

Innovation Performance 12

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	31.0	15
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	64.2	10
4.3	Proportion of high-tech products in total manufacturing exports	50.5	13
4.4	Labor productivity	47.5	16
4.5	Economic output per unit of energy consumption	40.3	15
4.6	Economic output per unit of CO_2 emission	27.8	14

Innovation Environment 4

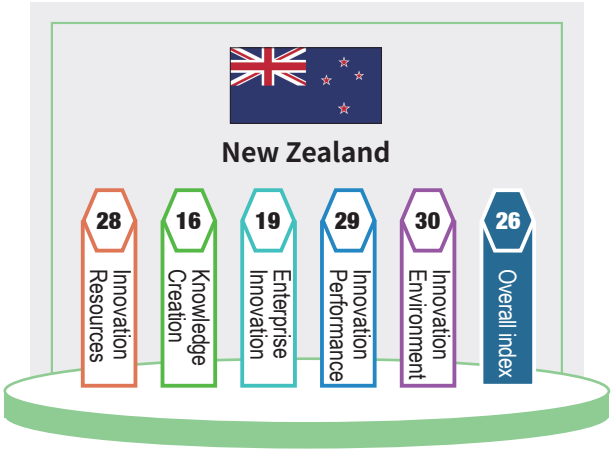
		Score	Ranking
5.1	Rule-of-law environment	90.7	10
5.2	Policy environment for doing business	83.5	8
5.3	E-government services	90.9	9
5.4	IT application	98.9	4
5.5	Availability of venture capital	92.2	2
5.6	Business-university collaboration in R&D	92.8	4
5.7	Proportion of international co-authored papers in all domestic papers	81.1	13
5.8	Ratio of international investment to GDP	—	—
5.9	Entrepreneurial culture	100.0	1

New Zealand

2024 Overall Index Ranking

26

Population/10,000 persons	522
Area/10,000 square kilometers	27
GDP/USD100 million	2, 467.3
GDP per capita/USD	48, 151.6
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.5
R&D expenditure/USD100 million	33.3
R&D expenditure intensity	1.35%
SCI indexed papers/piece	12, 643
PCT patent applications/piece	319
Proportion of high-tech products in total manufacturing exports	12.0%



Innovation Resources 28

		Score	Ranking
1.1	R&D expenditure intensity	22.4	28
1.2	Share of global R&D expenditure	0.4	32
1.3	Proportion of basic research funding in total R&D expenditure	47.2	18
1.4	Number of top-tier research institutions	2.7	29
1.5	Proportion of STEM graduates in all college graduates	49.2	24
1.6	R&D personnel intensity	55.7	21
1.7	Number of highly cited scientists	0.8	22
1.8	Level of S&T human resource development	52.9	18
1.9	Average score of top three domestic universities in the world university rankings	53.5	19

Knowledge Creation 16

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	39.2	13
2.2	Invention patents in force per 10,000 employed individuals	2.2	24
2.3	Number of industrial design applications per USD100 million of industrial value-added	6.2	12
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	61.5	10
2.5	Proportion of highly cited papers in all domestic papers	64.3	14

Enterprise Innovation 19

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	14.8	21
3.2	Enterprise researchers as a share of total researchers	55.8	25
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	6.0	24
3.4	Triadic patents as a share of the world's total	0.5	24
3.5	PCT applications per 10,000 enterprise researchers	5.3	19
3.6	Proportion of intellectual property royalty income in service exports	24.7	10
3.7	Economic growth rate	29.4	25
3.8	Density of newly registered companies	86.4	4
3.9	Number of high-growth technology companies	—	—

Innovation Performance 29

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	9.6	36
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	26.4	39
4.3	Proportion of high-tech products in total manufacturing exports	29.4	27
4.4	Labor productivity	41.7	20
4.5	Economic output per unit of energy consumption	41.6	13
4.6	Economic output per unit of CO_2 emission	43.7	8

Innovation Environment 30

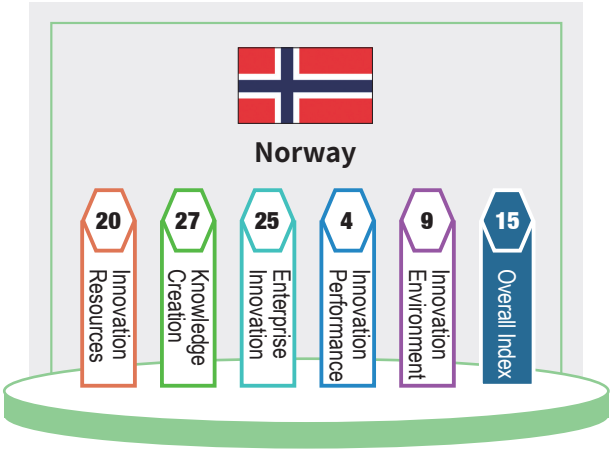
		Score	Ranking
5.1	Rule-of-law environment	93.0	5
5.2	Policy environment for doing business	67.6	22
5.3	E-government services	97.1	5
5.4	IT application	85.8	22
5.5	Availability of venture capital	—	—
5.6	Business-university collaboration in R&D	73.7	27
5.7	Proportion of international co-authored papers in all domestic papers	80.0	14
5.8	Ratio of international investment to GDP	6.2	25
5.9	Entrepreneurial culture	—	—

Norway

2024 Overall Index Ranking

15

Population/10,000 persons	552
Area/10,000 square kilometers	39
GDP/USD100 million	5, 937.3
GDP per capita/USD	108, 798.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	5.5
R&D expenditure/USD100 million	92.5
R&D expenditure intensity	1.56%
SCI indexed papers/piece	20, 060
PCT patent applications/piece	797
Proportion of high-tech products in total manufacturing exports	23.6%



Innovation Resources 20

		Score	Ranking
1.1	R&D expenditure intensity	25.9	22
1.2	Share of global R&D expenditure	1.0	24
1.3	Proportion of basic research funding in total R&D expenditure	43.2	24
1.4	Number of top-tier research institutions	7.1	16
1.5	Proportion of STEM graduates in all college graduates	46.2	27
1.6	R&D personnel intensity	73.8	9
1.7	Number of highly cited scientists	0.9	21
1.8	Level of S&T human resource development	62.5	10
1.9	Average score of top three domestic universities in the world university rankings	45.2	27

Knowledge Creation 27

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	22.4	25
2.2	Invention patents in force per 10,000 employed individuals	6.1	16
2.3	Number of industrial design applications per USD100 million of industrial value-added	0.6	39
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	34.1	31
2.5	Proportion of highly cited papers in all domestic papers	52.4	27

Enterprise Innovation 25

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	5.7	33
3.2	Enterprise researchers as a share of total researchers	63.0	22
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	1.3	33
3.4	Triadic patents as a share of the world's total	0.9	22
3.5	PCT applications per 10,000 enterprise researchers	9.3	12
3.6	Proportion of intellectual property royalty income in service exports	3.2	33
3.7	Economic growth rate	31.9	23
3.8	Density of newly registered companies	48.5	11
3.9	Number of high-growth technology companies	0.3	24

Innovation Performance 4

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	34.1	12
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	52.3	22
4.3	Proportion of high-tech products in total manufacturing exports	58.0	7
4.4	Labor productivity	96.7	2
4.5	Economic output per unit of energy consumption	50.8	7
4.6	Economic output per unit of CO_2 emission	85.6	3

Innovation Environment 9

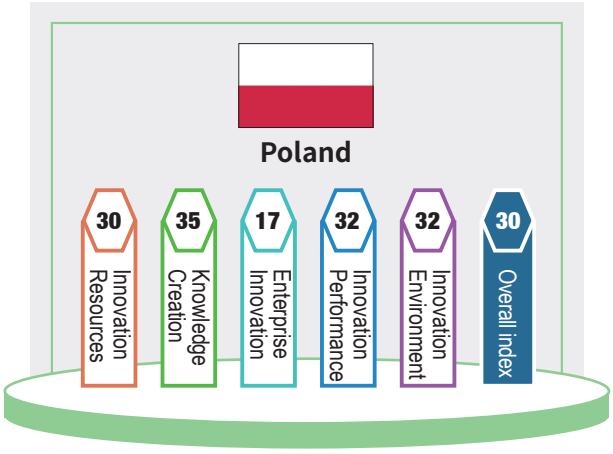
		Score	Ranking
5.1	Rule-of-law environment	96.8	2
5.2	Policy environment for doing business	81.7	11
5.3	E-government services	79.4	26
5.4	IT application	90.6	16
5.5	Availability of venture capital	76.9	14
5.6	Business-university collaboration in R&D	83.5	18
5.7	Proportion of international co-authored papers in all domestic papers	83.8	9
5.8	Ratio of international investment to GDP	2.9	33
5.9	Entrepreneurial culture	93.3	5

Poland

2024 Overall Index Ranking

30

Population/10,000 persons	3, 669
Area/10,000 square kilometers	32
GDP/USD100 million	6, 897.6
GDP per capita/USD	18, 732.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.1
R&D expenditure/USD100 million	100.3
R&D expenditure intensity	1.46%
SCI indexed papers/piece	40, 280
PCT patent applications/piece	370
Proportion of high-tech products in total manufacturing exports	10.8%



Innovation Resources 30

	Score	Ranking
1.1 R&D expenditure intensity	24.2	25
1.2 Share of global R&D expenditure	1.1	23
1.3 Proportion of basic research funding in total R&D expenditure	76.9	5
1.4 Number of top-tier research institutions	2.2	32
1.5 Proportion of STEM graduates in all college graduates	41.6	33
1.6 R&D personnel intensity	45.1	29
1.7 Number of highly cited scientists	0.2	31
1.8 Level of S&T human resource development	49.3	24
1.9 Average score of top three domestic universities in the world university rankings	38.3	29

Knowledge Creation 35

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	41.6	10
2.2 Invention patents in force per 10,000 employed individuals	0.1	37
2.3 Number of industrial design applications per USD100 million of industrial value-added	3.7	20
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	67.3	9
2.5 Proportion of highly cited papers in all domestic papers	42.7	33

Enterprise Innovation 17

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	10.7	27
3.2 Enterprise researchers as a share of total researchers	67.6	18
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	100.0	1
3.4 Triadic patents as a share of the world's total	0.4	27
3.5 PCT applications per 10,000 enterprise researchers	0.5	37
3.6 Proportion of intellectual property royalty income in service exports	5.1	30
3.7 Economic growth rate	59.8	7
3.8 Density of newly registered companies	11.4	32
3.9 Number of high-growth technology companies	0.1	29

Innovation Performance 32

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	26.6	19
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	40.2	30
4.3 Proportion of high-tech products in total manufacturing exports	26.5	29
4.4 Labor productivity	18.9	30
4.5 Economic output per unit of energy consumption	18.9	31
4.6 Economic output per unit of CO_2 emission	9.0	33

Innovation Environment 32

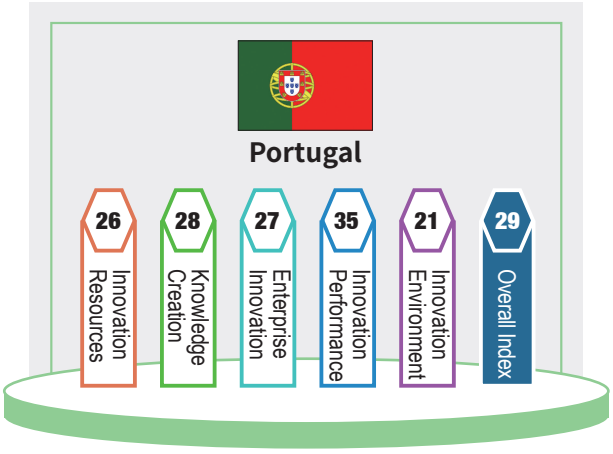
	Score	Ranking
5.1 Rule-of-law environment	52.7	29
5.2 Policy environment for doing business	40.0	39
5.3 E-government services	78.6	29
5.4 IT application	78.3	29
5.5 Availability of venture capital	69.1	24
5.6 Business-university collaboration in R&D	57.5	38
5.7 Proportion of international co-authored papers in all domestic papers	51.7	32
5.8 Ratio of international investment to GDP	11.9	14
5.9 Entrepreneurial culture	64.2	29

Portugal

2024 Overall Index Ranking

29

Population/10,000 persons	1, 053
Area/10,000 square kilometers	9
GDP/USD100 million	2, 552.0
GDP per capita/USD	24, 515.3
Economic output per unit of energy consumption/(USD10,000/petajoule)	3.8
R&D expenditure/USD100 million	43.4
R&D expenditure intensity	1.70%
SCI indexed papers/piece	22, 169
PCT patent applications/piece	218
Proportion of high-tech products in total manufacturing exports	6.2%



Innovation Resources 26

		Score	Ranking
1.1	R&D expenditure intensity	28.3	20
1.2	Share of global R&D expenditure	0.5	29
1.3	Proportion of basic research funding in total R&D expenditure	40.4	26
1.4	Number of top-tier research institutions	3.6	22
1.5	Proportion of STEM graduates in all college graduates	59.7	13
1.6	R&D personnel intensity	59.5	18
1.7	Number of highly cited scientists	0.7	23
1.8	Level of S&T human resource development	47.9	25
1.9	Average score of top three domestic universities in the world university rankings	37.5	31

Knowledge Creation 28

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	52.8	5
2.2	Invention patents in force per 10,000 employed individuals	0.9	29
2.3	Number of industrial design applications per USD100 million of industrial value-added	4.0	18
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	91.5	4
2.5	Proportion of highly cited papers in all domestic papers	48.1	31

Enterprise Innovation 27

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	18.5	16
3.2	Enterprise researchers as a share of total researchers	54.3	26
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	2.4	31
3.4	Triadic patents as a share of the world's total	0.3	28
3.5	PCT applications per 10,000 enterprise researchers	0.9	36
3.6	Proportion of intellectual property royalty income in service exports	1.1	38
3.7	Economic growth rate	72.4	5
3.8	Density of newly registered companies	36.8	14
3.9	Number of high-growth technology companies	—	—

Innovation Performance 35

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	15.6	31
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	33.8	35
4.3	Proportion of high-tech products in total manufacturing exports	15.1	36
4.4	Labor productivity	24.2	27
4.5	Economic output per unit of energy consumption	34.5	19
4.6	Economic output per unit of CO_2 emission	26.1	17

Innovation Environment 21

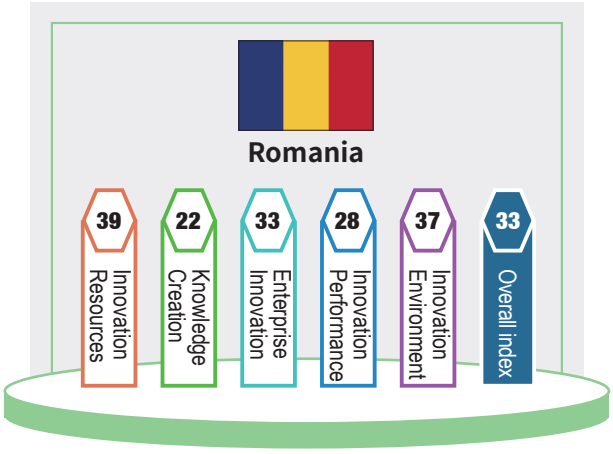
		Score	Ranking
5.1	Rule-of-law environment	72.9	21
5.2	Policy environment for doing business	59.6	27
5.3	E-government services	78.8	27
5.4	IT application	82.0	26
5.5	Availability of venture capital	78.0	10
5.6	Business-university collaboration in R&D	76.6	24
5.7	Proportion of international co-authored papers in all domestic papers	73.1	21
5.8	Ratio of international investment to GDP	12.0	13
5.9	Entrepreneurial culture	81.7	15

Romania

2024 Overall Index Ranking

33

Population/10,000 persons	1, 906
Area/10,000 square kilometers	23.8
GDP/USD100 million	2, 988.9
GDP per capita/USD	15, 692.3
Economic output per unit of energy consumption/(USD10,000/petajoule)	0.0
R&D expenditure/USD100 million	13.7
R&D expenditure intensity	0.46%
SCI indexed papers/piece	12, 661
PCT patent applications/piece	38
Proportion of high-tech products in total manufacturing exports	11.6%



Innovation Resources 39

	Score	Ranking
1.1 R&D expenditure intensity	7.6	39
1.2 Share of global R&D expenditure	0.1	36
1.3 Proportion of basic research funding in total R&D expenditure	45.2	20
1.4 Number of top-tier research institutions	2.7	29
1.5 Proportion of STEM graduates in all college graduates	62.6	11
1.6 R&D personnel intensity	16.8	36
1.7 Number of highly cited scientists	—	—
1.8 Level of S&T human resource development	36.8	35
1.9 Average score of top three domestic universities in the world university rankings	—	—

Knowledge Creation 22

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	95.5	2
2.2 Invention patents in force per 10,000 employed individuals	0.7	31
2.3 Number of industrial design applications per USD100 million of industrial value-added	1.7	31
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	100.0	1
2.5 Proportion of highly cited papers in all domestic papers	56.7	23

Enterprise Innovation 33

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	3.3	36
3.2 Enterprise researchers as a share of total researchers	38.0	34
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	—	—
3.4 Triadic patents as a share of the world's total	0.2	31
3.5 PCT applications per 10,000 enterprise researchers	0.5	39
3.6 Proportion of intellectual property royalty income in service exports	0.9	39
3.7 Economic growth rate	43.5	16
3.8 Density of newly registered companies	48.6	10
3.9 Number of high-growth technology companies	—	—

Innovation Performance 28

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	33.7	13
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	50.2	25
4.3 Proportion of high-tech products in total manufacturing exports	28.5	28
4.4 Labor productivity	16.7	33
4.5 Economic output per unit of energy consumption	—	—
4.6 Economic output per unit of CO_2 emission	21.4	21

Innovation Environment 37

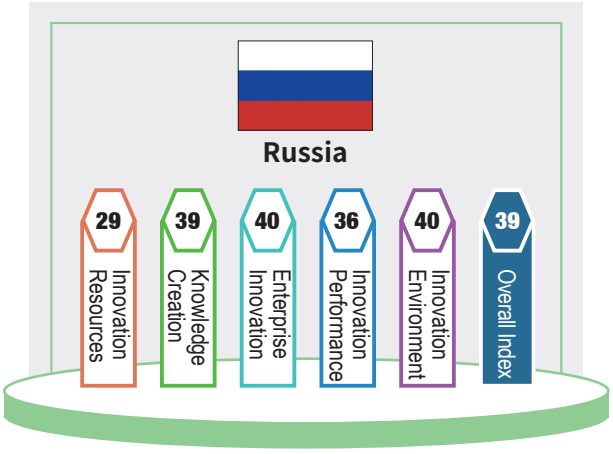
	Score	Ranking
5.1 Rule-of-law environment	51.7	30
5.2 Policy environment for doing business	49.8	34
5.3 E-government services	66.0	39
5.4 IT application	68.1	36
5.5 Availability of venture capital	59.0	31
5.6 Business-university collaboration in R&D	62.9	35
5.7 Proportion of international co-authored papers in all domestic papers	55.1	30
5.8 Ratio of international investment to GDP	10.8	16
5.9 Entrepreneurial culture	60.0	32

Russia

2024 Overall Index Ranking

39

Population/10,000 persons	14, 383
Area/10,000 square kilometers	1, 710
GDP/USD100 million	22, 660.3
GDP per capita/USD	15, 710.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	0.0
R&D expenditure/USD100 million	171.5
R&D expenditure intensity	0.76%
SCI indexed papers/piece	45, 604
PCT patent applications/piece	736
Proportion of high-tech products in total manufacturing exports	9.7%



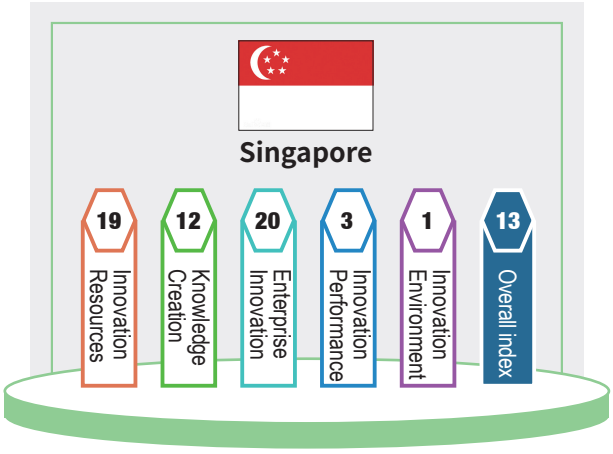
	Score	Ranking
Innovation Resources		29
1.1 R&D expenditure intensity	12.6	35
1.2 Share of global R&D expenditure	1.9	17
1.3 Proportion of basic research funding in total R&D expenditure	41.9	25
1.4 Number of top-tier research institutions	3.1	24
1.5 Proportion of STEM graduates in all college graduates	67.1	4
1.6 R&D personnel intensity	42.9	31
1.7 Number of highly cited scientists	0.2	32
1.8 Level of S&T human resource development	37.7	33
1.9 Average score of top three domestic universities in the world university rankings	45.3	26
Knowledge Creation		39
2.1 Number of S&T papers per USD1 million of R&D expenditure	27.5	19
2.2 Invention patents in force per 10,000 employed individuals	7.1	13
2.3 Number of industrial design applications per USD100 million of industrial value-added	5.0	14
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	26.9	36
2.5 Proportion of highly cited papers in all domestic papers	24.5	40
Enterprise Innovation		40
3.1 Ratio of enterprise R&D expenditure to value-added	4.3	35
3.2 Enterprise researchers as a share of total researchers	56.3	24
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	—	—
3.4 Triadic patents as a share of the world's total	0.7	23
3.5 PCT applications per 10,000 enterprise researchers	0.5	38
3.6 Proportion of intellectual property royalty income in service exports	6.2	27
3.7 Economic growth rate	−21.9	40
3.8 Density of newly registered companies	13.3	30
3.9 Number of high-growth technology companies	0.1	29
Innovation Performance		36
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	19.4	29
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	39.4	31
4.3 Proportion of high-tech products in total manufacturing exports	23.8	30
4.4 Labor productivity	15.3	34
4.5 Economic output per unit of energy consumption	—	—
4.6 Economic output per unit of CO_2 emission	5.8	38
Innovation Environment		40
5.1 Rule-of-law environment	14.2	40
5.2 Policy environment for doing business	54.9	30
5.3 E-government services	72.2	36
5.4 IT application	74.5	31
5.5 Availability of venture capital	53.1	34
5.6 Business-university collaboration in R&D	67.4	30
5.7 Proportion of international co-authored papers in all domestic papers	44.8	35
5.8 Ratio of international investment to GDP	—	—
5.9 Entrepreneurial culture	61.8	31

Singapore

2024 Overall Index Ranking

13

Population/10,000 persons	592
Area/10,000 square kilometers	0.1
GDP/USD100 million	4, 984.7
GDP per capita/USD	88, 428.7
Economic output per unit of energy consumption/(USD10,000/petajoule)	5.5
R&D expenditure/USD100 million	75.4
R&D expenditure intensity	1.51%
SCI indexed papers/piece	18, 934
PCT patent applications/piece	1, 759
Proportion of high-tech products in total manufacturing exports	25.0%



Innovation Resources 19

		Score	Ranking
1.1	R&D expenditure intensity	25.1	23
1.2	Share of global R&D expenditure	0.8	26
1.3	Proportion of basic research funding in total R&D expenditure	46.8	19
1.4	Number of top-tier research institutions	3.1	24
1.5	Proportion of STEM graduates in all college graduates	76.9	2
1.6	R&D personnel intensity	51.2	26
1.7	Number of highly cited scientists	4.0	10
1.8	Level of S&T human resource development	64.6	7
1.9	Average score of top three domestic universities in the world university rankings	71.4	12

Knowledge Creation 12

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	26.0	20
2.2	Invention patents in force per 10,000 employed individuals	2.2	23
2.3	Number of industrial design applications per USD100 million of industrial value-added	2.2	25
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	72.4	7
2.5	Proportion of highly cited papers in all domestic papers	100.0	1

Enterprise Innovation 20

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	13.1	25
3.2	Enterprise researchers as a share of total researchers	65.5	19
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	19.4	7
3.4	Triadic patents as a share of the world's total	1.4	20
3.5	PCT applications per 10,000 enterprise researchers	6.8	17
3.6	Proportion of intellectual property royalty income in service exports	17.1	15
3.7	Economic growth rate	40.7	19
3.8	Density of newly registered companies	59.9	6
3.9	Number of high-growth technology companies	2.7	10

Innovation Performance 3

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	14.8	34
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	100.0	1
4.3	Proportion of high-tech products in total manufacturing exports	61.5	6
4.4	Labor productivity	61.2	7
4.5	Economic output per unit of energy consumption	50.7	8
4.6	Economic output per unit of CO_2 emission	36.3	10

Innovation Environment 1

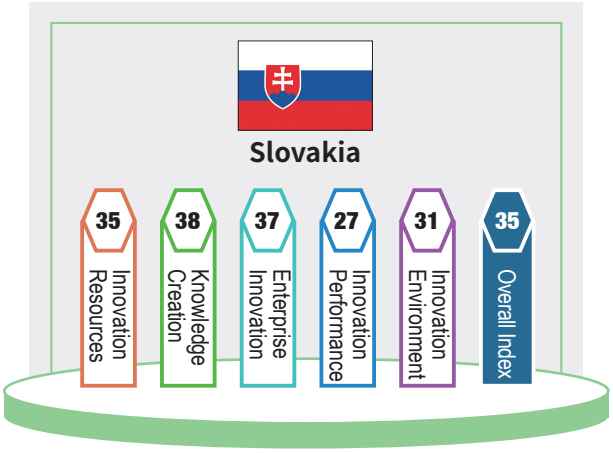
		Score	Ranking
5.1	Rule-of-law environment	94.1	4
5.2	Policy environment for doing business	97.5	2
5.3	E-government services	97.6	4
5.4	IT application	99.9	2
5.5	Availability of venture capital	—	—
5.6	Business-university collaboration in R&D	91.3	7
5.7	Proportion of international co-authored papers in all domestic papers	89.7	4
5.8	Ratio of international investment to GDP	100.0	1
5.9	Entrepreneurial culture	—	—

Slovakia

2024 Overall Index Ranking

35

Population/10,000 persons	543
Area/10,000 square kilometers	4.9
GDP/USD100 million	1, 155.8
GDP per capita/USD	21, 279.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	2.4
R&D expenditure/USD100 million	11.3
R&D expenditure intensity	0.98%
SCI indexed papers/piece	5, 173
PCT patent applications/piece	44
Proportion of high-tech products in total manufacturing exports	8.4%



Innovation Resources 35

		Score	Ranking
1.1	R&D expenditure intensity	16.3	31
1.2	Share of global R&D expenditure	0.1	38
1.3	Proportion of basic research funding in total R&D expenditure	93.2	2
1.4	Number of top-tier research institutions	0.4	38
1.5	Proportion of STEM graduates in all college graduates	45.8	29
1.6	R&D personnel intensity	38.9	32
1.7	Number of highly cited scientists	—	—
1.8	Level of S&T human resource development	35.0	36
1.9	Average score of top three domestic universities in the world university rankings	—	—

Knowledge Creation 38

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	47.3	7
2.2	Invention patents in force per 10,000 employed individuals	0.6	33
2.3	Number of industrial design applications per USD100 million of industrial value-added	2.1	26
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	54.5	16
2.5	Proportion of highly cited papers in all domestic papers	30.5	38

Enterprise Innovation 37

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	6.9	31
3.2	Enterprise researchers as a share of total researchers	37.1	35
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	—	—
3.4	Triadic patents as a share of the world's total	0.1	34
3.5	PCT applications per 10,000 enterprise researchers	1.4	29
3.6	Proportion of intellectual property royalty income in service exports	2.5	35
3.7	Economic growth rate	19.8	35
3.8	Density of newly registered companies	29.0	19
3.9	Number of high-growth technology companies	—	—

Innovation Performance 27

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	28.2	18
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	60.9	14
4.3	Proportion of high-tech products in total manufacturing exports	20.6	34
4.4	Labor productivity	22.7	28
4.5	Economic output per unit of energy consumption	22.1	28
4.6	Economic output per unit of CO_2 emission	14.5	27

Innovation Environment 31

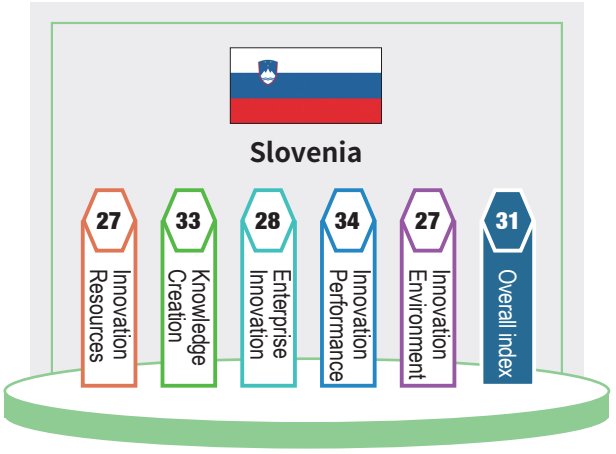
		Score	Ranking
5.1	Rule-of-law environment	60.4	27
5.2	Policy environment for doing business	60.3	25
5.3	E-government services	71.0	37
5.4	IT application	74.2	32
5.5	Availability of venture capital	68.4	25
5.6	Business-university collaboration in R&D	56.9	39
5.7	Proportion of international co-authored papers in all domestic papers	75.3	19
5.8	Ratio of international investment to GDP	7.5	21
5.9	Entrepreneurial culture	56.6	35

Slovenia

2024 Overall Index Ranking

31

Population/10,000 persons	212
Area/10,000 square kilometers	2.1
GDP/USD100 million	600.6
GDP per capita/USD	28, 439.3
Economic output per unit of energy consumption/(USD10,000/petajoule)	3.0
R&D expenditure/USD100 million	12.7
R&D expenditure intensity	2.11%
SCI indexed papers/piece	5, 301
PCT patent applications/piece	116
Proportion of high-tech products in total manufacturing exports	8.5%



Innovation Resources 27

	Score	Ranking
1.1 R&D expenditure intensity	35.0	17
1.2 Share of global R&D expenditure	0.1	37
1.3 Proportion of basic research funding in total R&D expenditure	54.7	14
1.4 Number of top-tier research institutions	1.3	34
1.5 Proportion of STEM graduates in all college graduates	63.2	8
1.6 R&D personnel intensity	65.1	15
1.7 Number of highly cited scientists	—	—
1.8 Level of S&T human resource development	54.9	17
1.9 Average score of top three domestic universities in the world university rankings	—	—

Knowledge Creation 33

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	43.3	8
2.2 Invention patents in force per 10,000 employed individuals	3.5	20
2.3 Number of industrial design applications per USD100 million of industrial value-added	1.3	33
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	89.1	6
2.5 Proportion of highly cited papers in all domestic papers	60.1	18

Enterprise Innovation 28

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	17.1	17
3.2 Enterprise researchers as a share of total researchers	70.3	17
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	19.2	8
3.4 Triadic patents as a share of the world's total	0.1	35
3.5 PCT applications per 10,000 enterprise researchers	1.3	30
3.6 Proportion of intellectual property royalty income in service exports	5.6	29
3.7 Economic growth rate	26.1	30
3.8 Density of newly registered companies	14.6	29
3.9 Number of high-growth technology companies	—	—

Innovation Performance 34

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	—	—
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	45.6	27
4.3 Proportion of high-tech products in total manufacturing exports	20.8	33
4.4 Labor productivity	26.5	25
4.5 Economic output per unit of energy consumption	27.8	24
4.6 Economic output per unit of CO_2 emission	18.0	24

Innovation Environment 27

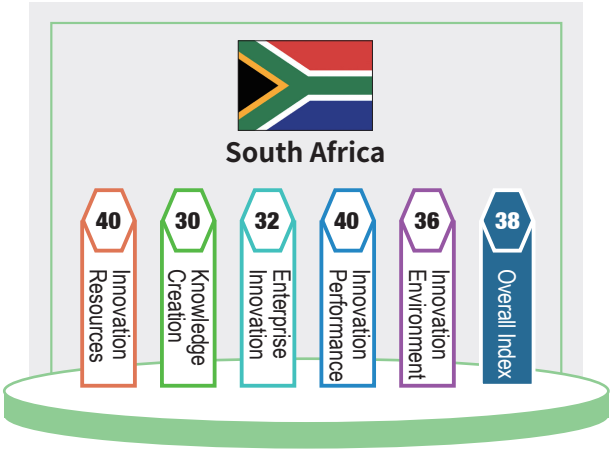
	Score	Ranking
5.1 Rule-of-law environment	69.9	24
5.2 Policy environment for doing business	46.9	36
5.3 E-government services	86.9	18
5.4 IT application	81.4	27
5.5 Availability of venture capital	69.8	23
5.6 Business-university collaboration in R&D	70.1	28
5.7 Proportion of international co-authored papers in all domestic papers	71.8	22
5.8 Ratio of international investment to GDP	8.5	19
5.9 Entrepreneurial culture	71.2	23

South Africa

2024 Overall Index Ranking

38

Population/10,000 persons	6, 041
Area/10,000 square kilometers	122
GDP/USD100 million	4, 052.7
GDP per capita/USD	6, 766.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	1.6
R&D expenditure/USD100 million	20.5
R&D expenditure intensity	0.51%
SCI indexed papers/piece	19, 824
PCT patent applications/piece	215
Proportion of high-tech products in total manufacturing exports	5.5%



Innovation Resources 40

		Score	Ranking
1.1	R&D expenditure intensity	8.4	37
1.2	Share of global R&D expenditure	0.2	35
1.3	Proportion of basic research funding in total R&D expenditure	79.7	4
1.4	Number of top-tier research institutions	4.0	20
1.5	Proportion of STEM graduates in all college graduates	37.9	37
1.6	R&D personnel intensity	11.5	37
1.7	Number of highly cited scientists	0.4	28
1.8	Level of S&T human resource development	16.9	39
1.9	Average score of top three domestic universities in the world university rankings	42.8	28

Knowledge Creation 30

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	100.0	1
2.2	Invention patents in force per 10,000 employed individuals	1.8	27
2.3	Number of industrial design applications per USD100 million of industrial value-added	6.9	11
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	96.8	2
2.5	Proportion of highly cited papers in all domestic papers	57.0	21

Enterprise Innovation 32

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	2.7	38
3.2	Enterprise researchers as a share of total researchers	12.8	40
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	—	—
3.4	Triadic patents as a share of the world's total	0.1	38
3.5	PCT applications per 10,000 enterprise researchers	16.2	3
3.6	Proportion of intellectual property royalty income in service exports	4.8	31
3.7	Economic growth rate	20.3	34
3.8	Density of newly registered companies	58.5	7
3.9	Number of high-growth technology companies	0.2	26

Innovation Performance 40

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	15.0	33
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	29.9	37
4.3	Proportion of high-tech products in total manufacturing exports	13.5	38
4.4	Labor productivity	12.5	36
4.5	Economic output per unit of energy consumption	14.9	37
4.6	Economic output per unit of CO_2 emission	4.0	40

Innovation Environment 36

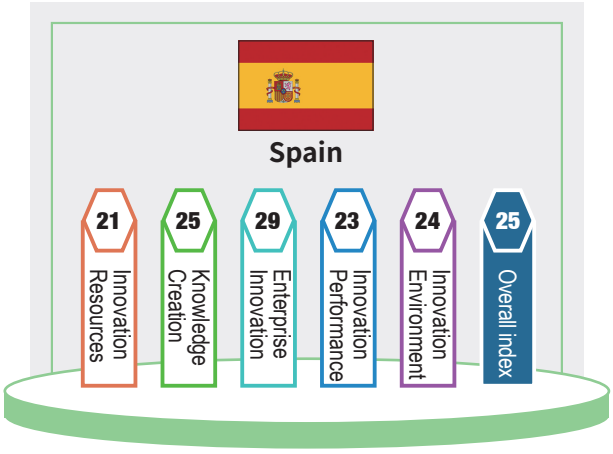
		Score	Ranking
5.1	Rule-of-law environment	43.5	33
5.2	Policy environment for doing business	52.2	33
5.3	E-government services	73.6	34
5.4	IT application	59.6	40
5.5	Availability of venture capital	57.2	33
5.6	Business-university collaboration in R&D	75.2	25
5.7	Proportion of international co-authored papers in all domestic papers	77.7	15
5.8	Ratio of international investment to GDP	7.4	22
5.9	Entrepreneurial culture	59.5	33

Spain

2024 Overall Index Ranking

25

Population/10,000 persons	4, 837
Area/10,000 square kilometers	51
GDP/USD100 million	14, 178.0
GDP per capita/USD	29, 674.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.2
R&D expenditure/USD100 million	203.5
R&D expenditure intensity	1.44%
SCI indexed papers/piece	78, 289
PCT patent applications/piece	1, 488
Proportion of high-tech products in total manufacturing exports	12.4%



Innovation Resources 21

	Score	Ranking
1.1 R&D expenditure intensity	23.8	26
1.2 Share of global R&D expenditure	2.2	14
1.3 Proportion of basic research funding in total R&D expenditure	54.1	15
1.4 Number of top-tier research institutions	22.3	5
1.5 Proportion of STEM graduates in all college graduates	45.7	30
1.6 R&D personnel intensity	52.0	25
1.7 Number of highly cited scientists	4.0	11
1.8 Level of S&T human resource development	63.0	8
1.9 Average score of top three domestic universities in the world university rankings	51.5	22

Knowledge Creation 25

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	39.8	12
2.2 Invention patents in force per 10,000 employed individuals	3.3	21
2.3 Number of industrial design applications per USD100 million of industrial value-added	3.7	21
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	58.5	13
2.5 Proportion of highly cited papers in all domestic papers	56.8	22

Enterprise Innovation 29

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	12.6	26
3.2 Enterprise researchers as a share of total researchers	48.6	30
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	3.9	29
3.4 Triadic patents as a share of the world's total	2.2	16
3.5 PCT applications per 10,000 enterprise researchers	3.2	25
3.6 Proportion of intellectual property royalty income in service exports	8.5	23
3.7 Economic growth rate	61.2	6
3.8 Density of newly registered companies	16.3	26
3.9 Number of high-growth technology companies	0.9	16

Innovation Performance 23

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	24.7	24
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	48.7	26
4.3 Proportion of high-tech products in total manufacturing exports	30.5	26
4.4 Labor productivity	33.1	22
4.5 Economic output per unit of energy consumption	38.3	17
4.6 Economic output per unit of CO_2 emission	26.7	16

Innovation Environment 24

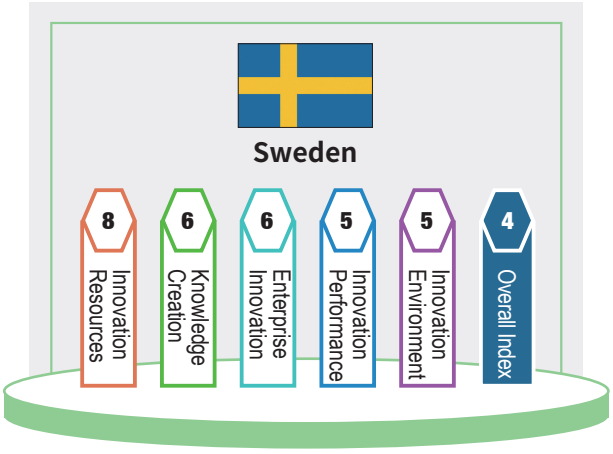
	Score	Ranking
5.1 Rule-of-law environment	65.4	26
5.2 Policy environment for doing business	54.2	31
5.3 E-government services	85.7	21
5.4 IT application	84.2	24
5.5 Availability of venture capital	66.3	27
5.6 Business-university collaboration in R&D	65.1	32
5.7 Proportion of international co-authored papers in all domestic papers	67.4	27
5.8 Ratio of international investment to GDP	13.6	10
5.9 Entrepreneurial culture	78.8	20

Sweden

2024 Overall Index Ranking

4

Population/10,000 persons	1, 054
Area/10,000 square kilometers	53
GDP/USD100 million	5, 904.1
GDP per capita/USD	56, 299.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	4.6
R&D expenditure/USD100 million	201.2
R&D expenditure intensity	3.41%
SCI indexed papers/piece	34, 988
PCT patent applications/piece	4, 482
Proportion of high-tech products in total manufacturing exports	16.8%



Innovation Resources 8

		Score	Ranking
1.1	R&D expenditure intensity	56.6	4
1.2	Share of global R&D expenditure	2.2	15
1.3	Proportion of basic research funding in total R&D expenditure	33.6	30
1.4	Number of top-tier research institutions	3.1	24
1.5	Proportion of STEM graduates in all college graduates	62.0	12
1.6	R&D personnel intensity	82.1	6
1.7	Number of highly cited scientists	2.3	16
1.8	Level of S&T human resource development	55.9	14
1.9	Average score of top three domestic universities in the world university rankings	65.1	14

Knowledge Creation 6

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	18.0	30
2.2	Invention patents in force per 10,000 employed individuals	8.5	11
2.3	Number of industrial design applications per USD100 million of industrial value-added	1.1	35
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	51.9	20
2.5	Proportion of highly cited papers in all domestic papers	73.1	7

Enterprise Innovation 6

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	34.0	6
3.2	Enterprise researchers as a share of total researchers	90.6	5
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	14.5	13
3.4	Triadic patents as a share of the world's total	4.8	11
3.5	PCT applications per 10,000 enterprise researchers	12.6	5
3.6	Proportion of intellectual property royalty income in service exports	36.7	7
3.7	Economic growth rate	28.2	27
3.8	Density of newly registered companies	48.9	9
3.9	Number of high-growth technology companies	0.9	16

Innovation Performance 5

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	73.9	2
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	62.6	13
4.3	Proportion of high-tech products in total manufacturing exports	41.4	19
4.4	Labor productivity	54.3	12
4.5	Economic output per unit of energy consumption	42.5	11
4.6	Economic output per unit of CO_2 emission	100.0	1

Innovation Environment 5

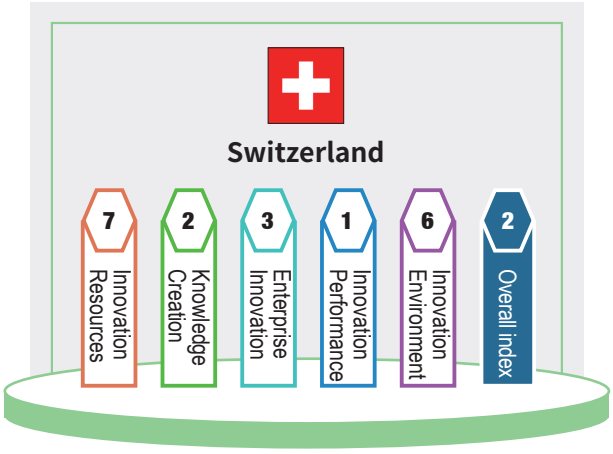
		Score	Ranking
5.1	Rule-of-law environment	90.5	11
5.2	Policy environment for doing business	75.2	16
5.3	E-government services	90.6	10
5.4	IT application	98.4	5
5.5	Availability of venture capital	81.2	7
5.6	Business-university collaboration in R&D	89.2	9
5.7	Proportion of international co-authored papers in all domestic papers	84.9	7
5.8	Ratio of international investment to GDP	47.6	2
5.9	Entrepreneurial culture	76.8	21

Switzerland

2024 Overall Index Ranking

2

Population/10,000 persons	885
Area/10,000 square kilometers	4
GDP/USD100 million	8, 184.3
GDP per capita/USD	93, 259.9
Economic output per unit of energy consumption/(USD10,000/petajoule)	10.7
R&D expenditure/USD100 million	257.4
R&D expenditure intensity	3.15%
SCI indexed papers/piece	39, 769
PCT patent applications/piece	5, 442
Proportion of high-tech products in total manufacturing exports	28.8%



Innovation Resources 7

		Score	Ranking
1.1	R&D expenditure intensity	52.3	8
1.2	Share of global R&D expenditure	2.8	12
1.3	Proportion of basic research funding in total R&D expenditure	70.1	7
1.4	Number of top-tier research institutions	9.4	14
1.5	Proportion of STEM graduates in all college graduates	53.9	20
1.6	R&D personnel intensity	70.8	10
1.7	Number of highly cited scientists	3.8	12
1.8	Level of S&T human resource development	49.4	23
1.9	Average score of top three domestic universities in the world university rankings	80.5	6

Knowledge Creation 2

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	16.0	32
2.2	Invention patents in force per 10,000 employed individuals	16.4	6
2.3	Number of industrial design applications per USD100 million of industrial value-added	3.9	19
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	41.3	27
2.5	Proportion of highly cited papers in all domestic papers	86.9	3

Enterprise Innovation 3

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	28.0	10
3.2	Enterprise researchers as a share of total researchers	58.9	23
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	20.5	6
3.4	Triadic patents as a share of the world's total	8.9	8
3.5	PCT applications per 10,000 enterprise researchers	46.8	2
3.6	Proportion of intellectual property royalty income in service exports	71.2	2
3.7	Economic growth rate	27.2	29
3.8	Density of newly registered companies	24.5	21
3.9	Number of high-growth technology companies	1.7	12

Innovation Performance 1

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	32.7	14
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	83.2	2
4.3	Proportion of high-tech products in total manufacturing exports	70.9	3
4.4	Labor productivity	75.5	5
4.5	Economic output per unit of energy consumption	98.3	2
4.6	Economic output per unit of CO_2 emission	88.9	2

Innovation Environment 6

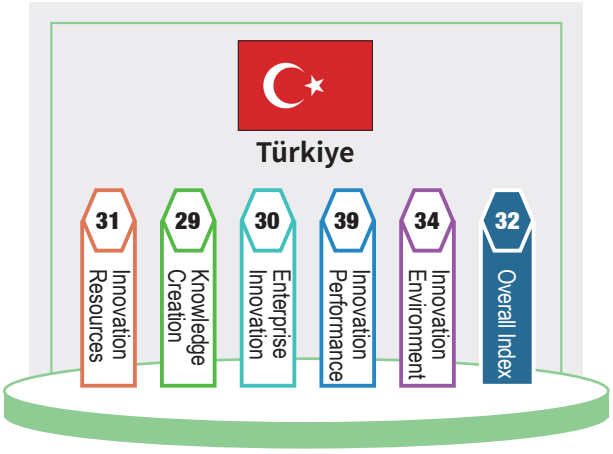
		Score	Ranking
5.1	Rule-of-law environment	92.7	6
5.2	Policy environment for doing business	100.0	1
5.3	E-government services	75.7	33
5.4	IT application	97.2	6
5.5	Availability of venture capital	83.2	6
5.6	Business-university collaboration in R&D	99.6	3
5.7	Proportion of international co-authored papers in all domestic papers	90.6	3
5.8	Ratio of international investment to GDP	—	—
5.9	Entrepreneurial culture	90.8	6

Türkiye

2024 Overall Index Ranking

32

Population/10,000 persons	8, 533
Area/10,000 square kilometers	79
GDP/USD100 million	9, 071.2
GDP per capita/USD	10, 674.5
Economic output per unit of energy consumption/(USD10,000/petajoule)	1.7
R&D expenditure/USD100 million	120.1
R&D expenditure intensity	1.32%
SCI indexed papers/piece	48, 278
PCT patent applications/piece	1, 770
Proportion of high-tech products in total manufacturing exports	3.6%



Innovation Resources 31

		Score	Ranking
1.1	R&D expenditure intensity	22.0	29
1.2	Share of global R&D expenditure	1.3	21
1.3	Proportion of basic research funding in total R&D expenditure	—	—
1.4	Number of top-tier research institutions	—	—
1.5	Proportion of STEM graduates in all college graduates	39.6	36
1.6	R&D personnel intensity	36.2	33
1.7	Number of highly cited scientists	0.3	29
1.8	Level of S&T human resource development	83.7	2
1.9	Average score of top three domestic universities in the world university rankings	34.4	32

Knowledge Creation 29

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	41.6	9
2.2	Invention patents in force per 10,000 employed individuals	0.8	30
2.3	Number of industrial design applications per USD100 million of industrial value-added	47.0	3
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	53.6	18
2.5	Proportion of highly cited papers in all domestic papers	47.7	32

Enterprise Innovation 30

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	8.4	30
3.2	Enterprise researchers as a share of total researchers	74.5	11
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	2.6	30
3.4	Triadic patents as a share of the world's total	0.4	26
3.5	PCT applications per 10,000 enterprise researchers	0.4	40
3.6	Proportion of intellectual property royalty income in service exports	1.9	36
3.7	Economic growth rate	58.7	9
3.8	Density of newly registered companies	12.9	31
3.9	Number of high-growth technology companies	0.2	26

Innovation Performance 39

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	16.8	30
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	42.0	29
4.3	Proportion of high-tech products in total manufacturing exports	8.9	40
4.4	Labor productivity	14.2	35
4.5	Economic output per unit of energy consumption	15.6	36
4.6	Economic output per unit of CO_2 emission	7.5	35

Innovation Environment 34

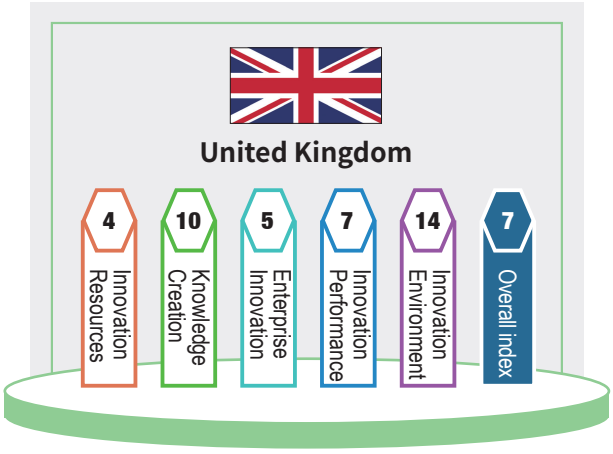
		Score	Ranking
5.1	Rule-of-law environment	27.5	37
5.2	Policy environment for doing business	44.9	37
5.3	E-government services	86.1	20
5.4	IT application	69.2	34
5.5	Availability of venture capital	69.8	22
5.6	Business-university collaboration in R&D	63.6	33
5.7	Proportion of international co-authored papers in all domestic papers	37.8	39
5.8	Ratio of international investment to GDP	5.0	27
5.9	Entrepreneurial culture	68.7	26

United Kingdom

2024 Overall Index Ranking

7

Population/10,000 persons	6, 835
Area/10,000 square kilometers	24
GDP/USD100 million	30, 888.4
GDP per capita/USD	46, 121.8
Economic output per unit of energy consumption/(USD10,000/petajoule)	6.3
R&D expenditure/USD100 million	815.6
R&D expenditure intensity	2.64%
SCI indexed papers/piece	150, 085
PCT patent applications/piece	5, 692
Proportion of high-tech products in total manufacturing exports	26.5%



Innovation Resources 4

	Score	Ranking
1.1 R&D expenditure intensity	43.9	13
1.2 Share of global R&D expenditure	8.8	6
1.3 Proportion of basic research funding in total R&D expenditure	43.8	22
1.4 Number of top-tier research institutions	25.4	3
1.5 Proportion of STEM graduates in all college graduates	47.6	26
1.6 R&D personnel intensity	54.9	23
1.7 Number of highly cited scientists	21.6	3
1.8 Level of S&T human resource development	55.0	16
1.9 Average score of top three domestic universities in the world university rankings	99.7	2

Knowledge Creation 10

	Score	Ranking
2.1 Number of S&T papers per USD1 million of R&D expenditure	19.0	29
2.2 Invention patents in force per 10,000 employed individuals	5.2	17
2.3 Number of industrial design applications per USD100 million of industrial value-added	9.3	8
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	56.8	14
2.5 Proportion of highly cited papers in all domestic papers	69.5	11

Enterprise Innovation 5

	Score	Ranking
3.1 Ratio of enterprise R&D expenditure to value-added	38.8	5
3.2 Enterprise researchers as a share of total researchers	46.6	32
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country	7.8	22
3.4 Triadic patents as a share of the world's total	11.6	7
3.5 PCT applications per 10,000 enterprise researchers	4.2	24
3.6 Proportion of intellectual property royalty income in service exports	22.0	12
3.7 Economic growth rate	46.1	13
3.8 Density of newly registered companies	98.6	2
3.9 Number of high-growth technology companies	10.0	4

Innovation Performance 7

	Score	Ranking
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector	26.4	21
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	54.9	18
4.3 Proportion of high-tech products in total manufacturing exports	65.2	4
4.4 Labor productivity	45.1	17
4.5 Economic output per unit of energy consumption	57.7	5
4.6 Economic output per unit of CO_2 emission	35.2	11

Innovation Environment 14

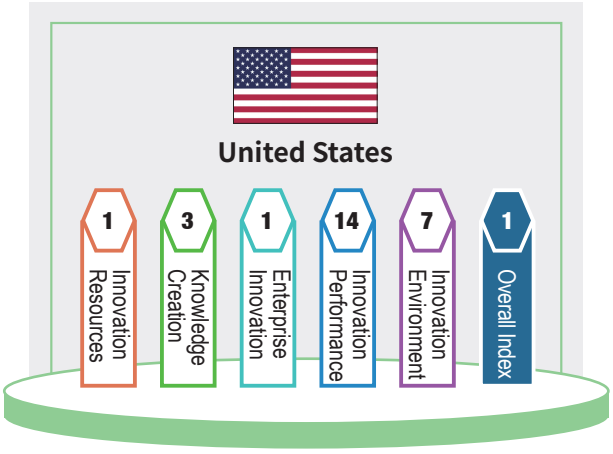
	Score	Ranking
5.1 Rule-of-law environment	81.5	17
5.2 Policy environment for doing business	74.7	18
5.3 E-government services	89.0	14
5.4 IT application	94.6	10
5.5 Availability of venture capital	76.2	16
5.6 Business-university collaboration in R&D	89.2	10
5.7 Proportion of international co-authored papers in all domestic papers	82.9	11
5.8 Ratio of international investment to GDP	12.1	12
5.9 Entrepreneurial culture	79.2	19

United States

2024 Overall Index Ranking

1

Population/10,000 persons	33, 492
Area/10,000 square kilometers	983
GDP/USD100 million	257, 441.1
GDP per capita/USD	77, 242.9
Economic output per unit of energy consumption/(USD10,000/petajoule)	3.7
R&D expenditure/USD100 million	9, 232.4
R&D expenditure intensity	3.59%
SCI indexed papers/piece	454, 894
PCT patent applications/piece	58, 854
Proportion of high-tech products in total manufacturing exports	17.9%



Innovation Resources 1

		Score	Ranking
1.1	R&D expenditure intensity	59.6	3
1.2	Share of global R&D expenditure	100.0	1
1.3	Proportion of basic research funding in total R&D expenditure	34.3	29
1.4	Number of top-tier research institutions	100.0	1
1.5	Proportion of STEM graduates in all college graduates	43.0	32
1.6	R&D personnel intensity	66.7	14
1.7	Number of highly cited scientists	100.0	1
1.8	Level of S&T human resource development	52.8	19
1.9	Average score of top three domestic universities in the world university rankings	100.0	1

Knowledge Creation 3

		Score	Ranking
2.1	Number of S&T papers per USD1 million of R&D expenditure	5.1	40
2.2	Invention patents in force per 10,000 employed individuals	29.8	3
2.3	Number of industrial design applications per USD100 million of industrial value-added	3.4	23
2.4	Number of scientific paper citations per USD1 million of R&D expenditure in academic departments	14.8	40
2.5	Proportion of highly cited papers in all domestic papers	51.4	29

Enterprise Innovation 1

		Score	Ranking
3.1	Ratio of enterprise R&D expenditure to value-added	49.8	2
3.2	Enterprise researchers as a share of total researchers	98.4	2
3.3	Average R&D expenditure intensity of the top ten R&D-spending companies in the country	26.7	2
3.4	Triadic patents as a share of the world's total	89.1	2
3.5	PCT applications per 10,000 enterprise researchers	7.0	16
3.6	Proportion of intellectual property royalty income in service exports	51.0	4
3.7	Economic growth rate	20.5	33
3.8	Density of newly registered companies	—	—
3.9	Number of high-growth technology companies	100.0	1

Innovation Performance 14

		Score	Ranking
4.1	Proportion of knowledge-intensive service industries in the total value-added of the service sector	34.4	11
4.2	Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector	53.9	20
4.3	Proportion of high-tech products in total manufacturing exports	43.9	15
4.4	Labor productivity	76.7	4
4.5	Economic output per unit of energy consumption	33.6	20
4.6	Economic output per unit of CO_2 emission	20.5	22

Innovation Environment 7

		Score	Ranking
5.1	Rule-of-law environment	81.2	18
5.2	Policy environment for doing business	86.3	5
5.3	E-government services	94.0	7
5.4	IT application	100.0	1
5.5	Availability of venture capital	89.1	4
5.6	Business-university collaboration in R&D	100.0	2
5.7	Proportion of international co-authored papers in all domestic papers	51.6	33
5.8	Ratio of international investment to GDP	6.6	24
5.9	Entrepreneurial culture	88.7	8

9 Appendixes

Appendix I NII assessment theories and methodology

Appendix II Definition of indicators

Appendix III Data sources

The NII study draws upon theories and methodologies from both domestic and international research on national competitiveness and innovation assessment. Based on the evaluation objectives and the conceptual connotations of innovative countries, the NII framework is constructed across five dimensions: innovation resources, knowledge creation, enterprise innovation, innovation performance, and innovation environment, providing a comprehensive approach and methodology for evaluation.

1. Evaluation objectives

The NII study has three main objectives.

First, constructing a standardized indicator matrix for the assessment of national innovation capacity, developing scientific indicator interpretations, calculation methods and analytical framework, and constantly refining the system in line with the evaluation practice in order to provide theoretical support for monitoring and assessing China's progress in building an innovative country.

Second, measuring the NII performance of countries worldwide based on the indicator matrix for evaluating national innovation capacity in order to provide a reference for understanding the global STI situation and tracking the dynamics on the innovation landscape.

Third, comprehensively, objectively and accurately depicting China's national innovation capability across different dimensions and levels of the innovation chain through the measurement of national innovation capability, pinpointing China's position on the global innovation landscape, and providing insights and services for China to build itself into an innovative country and a strong S&T nation and improve its STI policies.

2. Theoretical foundation

The construction of the NII is based on the understanding of innovation and the knowledge of innovative countries.

Innovation is a comprehensive process influenced by external environments and policy frameworks, spanning from the conception of innovation ideas to research and development, knowledge output, and commercial application. National innovation capability should be reflected in the entire process of generating, disseminating, and commercializing scientific and technological knowledge, as well as in the entire innovation ecosystem. Therefore, for the purpose of assessing the national innovation capability, the NII indicators should be constructed across the vital links of the innovation chain, from the input of innovation resources, cultivation of innovation environment and enterprise innovation to the output of innovation results and impact on innovation performance. The world's leading reports on innovation capacity assessment, such as the WIPO *Global Innovation Index* and the *European Innovation Scoreboard*, have all spanned across the whole innovation chain and adopted a composite index approach to examine the comprehensive innovation capacity of each country.

Innovation is the fundamental driving force for the continuous and stable development of countries worldwide, especially large nations. Technological progress in countries often goes hand in hand with economic development. Statistics show that among the 200-plus countries and regions globally, only 35 have seen their R&D expenditure exceeding 1% of GDP. Although these countries represent only about 35% of the world's population, they account for 80% of the world's GDP. This shows that the economic strength of major economies depends primarily on technological advances, rather than on population or natural resources. While some small countries may have been able to achieve economic growth and accumulate national wealth based on their natural resources, no large country has grown into a global economic powerhouse by relying solely on natural resources. As a big country, China does not have too many resources to export, nor can it follow the path of economic dependence. Therefore, the only viable path for China is to pursue innovation-driven development, build itself into an innovative country and strive to become a S&T power.

Combining all the results of the world's major studies on the evaluation of competitiveness and innovation capacity, the most

important feature of an innovative country is the fundamental change of its model of economic and social development compared with the traditional model. Whether a country is considered innovative depends on whether its economic and social development is driven primarily by the traditional means of natural resources consumption and capital input or by the innovation activities characterized by the creation, promotion, and application of knowledge. An innovative country should have the following five capabilities:

(1) Strong comprehensive capability for the input of innovation resources;

(2) Strong capability in knowledge creation, diffusion, and impact;

(3) Strong enterprise innovation capability;

(4) Strong capability in innovation output and impact;

(5) A favorable innovation environment.

Based on the above theoretical analysis, and with reference to the major global reports on the evaluation of innovation capability and competitiveness, we have constructed a NII indicator matrix underpinned by a set of first-level indicators and the corresponding second-level indicators selected from across the innovation chain, and adopted a system of comprehensive index for calculation, allowing for a holistic analysis, comparison, and assessment of national innovation capabilities.

3. Principles for indicator selection

— Authoritative data sources: Basic data must come from official statistics and surveys of recognized international organizations and national governments, and be regularly collected through formal channels to ensure accuracy, authority, continuity, and timeliness.

— Representative evaluation subjects: The subjects selected must be countries with significant investment in S&T resources and substantial innovation output. For the purpose of this study, 40 major countries have been selected, representing over 95% of the world's R&D input and over 80% of the global GDP.

— International comparability of indicators: The indicator

matrix is constructed using internationally recognized indicators, with definitions and statistical scope aligned with international standards.

— Insensitivity to country size: The selected indicators are primarily relative metrics, taking into account the characteristics of countries with different sizes in terms of the efficiency of innovation input and output, scale of innovation activities and scope of innovation.

— Combination of quantitative and qualitative analysis: Both quantitative statistical indicators and authoritative, reliable qualitative survey indicators are used.

— Integration of historical analysis and contemporaneous comparison: Countries are both compared with each other in the current context and analyzed for year-by-year changes.

Additionally, the indicator matrix of this year's report has been adjusted, with content expanded to further underscore the importance of innovation quality, efficiency, and future potential in the new era and context. The selection of indicators also takes into account the relative stability of country rankings compared to previous annual reports.

Indicator matrix

The NII indicator matrix consists of five first-level indicators (innovation resources, knowledge creation, enterprise innovation, innovation performance and innovation environment) and 38 second-level indicators.

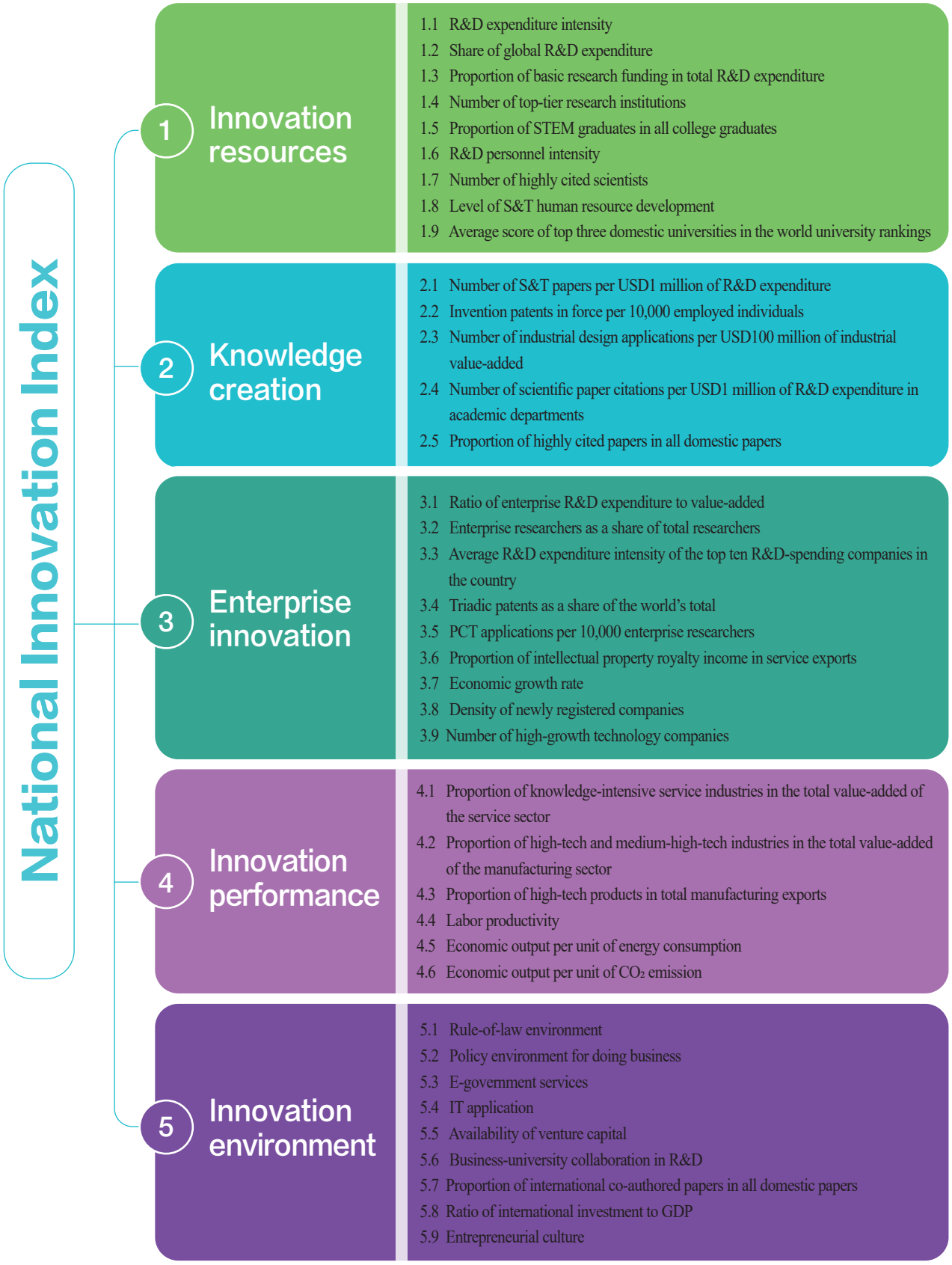
Innovation resources: This indicator reflects a country's availability of funding and human capital resources for innovation activities.

Knowledge creation: This indicator reflects a country's output of science and intellectual property.

Enterprise innovation: This indicator reflects the intensity, efficiency and efficacy of a country's enterprise innovation activities.

Innovation performance: This indicator reflects the economic and ecological impact of a country's innovation activities, and their role in driving industrial transformation and upgrading.

Innovation environment: This indicator reflects the external soft environment of innovation activities, such as market, policy, system and culture.


National Innovation Index
1
Innovation resources
1.1 R&D expenditure intensity
1.2 Share of global R&D expenditure
1.3 Proportion of basic research funding in total R&D expenditure
1.4 Number of top-tier research institutions
1.5 Proportion of STEM graduates in all college graduates
1.6 R&D personnel intensity
1.7 Number of highly cited scientists
1.8 Level of S&T human resource development
1.9 Average score of top three domestic universities in the world university rankings
2
Knowledge creation
2.1 Number of S&T papers per USD1 million of R&D expenditure
2.2 Invention patents in force per 10,000 employed individuals
2.3 Number of industrial design applications per USD100 million of industrial value-added
2.4 Number of scientific paper citations per USD1 million of R&D expenditure in academic departments
2.5 Proportion of highly cited papers in all domestic papers
3
Enterprise innovation
3.1 Ratio of enterprise R&D expenditure to value-added
3.2 Enterprise researchers as a share of total researchers
3.3 Average R&D expenditure intensity of the top ten R&D-spending companies in the country
3.4 Triadic patents as a share of the world's total
3.5 PCT applications per 10,000 enterprise researchers
3.6 Proportion of intellectual property royalty income in service exports
3.7 Economic growth rate
3.8 Density of newly registered companies
3.9 Number of high-growth technology companies
4
Innovation performance
4.1 Proportion of knowledge-intensive service industries in the total value-added of the service sector
4.2 Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector
4.3 Proportion of high-tech products in total manufacturing exports
4.4 Labor productivity
4.5 Economic output per unit of energy consumption
4.6 Economic output per unit of CO_2 emission
5
Innovation environment
5.1 Rule-of-law environment
5.2 Policy environment for doing business
5.3 E-government services
5.4 IT application
5.5 Availability of venture capital
5.6 Business-university collaboration in R&D
5.7 Proportion of international co-authored papers in all domestic papers
5.8 Ratio of international investment to GDP
5.9 Entrepreneurial culture

Calculation methodology

The NII scores are calculated with the internationally-recognized benchmarking method. The principle of benchmarking is to give a benchmark value to the evaluated subject and use the benchmark to measure all the evaluated subjects, so as to find the gap between the subjects and produce the ranking results.

1. Formula symbols

$i = 1\text{-}40$, refers to the 40 countries evaluated.

$j = 1\text{-}5$, refers to the five first-level indicators.

Each first-level indicator j corresponds to K^j second-level indicators, i.e.

$$\sum_{j=1}^{5} K^j = 38 .$$

where K^j refers to the Kth second-level indicator in the first-level indicator j, abbreviated as K in the following formula.

β_{jk} refers to the weight of the second-level indicator in the first-level indicator, and w_j refers to the weight of the first-level indicator in the NII. In this report, the synthetic indicators are all treated as mean values, i.e. $\beta_{jk} = 1$, $w_j = 1$.

2. Data treatment of second-level indicators

The original values of the 40 countries in the 38 second-level indicators are non-dimensionalized. Non-dimensionalization is used for the purpose of removing the discrepancies in quantitative units and the differences in the order of magnitude and form of relative number and enabling the generalization of indicators in assessment using multiple indicators.

Second-level indicator data are treated using linear non-dimensionalization, i. e.

$$y_{ijk} = \frac{x_{ijk} - \min x_{.jk}}{\max x_{.jk} - \min x_{jk}} .$$

where y = non-dimensionalized value of the second-level indicators, x = actual value of the second-level indicators.

3. Calculation of first-level indicators

Non-dimensionalized second-level indicators are combined into first-level indicator Y_{ij} :

$$Y_{ij} = \sum_{k=1}^{K^j} \beta_{jk} y_{ijk} .$$

The score of the first-level indicator $\overline{Y}_{ij}$ is non-dimensionalized in the same way:

$$\overline{Y}_{ij} = \frac{Y_{ij}}{\max Y_{\cdot j}} \times 100 .$$

4. Calculation of NII score

NII score is calculated to produce the rankings of the 40 countries.

$$Y_i = \sum_{j=1}^{5} w_j \overline{Y}_{ij} ,$$

$$\overline{Y}_i = \frac{Y_i}{\max Y_{\cdot}} .$$

1. R&D expenditure intensity

The ratio of total R&D expenditure to Gross Domestic Product (GDP), which is used to reflect the intensity of a country's STI funding.

2. Share of global R&D expenditure

The share of total R&D expenditure in the global total, which is used to reflect the scale of R&D activities and availability of innovation resources in a country.

3. Basic research expenditure as a percentage of total R&D expenditure

The share of basic research funding in total R&D expenditure, which is used to reflect the scale of basic research and original innovation capability of a country.

4. Number of top-tier research institutions

The total number of government-funded research institutions and non-profit organizations is on the top 500 list of the Nature Index, which is used to reflect a country's strength and competitiveness in the field of scientific research.

5. Proportion of STEM graduates in all college graduates

The share of Science, Technology, Engineering, and Mathematics (STEM) graduates in all college graduates, which is used to reflect a country's performance of talent cultivation in the STEM domain.

6. R&D personnel intensity

The number of R&D personnel per 10,000 employed population, which is used to reflect a country's human resource investment in innovation.

7. Number of highly cited scientists

The number of highly cited scientists in a country, based on the Clarivate Analytics' Highly Cited Researchers List, which is used to reflect a country's accumulation of top-class scientific talent with significant and extensive influence.

8. Level of S&T human resource development

Gross enrollment rate in higher education, i.e. proportion of the population in the 18-22 age group that are enrolled in higher education, which is used to reflect a country's capability for cultivating and supplying S&T human resources.

9. Average score of top three domestic universities in the world university rankings

The average score of the top three universities in the country that have made it into the top 500 list of the global university rankings, which is used to reflect a country's performance in S&T talent cultivation and appeal to talents. All data are sourced from the QS World University Rankings.

10. Number of S&T papers per USD1 million of R&D expenditure

The ratio of the number of SCI-indexed papers produced by a country's universities and research institutes to its total R&D expenditure, which is used to reflect the efficiency of S&T input-output and quality of knowledge output.

11. Invention patents in force per 10,000 employed individuals

The number of invention patents in force per 10,000 employed individuals. Patents in force refer to the number of invention patents that are owned by the country's nationals and still in a valid status. This indicator reflects a country's innovation activity and protection of innovation outcomes.

12. Number of industrial design applications per USD100 million of industrial value-added

The number of industrial design registration applications is divided by industrial value-added (counting unit: USD100 million, converted at the prevailing exchange rate), which is used to reflect a country's technological creativity.

13. Number of scientific paper citations per USD1 million of R&D expenditure in academic departments

The ratio of the citations of SCI-indexed papers produced by the country to the total R&D expenditure of its universities and research institutions, which is used to reflect the efficiency of S&T input-output and impact of knowledge output.

14. Proportion of highly cited papers in all domestic papers

The ratio of the number of papers published in a country with cumulative citations in the top 1% of each discipline to the total number of papers in the country, which is used to reflect the quality and influence of scientific research output.

15. Ratio of enterprise R&D expenditure to value-added

The ratio of R&D expenditure to the industrial value-added of a country's corporate sector, which is used to measure the intensity of corporate investment in innovation.

16. Enterprise researchers as a share of total researchers

The share of enterprise-based R&D researchers in a country's total R&D personnel, which is used to reflect the capacity and level of corporate R&D human resource investment.

17. Average R&D expenditure intensity of the top ten R&D-spending companies in the country

The average R&D intensity (R&D expenditure/net sales revenue) of the top ten enterprises in a country by R&D investment scale, which is used to reflect the innovation capability and international competitiveness of the country's leading enterprises. The scope of enterprises and related R&D investment data are sourced from the EU Industrial R&D Investment Scoreboard.

18. Triadic patents as a share of the world's total

The share of a country's triadic patents in the global total. A triadic patent refers to the same invention patent field in the European Patent Office (EPO), the Japan Patent Office (JPO), and the United States Patent and Trademark Office (USPTO). This indicator measures a country's technological innovation capability and international competitiveness.

19. PCT applications per 10,000 enterprise researchers

The ratio of the total number of PCT patent applications filed within the year to the number of enterprise R&D personnel, which is mainly used to reflect the efficiency of innovation investment and quality of innovation output of a country's corporate sector, as well as the global competitiveness of its technologies.

20. Proportion of intellectual property royalty income in service exports

The ratio of a country's intellectual property royalty income to the value of its service export trade, which is mainly used to reflect the value of intellectual property held by a country's innovation entities and their competitiveness in the international market.

21. Economic growth rate

The rate of increase in the total economic output of a country or region over a certain period, which is one of the key indicators for observing macroeconomic performance and reflects the overall vitality of economic development.

22. Density of newly registered companies

The number of newly registered businesses per 1,000 working-age population, with data sourced from the World Bank, which is used to reflect a country's enterprise innovation activity and business environment.

23. Number of high-growth technology companies

The combined number of unicorn companies and technology gazelle enterprises, which is used to reflect the innovation potential and competitiveness of a country's enterprises.

24. Proportion of knowledge-intensive service industries in the total value-added of the service sector

The share of value-added from knowledge-intensive service industries, such as information transmission, software and ICT services, leasing and business services, scientific research and technology services, in the total value-added of the service sector, which is used to reflect the development level of knowledge-intensive services in a country and measure the output of its knowledge-based economies and optimization of industrial structure.

25. Proportion of high-tech and medium-high-tech industries in the total value-added of the manufacturing sector

The ratio of the value-added from high-tech and medium-high-tech industries to the total value-added of the manufacturing sector, which is used to reflect the industrial structure and technological level of a country. High-tech and medium-high-tech industries include aerospace and equipment manufacturing, pharmaceutical manufacturing, computer and office equipment manufacturing, electronic and communication equipment manufacturing, scientific instrument manufacturing, as well as automotive and parts manufacturing, electrical machinery and electronic equipment manufacturing, mechanical equipment manufacturing, railway and other transportation equipment manufacturing.

26. Proportion of high-tech products in total manufacturing exports

The share of high-tech product exports in the total manufacturing exports of a country, which is used to reflect the role of technological innovation in improving economic structure.

27. Labor productivity

The ratio of a country's GDP to its labor force, which is used to reflect the impact of innovation activities on economic output.

28. Economic output per unit of energy consumption

The GDP output per unit of standard oil energy consumption, which is used to measure the effect of technological innovation in reducing energy consumption and reflect the energy intensity of a country's economic growth.

29. Economic output per unit of CO_2 emission

The GDP output per unit of CO_2 emissions, which is used to reflect improvements in energy utilization and corresponding carbon emissions in a country's development.

30. Rule-of-law environment

The index that measures the level of confidence of a country's market players in the rules of the society and their compliance with such rules, especially the quality of law enforcement concerning contracts, intellectual property, police and court, which is used to reflect the country's overall environment of market

operation, intellectual property protection, and defense of legal rights (1=very poor, 100=very good).

31. Policy environment for doing business

The extent to which a country's government ensures a stable business policy environment (1=very unstable, 7=very stable).

32. E-government services

This indicator, which is based on surveys of national websites and e-government policies, with scores standardized on a scale of 0 to 1, assesses how a country's government utilizes technology at the national level to provide public services.

33. IT application

The results of the *Network Readiness Index 2022*, jointly published by the Portulans Institute in the US and the Said Business School of the University of Oxford, have been adopted for the purpose of this indicator, which is used to reflect a country's IT infrastructure conditions for knowledge creation, communication and dissemination.

34. Availability of venture capital

The degree to which it is easy for enterprises with innovative but risky projects to access venture capital (1=extremely difficult, 7=extremely easy).

35. Business-university collaboration in R&D

The degree to which businesses and universities collaborate on R&D (1=barely collaborate, 7=collaborate closely).

36. Proportion of international co-authored papers in all domestic papers

The ratio of the number of papers co-authored with other countries to the total number of papers published by a country during the same period, which is used to reflect a country's level of participation in international cooperation and influence in the field of scientific research.

37. Ratio of international investment to GDP

The ratio of the sum of foreign direct investment and outward direct investment to GDP (counting unit: USD100 million, converted at the prevailing exchange rate), which is used to reflect a country's investment capability and market attractiveness.

38. Entrepreneurial culture

Consisting of comprehensive factors such as public attitude to ventures, corporate management structure, development of innovative enterprises, entrepreneurship conditions and enterprises' acceptance of disruptive innovation, the indicator is used to reflect the innovation and entrepreneurial culture in the society (1=lowest, 7=highest).

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