

STI OUTLOOK 2002 – COUNTRY RESPONSE TO POLICY QUESTIONNAIRE

KOREA

1. General framework and trends in science, technology, and industry policy

The enactment of the Science and Technology Framework Law in 2001 brought about several important changes in STI policy in Korea. The new law replaced the Law for the Promotion of Science and Technology Development of 1967 (amended in 1972) as well as the Special Law for Scientific and Technological Innovation of 1997 (Special Law), and places emphasis on the co-ordination of national S&T and R&D policies and investments. This law provides the legal basis for the National Science and Technology Council (NSTC), which set the priorities for S&T policy and R&D investments of the government. Based on the law, the Korea Institute for S&T Evaluation and Planning (KISTEP) was created as an organisation to assist the activities of the NSTC. The NSTC runs several subcommittees for practical working level deliberation of the policies and programs of individual ministries and agencies, such as the Subcommittee for S&T Policy, Subcommittee for R&D, Subcommittee for Biotechnology and Bioindustry, and the Subcommittee for Nanotechnology. Along with this, the government enforced the Guidelines on the Management of the National R&D Programs, which apply to the management of all government-sponsored R&D programs, regardless of sponsoring ministry.

Based on the current and preceding laws, the Korean government formulated the First Five-Year S&T Plan (1997-2002) as well as the Long-Term Vision for S&T Development toward 2025 (or Vision 2025) in 1999, which map out basic policy directions and strategies for science and technology development in Korea. The major features of the plan include the following actions:

Short-term actions

- To increase government R&D investment to 5% of the total government budget by the year 2002.
- To Increase basic research investment to 20% of the government R&D budget from 16% in 2000.
- To increase R&D manpower to 40 researchers per a population of 10,000 by the end of the plan period.

Long-term targets

- To reduce the role of government and shift the national innovation system toward a private-led one;

- To harmonise the NIS with the global system of innovation;
- To attain world leadership in key areas of science and technology.

The year 2002 is an important milestone for Korean public sector R&D, because the HAN (Highly Advanced National) Projects, which are the major national R&D program, come to a complete end. As a follow-up to the program, the government launched the 21st Century Frontier Programs for research and development in the key areas, such as information and communication technology, biotechnology, life sciences, nanotechnology, environmental technology, new materials, etc. This is a ten-year program, investing approximately 8 million dollars per year per project. At the same time, the government will conduct an assessment of the performances of the HAN projects from various perspectives – scientific, economic, social, and management.

Over the recent years, biotechnology and nanotechnology have been receiving increased policy attention. The government established the Third Biotechnology Development Plan (2002-2007) in 2001, and created the National Genetic Information Center in the same year, along with the Advisory Committee on Ethical Issues in Biotechnology. To promote the development of nanotechnology, the government formulated the Comprehensive Plan for the Development of Nanotechnology in 2001. Korea also started in 2000 the construction of a “Space Center,” including a “Spaceship Launching Site” which will be completed in 2005.

To finance the ambitious programs, the government has increased budget for R&D in a remarkable way: from 2.7 trillion won (2.2 billion dollars) or 3.6% of the government budget in 1998 to 5 trillion won (4.2 billion dollars) or 4.7% of the government budget in 2002.

2. Public sector R&D and R&D organization

As a consequence of the financial crisis of 1997, the share of the private industries in total R&D investments declined to 73% in 1998 from 77-81% in the preceding years, while the public sector’s share increased from 19-23% to 27% during the same period. This new balance has been maintained over the past couple of years, increasing the role of public sector in R&D. In terms of expenditures, however, the share of the private sector increased after the financial crisis from 72.6% in 1997 to 74% in 2000, implying a net inflow of public R&D funds into the private sector.

Public sector R&D has undergone important changes over the recent years: (1) the launching of the 21st Frontier Program, and (2) increased role of university. As the major component of the national R&D efforts, the government launched the 21st Frontier R&D Program, which is to develop core technologies with a time horizon of 10 years. Under the new program, 10 projects have been launched in the areas of life science, biotechnology, nanotechnology, new materials and environmental technology. Consortia of researchers from both private and public sectors conduct the projects. Each of the projects receives approximately 8 million US dollars per year for ten years.

The balance between universities and government research institutions shows visible changes over the last 3-4 years. The share of universities in the public sector R&D expenditures increased from 38% in 1997 to 42% in 1999 and to 44% in 2000, indicating a trend of increasing role of universities in public sector R&D. This is also related to the fact that government investment in basic science has increased 72.5% over the past 3 years, and thus, the share of basic science in the total budget rose from a mere 5.8% in 1998 to 18.1% in 2001.

In 2001, 29% of the government R&D budget was spent on industrial technology development, 18.4% on the advancement of science, 16.5 % on defense research, 8.7% on research in the areas of agriculture, fisheries and forestry, 5.3% on health research, and so on. In other words, investment in basic research has increased in a remarkable way over the recent years, but industrial technology still remains the main recipient of government R&D budget.

3. Government support for private-sector R&D and innovation

There have been no significant changes in policy and policy programs in this area.

4. Enhancing collaboration and networking among innovating organisations

The government has initiated several new programs to promote technology transfer, diffusion and commercialisation of new technologies. First, to promote and facilitate the transfer of technologies developed by universities or government research institutes (GRI), the government provides financial assistance for the operation of university-GRI consortia for technology transfer. Second, the government encourages the formation of partnerships between business incubators at GRIs and new technology start-ups so as to promote mutual technological interactions and co-operation, with a view to developing the major science towns into homes for new technology ventures.

The government will also launch an initiative to promote the commercialisation of the results of national R&D programs, where business firms, technology consultants, and venture capitalists collaborate in identifying commercially promising technologies. At the same time, the government will nurture and support R&D corporations, where technology inventors, R&D organisations, venture capitalists, and business companies participate as stock-holders. In 2002, such R&D corporations will be created to commercialise the results of the HAN Projects.

To promote regional innovation, the government urges regional governments to increase investments in S&T and to strengthen S&T related organisations within the regional governments. In 2001, the share of R&D investment in the total budgets of regional governments remained at 0.77%. The government recommends regional governments to increase the share up to 1.5% by the year 2004. Also, to strengthen research capabilities of regional universities and to help develop regional industrial core competences, the government will continue supporting the Regional Research Centers or RRCs, which are research consortia of regional universities and industries. At present, there are 45 RRCs, and 6 new RRCs will be created this year.

5. S&T Human resources

The number of researchers was reduced by 6.3% in 1998 (from 138,438 to 129,767) as an aftermath of the financial crisis in 1997, but has more than recovered in 2000 (159,973).

S&T human resource has become an important political issue in Korea, as the number of young students pursuing S&T careers has dropped sharply over the recent years. In 1998, 42.4% of the college applicants took the Scholastic Ability Test for natural science and engineering majors, but the figure was reduced to 26.9% in 2002. Furthermore, the number of applicants for graduate studies in the areas of science and technology also has been declining markedly. The simple reason behind this phenomenon is the unfavourable economic and social rewards given to scientists and engineers.

Several policy programs have been announced to correct the trend. First, in order to upgrade the science education at high schools, the labs and research facilities of universities and GRIs will be open for high school science education. High school students with distinctive performance in science will be awarded “Presidential Scholarship.”

For scientifically talented students, selected science high schools will be transformed into special schools for talented youths. For the transformation, the government will provide funds for the development of educational materials, recruit of qualified teachers, and the improvement of education environments.

To encourage young students to take science and technology as the areas for their future careers, the government offers various incentives, such as preferential treatment in financial aid programs for university students, special military service programs for science and engineering majors, and so on. The government has formed a “Committee for the Development of Science Education” to set government policies on S&T education. The Minister of S&T chairs the committee.

Economic and social rewards to scientists and engineers are the major factors that young people consider when choosing their careers. To provide secure research environments for scientists at the GRIs, the government will offer scientists with distinctive achievements tenures until they reach the compulsory retirement ages. Currently, all the research scientists at the GRIs are on 3-5 year appointments. At the same time, the government plans to improve the job terms for scientists at the GRIs by raising salaries and providing stable research environments.

Various other measures are being considered to enhance the morale of scientists and engineers, such as a “National Research Fellowship” for scientists and engineers with distinguished achievements, “Pension” programs for scientists and engineers, “Hall of Fame” for scientists and engineers, etc.

Another notable development in S&T human resource is the movements within the government to introduce an “Affirmative Action” program for women scientists. The government plan to raise the proportion of woman scientists at the GRI which remain at 6.9% (2000) to 10% by 2002 and to 20% by 2010.

6. International co-operation and globalisation

The government established “the S&T Globalisation Strategy” in 2001, which sets forth new policy direction and programs to facilitate the globalisation of the S&T and R&D activities. The international S&T policy direction can be summarised as follows:

- To complement domestic weakness through international co-operation;
- To contribute to the scientific advances through international collaboration; and
- To participate in the international scientific efforts for global sustainability.

Towards these ends, the plan pursues the following policy actions:

- To enhance international linkage of the national R&D programs
- Expand the participation of foreign researchers and organizations in the national R&D programs

- Encourage and expand international collaboration, exchanges and interactions in conducting national R&D programs

To attract foreign scientists and research organizations

- Create special programs to attract foreign scientific brains and institutions
- Encourage the employment of foreign scientists in permanent research positions (To facilitate this, the government has recently introduced a “Green card” system. Green card is issued to qualified foreign scientists by the government, and it qualifies its holders for long-term multiple visa.)
- Promote direct foreign investments in R&D

To expand off-shore research activities at major centers of S&T developments

- Create a “Korea Research Grant Program” for research collaboration with foreign universities
- Create overseas R&D centers at the major hubs of S&T development

To develop an international S&T information system

- Strengthening S&T and R&D information networks with foreign institutions

To contribute to the world scientific advances

- Expand participation in the existing multinational scientific programs

To participate in the international efforts for global sustainability

- Expand Korean participation in the global and regional scientific programs on the issues of global concern

7. Industry policies

Since the financial crisis in 1997, President Kim Dae-jung’s administration has pursued economic reform, focusing on the four major sectors of the economy: corporate, financial, labour, and public. These reforms have removed most of the structural problems and inefficiencies of the Korean economy, providing Korea with the benefits of the reform program. Korea saw a record influx of new foreign direct investment(FDI) and developed a healthy trade surplus. In addition, Korea fully repaid its IMF loan (US\$ 19.5 billion) in August 2001, three years ahead of schedule.

The Ministry of Commerce, Industry and Energy (MOCIE) has played a pivotal role in ensuring this progress by enhancing industrial competitiveness and implementing measures to improve the foreign direct investment (FDI) climate. MOCIE has tried to strengthen industrial competitiveness by providing an excellent industrial infrastructure and establishing a favourable business environment. Since FDI brings with it new technology, advanced management expertise and strategic alliances with foreign partners, all of which are essential to strengthening the economy’s competitiveness, Korea is eager to attract the maximum amount of FDI possible.

Korea's industrial policies are responding to the new economic environment of the 21st century, which is characterized by globalization, informationization and digitalization. MOCIE's policy direction is to facilitate the market mechanisms needed for this, and its role is to monitor progress and prevent market failures.

- Establishment of a market-oriented corporate restructuring system, including strengthening the function of Corporate Restructuring Companies (CRC) which are privately owned enterprises seeking capital gain from financial and operational restructuring of failing companies.
- Transition to an environmentally friendly industrial structure, including joining the international network for cleaner production centers operated jointly by UNIDO and UNEP.
- Stimulating e-commerce transactions, including mapping out standards for e-commerce and increasing the number of relevant experts.
- Creation of a new momentum for the growth of small, medium and venture enterprises to nurture them as the new engine for economic growth.
- Privatisation of state-owned companies to boost productivity and managerial efficiency
- Strengthening technology infrastructure, including the formation of regional academia-industry- research networks.

In the knowledge-driven economy, the drive for knowledge-intensive technology is much more important to boost competitiveness. Industries are placing an emphasis on intensifying their efforts to use new technologies including information technology in developing new products and manufacturing processes. MOCIE assists these efforts by providing excellent industrial infrastructure.

7.1. Globalisation

The direction of Korean industrial policies is to establish a market economy matching global standards and to revitalise and improve Korea's business environment, thereby making Korea a good place to do business. To accomplish a market economy in accordance with international standards, the Korean government is continuing with corporate reforms to set up a transparent corporate governance system and endeavours to carry out smooth restructuring according to market principles. To nurture a favourable environment to do business, the Korean government promotes deregulation of measures affecting the business environment.

7.3. Services

To promote innovation and productivity in the services sector, Korea has focused on;

- Trying to deregulate measures affecting the services sector,
- Compiling more specific statistics for services by type of business, such as consulting and human resources management, etc.
- Stimulating demand for service markets through increased outsourcing of public services.

7.4. Intangible Investment

Korea encourages companies to invest in facilities for e-commerce such as Entire Resource Planning (ERP) equipment. Also Korea encourages companies to offer job training to workers. Budgetary assistance is provided for paid leave for training purposes. To facilitate labor flexibility, the country also allows various forms of employment, such as part-time, dispatched and periodic work. Budgetary assistance for job transfers is also provided, by supporting the companies with job transfer programs.

Major statistics

**<Table 1> The trend of the total R&D expenditures in Korea
(by current prices)**

Year	R&D EXPENDITURES			Ratio to GDP	R&D per person (US dollar)
	Billion won	Million dollars	Growth Rate(%)		
1991	4,158.4	5,670	24.1	1.92 %	131
1992	4,989.0	6,391	20	2.03 %	146
1993	6,153.0	7,666	23.3	2.22 %	173
1994	7,894.7	9,826	28.3	2.44 %	220
1995	9,440.6	12,240	19.6	2.50 %	272
1996	10,878.0	13,522	15.2	2.60 %	297
1997	12,185.8	12,810	12	2.69 %	279
1998	11,336.6	8,104	Δ7	2.55 %	175
1999	11,921.8	10,023	5.2	2.47 %	214
2000	13,848.5	12,249	16.2	2.68p) %	259

p) Preliminary

<Table 2> Trends of R&D expenditures by source of funds

(unit: hundred million won)

	1995	1996	1997	1998	1999	2000
○ Total	94,406	108,780	121,858	113,366	119,218	138,485
-Growth rate	19.6	15.2	12	Δ7	5.2	16.2
○ Govt & public	17,795	23,977	28,507	30,518	32,031	34,518
-Growth rate	41.6 %	34.7 %	18.9 %	7.1 %	5.0 %	7.8 %
○ Private source	76,597	84,667	93,233	82,764	87,117	103,872
-Growth rate	15.4 %	10.5 %	10.1 %	Δ11.2 %	5.3 %	19.2 %
○ Foreign source	13	136	118	84	70	95
○ Govt*:Private	19 : 81	22 : 78	23 : 77	27 : 73	27 : 73	25 : 75

* Including government and public sectors

<Table 3> R&D expenditures by sector of performance

(unit: hundred million won, %)

	1995	1996	1997	1998	1999	2000
○ Total	94406	108780	121858	113366	119218	138485
GROWTH	19.6	15.2	12	Δ7	5.2	16.2
- GRIs	17767	18956	20689	20994	19792	20320
Growth	14.7	7.3	9.1	1.5	Δ5.7	2.7
-Univ	7709	10188	12716	12651	14314	15619
Growth	26.6	32.2	24.8	Δ0.5	13.1	9.1
-Private industries	69030	79636	88453	79721	85112	102547
Growth	20.2	15.4	11.1	Δ9.9	6.8	20.5

<Table 5> R&D expenditures by nature

(unit: hundred million won, %)

	1995	1996	1997	1998	1999	2000
○Total (%)	94,406 (100%)	108,780 (100%)	121,858 (100%)	113,366 (100%)	119,218 (100%)	138,485 (100%)
GROWTH RATE	19.6	15.2	12	Δ7	5.2	16.2
- Basic (%)	11,768 (12.5%)	14,390 (13.2%)	16,165 (13.3%)	15,854 (14.0%)	16,255 (13.6%)	17,461 (12.6%)
Growth rate	4	22.3	12.3	Δ1.9	2.5	7.4
- Applied (%)	23,621 (25.0%)	29,273 (26.9%)	34,706 (28.5%)	28,484 (25.1%)	30,652 (25.7%)	33,701 (24.3%)
Growth rate	25.6	23.9	18.6	Δ17.9	7.6	9.9
-Develop (%)	59,017 (62.5%)	65,117 (59.9%)	70,987 (58.2%)	69,028 (60.9%)	72,311 (60.7%)	87,323 (63.1%)
Growth rate	20.9	10.3	9	Δ2.8	4.8	20.8

<Table 8> The number of researchers by degree

(unit: person)

	1995	1996	1997	1998	1999	2000
Doctorate (%)	35,105 (27.4%)	36,106 (27.3%)	37,859 (27.4%)	40,607 (31.3%)	42,134 (31.3%)	46,146 (28.8%)
Growth (%)	3.3	2.9	4.9	7.3	4.2	10
Master (%)	44,178 (34.4%)	46,537 (35.2%)	49,999 (36.1%)	44,077 (34.0%)	46,231 (34.4%)	51,130 (32.0%)
Growth (%)	14.1	5.3	7.4	Δ11.8	4.9	10.6
Bachelor (%)	44,991 (35.1%)	45,084 (34.2%)	45,828 (33.1%)	40,034 (30.9%)	40,340 (30.0%)	54,026 (33.8%)
Growth (%)	10.0	0.2	1.7	Δ12.6	0.8	33.9
Others (%)	4,041 (3.1%)	4,296 (3.3%)	4,752 (3.4%)	5,049 (3.9%)	5,863 (4.3%)	8,671 (5.4%)
Growth (%)	10.0	6.3	10.6	6.3	16.1	47.9
Total (%)	128,315 (100%)	132,023 (100%)	138,438 (100%)	129,767 (100%)	134,568 (100%)	159,973 (100%)
Growth (%)	9.3	2.9	4.9	Δ6.3	3.7	18.9