Series report of national innovation survey

National Innovation Index Report 2016–2017

Chinese Academy of Science and Technology for Development

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National Innovation Index Report 2016–2017

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Foreword

Improving indigenous innovation capability and building an innovation-oriented country is a strategic goal set forth in China's *National Guideline on Medium- and Long-Term Plan for Science and Technology Development (2006–2020)*. The Chinese Academy of Science and Technology for Development began working on the national innovation index research in 2006 in order to track and assess China's progress in building itself into an innovation-oriented country. With the support and assistance from the Ministry of Science and Technology and its related departments and bureaus, related public institutions, and experts from various sectors, the *National Innovation Index Report* has been published annually since 2011. *The National Innovation Index Report 2016–2017* is the 7th release.

The National Innovation Index Report, as one of the reports of the "national innovation survey system" series prepared in accordance with the *Work Plan to Establish a National Innovation Survey System* and the *Measures for Implementation of the National Innovation Survey System*, is a state-level innovation capacity evaluation report. Drawing upon domestic and international theories and methods of evaluation of national competitiveness and innovation capacity, it is based on an indicator matrix comprising five pillars, i.e. innovation resources, knowledge creation, enterprise innovation, innovation performance, and innovation environment. This report is still framed around the same indicator system structure as the previous release, which consists of 5 first-level indicators and 30 second-level indicators. The 30 second-level indicators include 20 quantitative indicators which highlight

innovation scale, quality and efficiency and international competitiveness while maintaining a balance between large and small countries, and ten qualitative indicators which reflect the innovation environment.

This report continues to feature 40 countries with active science, technology and innovation (STI) activities (whose combined R&D expenditure accounts for more than 95% of the world's total), and continues to use the commonly adopted benchmarking method worldwide to calculate the national innovation index. All data are obtained from databases and publications of governments or international organizations are internationally comparable and authoritative. It calculates the innovation index scores of the 40 countries based on the latest statistical data (2015 data unless otherwise indicated) and compare them with their performances in the previous release.

In today's world, a country's prosperity and sustainable development is mainly dependent on the development and accumulation of its national innovation capacity, rather than on the size of population or availability of natural resources. In the face of the opportunities and challenges accompanying science and technology development and the evolution of the international political and economic landscape, countries are increasing investment in innovation resources to strengthen their innovation capacity. Against the backdrop of global competition, China moved up to the 17th spot in the national innovation index with a higher overall index score, further narrowing its gap with advanced countries.

In May 2016, China released the *Outline of the National Strategy of Innovation-Driven Development*, officially sounding the bugle for its drive to build a global power in science and technology. With the implementation of the innovation-driven development strategy, there will be new opportunities and challenges in respect of the assessment of national innovation capacity, which requires constant exploration and in-depth research. We sincerely hope that the annual *National Innovation Index Report* will provide a window through which people can examine and understand China's innovation capacity development. We will

continue to draw upon the valuable opinions of experts and scholars to continuously improve the national innovation index as we witness the great historical process of China becoming an innovation-oriented country.

Editorial Committee of
National Innovation Index Report 2016–2017

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National Innovation Index Report 2016–2017

Part One:

China's Innovation Landscape Through Data

I. China's Innovation Progress Reflected in Key Indicators

Since the promulgation of the *National Guideline on Medium- and Long-Term Plan for Science and Technology Development (2006–2020)* (the "MLP"), China's innovation capacity has improved significantly. China has kept increasing investment in innovation resources, having risen to the 2nd place globally in gross domestic expenditure on R&D in addition to having held the No. 1 position in R&D personnel for many years. China has been steadily climbing up in knowledge creation capacity, ranking the 2nd in scientific output, staying on top in resident patent applications, and having overtaken Japan to lead the world in resident patent granted. China has also made giant strides in MFP contribution to economic growth (55.3%) and R&D intensity (2.06%), further closing the gap with innovative countries. China's knowledge-intensive industries have also maintained a strong momentum of growth as its industrial structure is continuously optimized.

With the effective implementation of the innovation-driven development strategy, China has significantly strengthened its innovation capacity with a positive trajectory in key indicators including input of innovation resources, scientific output, MFP contribution to economic growth, and the development of knowledge-intensive industries, as innovation plays an increasing role in supporting and leading economic and social development. China has reached a new stage in its drive to develop into an innovative country.

(I) Input of Innovation Resources Steadily Increased

Rich innovation resources provide an important condition for innovation activities. R&D expenditure and personnel are core elements of innovation resources and have a direct bearing on a country's activity of innovation. In recent years, China has maintained high levels of R&D expenditure and personnel input.

1. China maintained the 2nd place in R&D expenditure

The global (referring to the 40 countries included in this study, the same below) total R&D expenditure reached USD1.45 trillion, down 2.0% from a year earlier[①]. The global R&D expenditure was mainly distributed in the three pillar regions of North America, Asia and Europe[②] (Figure 1-1). Specifically, North America took up 37.0%, down 7.0 percentage points from 2000, Asia 32.6%, up 5.3 percentage points, and Europe 25.6%, slightly down 0.7 percentage point.

The top three countries in R&D expenditure were the United States, China and Japan, respectively. China maintained the 2nd place with USD 227.54 billion, or 15.6% of the global total, further narrowing the gap with the United States (Figure 1-2). The United

① Growth data calculated on a constant price basis.

② Asian countries: China, Japan, Korea, Singapore, India, Israel and Turkey; European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Netherlands, Norway, Poland, Portugal, Romania, Italy, Luxembourg, Russian Federation, Slovak Republic, Slovenia, Spain, Sweden, Switzerland and United Kingdom; North American countries: United States, Canada and Mexico; South American countries: Argentina and Brazil; Oceanian countries: Australia and New Zealand; African country: South Africa.

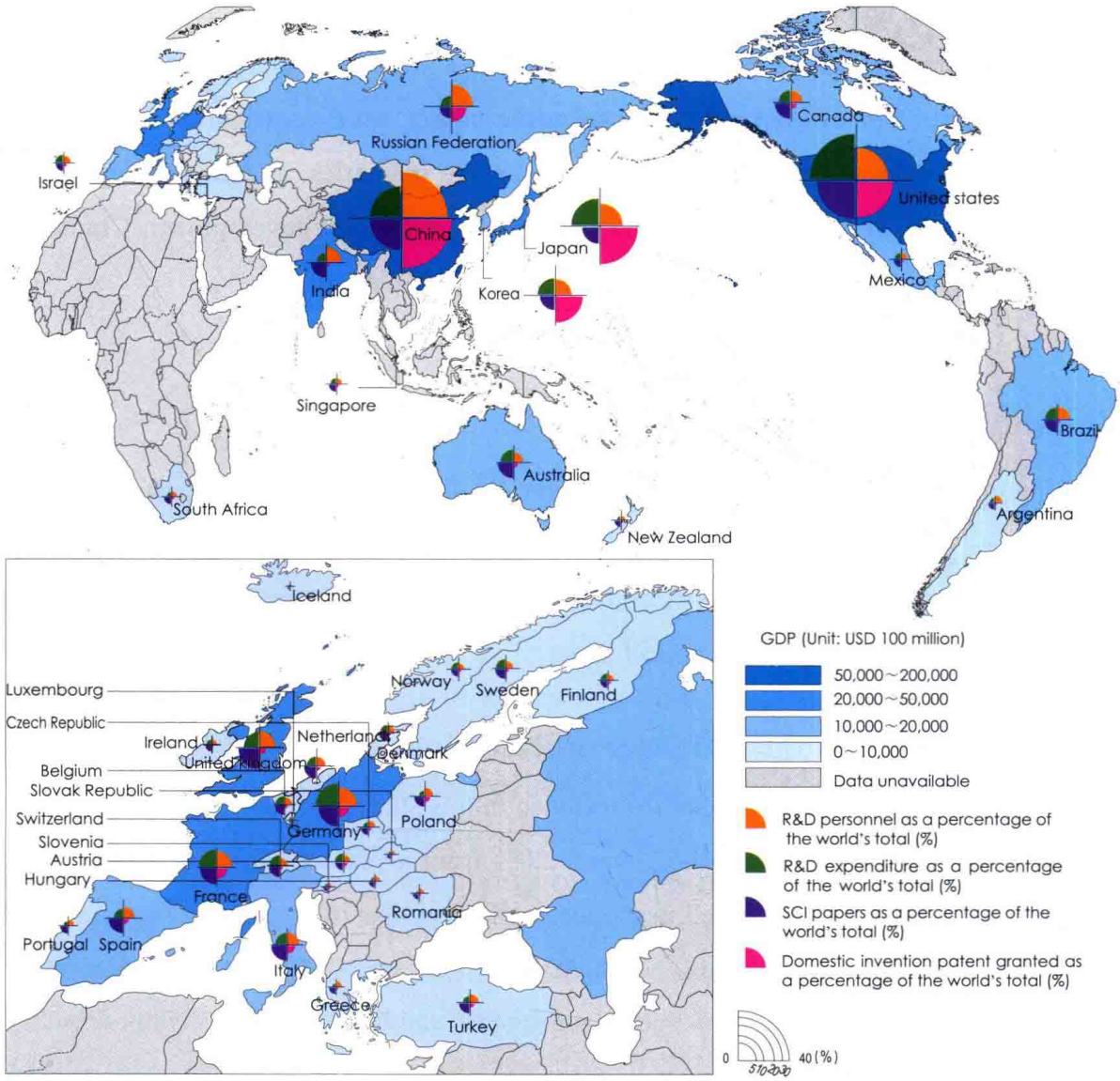

Figure 1–1 Global distribution of GDP, R&D expenditure, R&D personnel, SCI papers and resident invention patents

States' R&D expenditure maintained its clear lead, accounting for 34.6% of the global total, being 2.2 times of China's. Japan's R&D expenditure dropped by USD 20.88 billion from a year earlier to USD 144.05 billion, accounting for 9.9% of the global total.

With the rapid rise of emerging economies and developing countries, the concentration of global R&D expenditure among developing countries went down significantly. The

combined R&D expenditure of G7 countries as a percentage of the global total slipped down by 21.2 percentage points from 2000 to 61.8%. In contrast, the combined R&D expenditure of the BRICS countries maintained a steady growth, rising to 20.0% in 2015 from 3.8% in 2000.

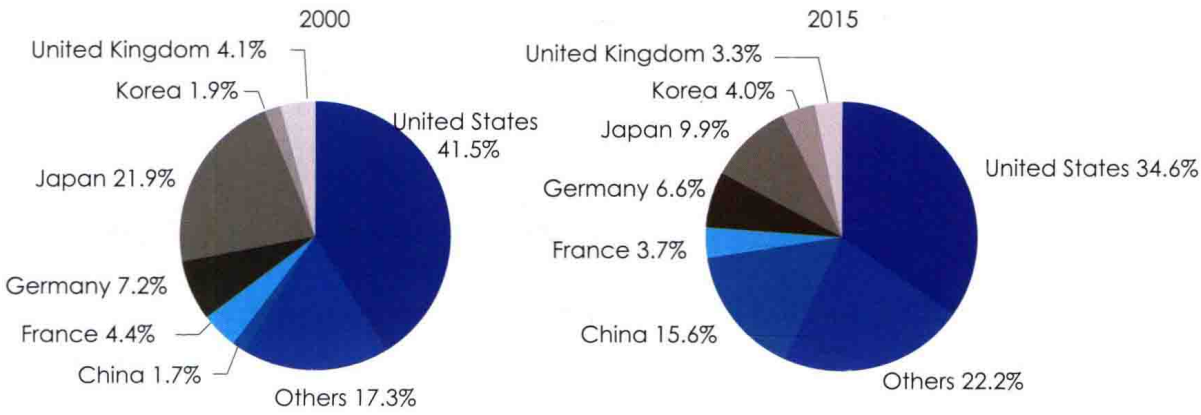

Figure 1–2 Percentage of R&D expenditure in the world's total

2. China leaded the world in R&D expenditure growth

Since the onset of the 21st century, the R&D expenditures of countries have maintained an upward trend overall. On a constant price basis, China had the world's highest average annual growth of R&D expenditure at 15.9% for the period from 2000 to 2015, ranking the 1st in the world and leading other countries by a big margin. Korea and India, representatives of emerging markets, also maintained an impressive average annual growth at 8.6% and 7.2%, respectively, significantly higher than G7 countries such as the United States (2.2%), Japan (1.7%) and the United Kingdom (2.0%) (Figure 1-3) .

Impacted by the financial crisis, the European debt crisis and other factors, countries like Finland, Spain and Greece slowed down in their R&D expenditure growth from 2010, with some even experiencing a negative growth. Countries like Japan and the United States went out of the financial crisis, and their R&D expenditures returned to the upward trend as well. Judging from their recent performance, countries such as the United States and the

United Kingdom remained on track of steady growth in R&D expenditure, while countries such as Japan and India slowed down, even posting a negative growth in 2015. Against the backdrop of challenging international and domestic economic situations, China's R&D expenditure also experienced a slowdown, though remaining at high levels.

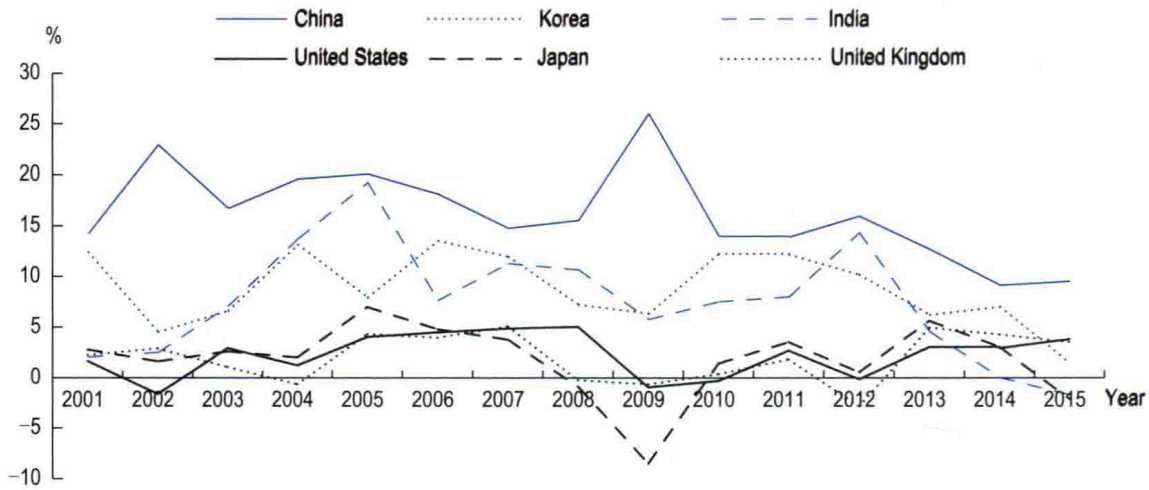

Figure 1–3 R&D expenditure growth of countries (on constant price basis)

3. China ranked the 1st in R&D personnel

The number of global R&D personnel reached 12.1 million representing a growth of 67.5% from 2000. They were mainly distributed in Asia (47.2%) and Europe (30.9%). From 2000, most countries, with the exception of a few countries such as Finland, Japan, Romania and the Russian Federation, saw a steady growth in R&D personnel, especially emerging economies represented by China and Korea which recorded an average annual growth rate of 9.8% and 8.1%, respectively, significantly higher than the global average growth rate of 3.5%.

China's R&D personnel reached 3.8 million, or 31.1% of the global total, leading the world for the ninth consecutive year from 2007. Japan and the Russian Federation, both rich in R&D human resources with more than 800,000 R&D personnel, saw a steady fall of their

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