ATIP06.045: Korean S&T Overview

ATIP/Korea

ABSTRACT: By 2025, Korea aims to be among the top seven most technologically advanced nations in the world. The government of Korea has announced an ambitious plan and is significantly increasing the powers of its science and technology (S&T) agencies such as the Ministry of Science and Technology (MOST). Along with these changes comes a substantial increase in funding. Over the next 20 years, investments will be focused in key areas such as information technology (IT), biotechnology, environmental technologies, new materials, nanotechnology, space technology, and atomic energy. This report provides a review of Korea's new government research and development (R&D) programs, R&D budgets, S&T policies, S&T organizations, and international S&T activities.

KEYWORDS: Basic Sciences, Biotechnology (Bio), Bio-Nano, Energy, Environmental, Government Funding, Government S&T Policy, Information Technology, Nanotechnology, Regional S&T Overviews, Renewable Energy, Space

COUNTRY: Korea

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REPORT CONTENTS

1. INTRODUCTION

Korea is a rapidly developing economy that has pursued remarkable economic growth since the 1950s. The country has progressed from the assembly of low-priced, simple consumer products to the design and development of complex industrial and scientific processes. Many of Korea's companies are recognized as world leaders. However, further growth requires that the country deepen and internalize its own science and technology (S&T) infrastructure to maintain its competitive edge and enhance its standard of living.

Korea aims to be one of the top seven technologically advanced nations by 2025. The Government has announced 'Vision 2025,' an ambitious plan for reforming the somewhat convoluted S&T infrastructures and policies within the government, as well as significantly increasing the powers of S&T agencies, such as the Ministry of Science and Technology (MOST). Along with these changes come substantial increases in funding. Over the next 20 years, investments will be focused on key areas such as information technology, biotechnology, environmental technologies, new materials, nanotechnology, space technology, and atomic energy.

The Korean government's current key strategy for national development is the Regional Innovation System (RIS), which aims to reinforce each local region's competitiveness by networking and balancing local government organizations, universities, and industries. The RIS forms the basis of the National Innovation System (NIS), which is more integrated, synthetic, and countrywide.

This report provides a review of the Korean government's new R&D programs, R&D budget, S&T policies, S&T organizations and international S&T activities.

*Note: A currency exchange rate of 1 South Korean Won (KRW) per .001077 United States Dollar (US$) was used in this report.

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ATIP06.045 (continued): Korean S&T Overview

EXECUTIVE SUMMARY

- The Korean government has increased its R&D expenditures from 2005 to 2006 by 15%, and has announced that they will be increasing R&D expenditures for 2007 by an additional 6.8% (to a total of ~US$9.518 billion). Government organizations will provide about 80% of the funds, and the remainder will come from industry.
- The government R&D budget represents 4.7% of the total government budget (in 2005, it was 4.57%). There will be an increased focus on basic research from 21.5% (in 2005) to 23.7% of the total government R&D budget.
- Efforts are also being made to increase regional R&D activities.
- The three key Korean R&D organizations are the Ministry of Science &Technology (MOST), the Ministry of Commerce, Industry and Energy (MOCIE), and the Ministry of Information and Communication (MOIC). MOST and MOCIE currently have budgets of ~US$2.2 billion and US$2.0 billion, respectively (the defense R&D budget is ~US$1.1 billion).
- Six focus areas are to be emphasized, Information Technology (IT), Bio Technology (BT), Nanotechnology (NT), Space Technology (ST), Environment Technology (ET), Culture Technology (CT). The basic research thrusts are focused primarily in the first three areas.
- The national strategy also includes the construction of a space center with launch facility, development of a space launch vehicle (projectile), the first Korean astronaut program, and participation in the Galileo project.
- International cooperation is to be enhanced and emphasized. Cooperation with North Korea is currently at a very delicate stage due to that country's recent nuclear testing activities.
- This report is based on information obtained from the Canadian organization, "International Trade Canada," dated April 2006; the content has been updated, revised and reorganized by ATIP for the present report.

IMPACT & ASSESSMENT

Korea's S&T emphasis is shifting away from one that revolves around the ideas of imitation, improvement, non-collaboration, closed, and investment- and supply-oriented, to one that is basic, networked, open, focused on value-creation, and is result- and demand-oriented. In this way the government intends to meet its long-term market development for the benefit of the Korean economy and the social needs of the growing population. The Korean innovation strategy can be summarized as a move from an "imitate and improve" tactic to one of "innovate and internationalize." This policy comes with significantly

increased funding for key technology fields. There are ample opportunities for international collaboration.

2. KOREA'S S&T POLICY OVERVIEW

Korea's S&T policy is directed toward the continuous development of the country, concentrating on meeting social needs, and pursuing harmonization of human activities and nature. This is a drastic departure from the past policy of rapid industrialization. Korea wants to act as a responsible member of the international community, and is ready to play an active role in the global effort to improve human welfare through the advancement of S&T.

To this end, MOST has been seeking to establish a more balanced innovation system that encourages a simultaneously cooperative and competitive tripartite partnership among industry, academia, and public research organizations. As a part of these efforts, the Korean government elevated the position of the Minister for S&T to that of Deputy Prime Minister in October 2004 and established the Headquarters of S&T Innovation in MOST to provide a more balanced, innovative administration system. This system is designed to facilitate drastic domestic and international changes on the horizon, and to plan, coordinate, and evaluate national R&D programs.

Specifically, the Korean government has increased R&D expenditures from 2005 to 2006 by 15%, and announced that they will increase this amount for 2007 by an additional 6.8% (to a total of US$9.518 billion). Government will provide 81% of the funds, and the remaining 19% will come from public R&D funds (industry). The 2006 government R&D budget represents 4.7% of the total government budget (it was 4.57% in 2005). The government will focus more on basic research by increasing the budget for basic science research to 23.7% of the total government R&D budget (up from 21.5% in 2005), and by increasing the budget for regional R&D activities to 36.5% (up from 33.7% in 2005).

MOST's R&D budget in 2006 is expected to be increased to KRW 212 billion, an increase of 17.9% over 2005. In August 2006, the government announced plans to increase the national R&D budget to KRW 9.518 trillion in 2007, which is a 6.8% increase rate compared to 2006. Over the past five years, the average R&D budget rate of increase has been 9.7%.

Other Korean government organizations related to S&T are the Ministry of Commerce, Industry and Energy (MOCIE) and the Ministry of Information and Communication (MOIC), since these two organizations are related to Korean R&D programs. MOCIE is oriented to technology commercialization and production and MOIC is oriented to communication technology and product development.

The Ministry of Commerce, Industry and Energy (MOCIE) is the central government organization responsible for the control of trading, industry, technology, and energy resources. MOCIE's main responsibility is the establishment and control of technology development, transfer, and infrastructure of current and future potential industrial businesses such as gas, oil, atomic power, heavy industry, biology, chemistry, semiconductors, etc. MOCIE provides support for MOST programs such as the Nano-Bio Technology Development Program and the 21st Century Frontier R&D Program.

MOIC is the central government organization that regulates information communication, spectrum, the postal service, etc., and it is primarily responsible for the control of national IT development, IT standardization, information network infrastructure, ubiquitous IT,

information security, broadcasting, the postal service, etc. The organization's main R&D programs focus on IT, BT and NT.

3. MAJOR NATIONAL R&D PROGRAMS FOR MOST

The National R&D Program was first initiated by the Ministry of Science and Technology in 1982 with the aim to strengthen technological capabilities and competitiveness. The current National R&D Program includes the 21st Century Frontier R&D Program, the Creative Research Initiative (CRI), the National Research Laboratory (NRL), the Biotechnology Development Program, the Nanotechnology Development Program, and the Space Technology Development Program. A brief summary of each of these projects is provided below.

- The 21st Century Frontier R&D Program was initiated in 1999 with a vision to develop core technologies and to secure leading-edge technologies in promising areas by 2010. Technologies selected for development are those that will be able to produce prototype products to improve national competitiveness within 10 years of the start of development.

  The government plans to support 20 projects at a total cost in excess of US$3.5 billion under the program. Eight projects in the areas of biotechnology (BT), three in nanotechnology (NT), and five in environment and energy are currently underway, for a total of 16 projects. The government budget for this program in 2006 is KRW 144 billion.

- The Creative Research Initiative (CRI) Program, which was launched in 1997, symbolizes the policy shift in S&T development in Korea "from imitation to innovation." It aims to strengthen the national potential for technological competitiveness through creative basic research. Therefore, it focuses on exploring various phenomena that occur in nature, developing new fields of scientific research, and making technological breakthroughs. Grants are awarded to researchers on the basis of creativity and originality of their proposals. Thirty-seven CRIs are already under way, and ten new CRIs were selected this year (US$600,000-700,000 per year for 10 projects through 2016). Five CRIs that showed remarkable achievements were renewed this year (US$500,000 per year for five projects through 2011). A total of KRW 32.5 billion has been allocated for this initiative for 2006.

  The ten new CRIs include Artificial Bio Muscle research, Micro Electromechanical Systems (MEMS) Astronomical Telescope research, Three-dimensional (3D) Nano Optical Imaging System research, Immunity Control research, Functional Molecular Memory research, etc. The five renewed CRIs include Nano Particle Control Technology research and Superconductor Research, among others.

- The National Research Laboratory (NRL) Program, launched in 1999, aims to explore and foster research centers of excellence, which will play a pivotal role in improving technological competitiveness. Annually, the government will fund US$250,000 per laboratory for a maximum of five years, with special emphasis on strengthening core technology in relevant fields. From 1999 to 2006, a total of 666 NRLs were funded at a total of US$580 million. Basically, the selected NRL receives funding for five years, and depending on the NRL's research achievements, it can be funded for an additional five years. About 175 NRLs are expected to receive funding in

2006, totaling KRW 37.4 billion. The NRLs have produced over 12,300 technical papers and over 3,600 patents.

- The Nano-Bio Technology (NT-BT) Development Program was established in 2001. The Korean government declared 2001 as "The Year of Nano-Bio Technology," and plans to put available S&T resources together toward building "Nano-Bio Korea." The Nanotechnology Development Program will work on core research in nano-materials, electronic devices based on miniaturization technology, computer memories and molecular-logic devices. The increase in funding over previous years was a result of the government's recognition of the importance of nano-technology. As a result, a National NanoFab Center was constructed in December 2004. The center is a silicon-based and compound silicon-based device fabrication R&D center, with class 1000 to 1 fabrication rooms. An amount of KRW 5.7 billion has been allocated for four projects in 2006. The Biotechnology Development Program aims to make Korea a high-level biotechnology power at an international scale comparable to Korea's IT economy. The government formulated "Biotech 2000," which is the basic plan for the development of biotechnology. The plan was put into action under the co-sponsorship of seven government ministries including MOST. Through the plan, Korea aims to attain technological competitiveness in the areas of biotechnology, with a view to joining the ranks of the G-7 by the year 2010. MOST allocated KRW 47.6 billion for 33 projects in 2006.
- The Space Technology Development Program, which runs from 1996 to 2015, aims to acquire core and fundamental technologies for the peaceful utilization of space. Under this program, the government has successfully launched four scientific satellites (Uribyoel 1 to 3, and Science Technology Satellite 1), two multi-purpose satellites (Arirang 1 and 2), three commercial communication broadcasting satellites (Mugunghwa 1 to 3) and, more recently, one civil-military common communication satellite (Mugunghwa 5). In 2007, the Science Technology Satellite 3 will be launched by Korea’s internally developed rocket, and plans to launch a total of nine satellites by 2015. The national strategy also includes the construction of a space center with launch facility, development of a space launch vehicle (projectile), the first Korean astronaut program, and participation in the Galileo project. Korea successfully launched a 13-ton class liquid fuel sounding rocket in 2003 and expects to launch its first satellite from its own center in 2007, utilizing an indigenous launch vehicle. The total budget for the space development program in 2006 is KRW 250 billion for seven projects.
- Atomic Energy R&D Program: Korea invested KRW 1.86 trillion into this program during the period 1992-2005 for the R&D of future nuclear reactor, proton accelerator, nuclear fusion, nuclear fuel, nuclear safety, radioactive therapy, and radioactive waste management technologies. For 2006, the government has budgeted KRW 188.7 billion for this program. As natural energy resources are scarce in Korea, it is essential for the country to develop alternative energy sources and to increase energy efficiency. An estimated 41% of Korea's energy comes from atomic sources; hence, nuclear science and engineering have been a major focus. Korea would also like to develop basic technology for fuel cell and fuel cell vehicles by 2010. Superconductivity and super-thin-film solar battery projects are also receiving attention. From 2006, Korea will also begin developing a hydrogen production system using atomic energy.

4. S&T DIRECTIONS IN 2006

The Korean government's policy directions for S&T are currently geared towards achieving a national S&T renaissance in line with national social, cultural and economic developments, in order to satisfy the following goals:

- Realize a knowledge, information, and intelligence-based society
- Pursue a society that focuses on a healthy life
- Realize a sustainable society
- Realize a value-creating industrial structure
- Enhance national security and prestige

In September of 1999, the government launched a long-term strategic initiative: the Long-term Vision for S&T Development Toward 2025 (Vision 2025). This initiative includes a series of 40 tasks and 20 recommendations designed to guide the transition to an advanced and prosperous economy through the development of S&T. The goals are grouped in three time frames, spanning a 25-year period. Each time frame is defined by a unifying theme that characterizes the primary focus of activity for that period.

- First Step (by 2005): Place the Korean scientific and technological capabilities at competitive levels with those of the world's leading countries by mobilizing resources, expanding industrialized infrastructure, and improving relevant laws and regulations.
- Second Step (by 2015): Stand out as a major R&D promoting country in the Asia-Pacific region, actively engaging in scientific studies and creating a new atmosphere conducive to the promotion of R&D.
- Third Step (by 2025): Secure a scientific and technological competitiveness in selected areas comparable to those of G-7 countries: France, Germany, Italy, United Kingdom (UK), United States (US), and Canada.

The Vision 2025 plan has several major features including the following:

- Shifting from a government-led to a private sector-led innovation system
- Improving the effectiveness of national R&D investment
- Aligning the R&D system from a domestic to a global network
- Meeting the challenges of the IT and biotechnology revolutions

In an effort to realize the vision by the year 2025, the Korean government formulated the Five-Year S&T Plan and National Technology Road Map. Finalized in December 2001, this plan serves as the action plan for reaching the first stage of the development goal set in Vision 2025, and supplements the Five-Year Plan for S&T Innovation. The plan had aimed to place Korea among the ranks of the top ten S&T powers by 2006, and has pursued the following strategies towards this end:

- Investment in S&T development on the principle of "selection and concentration"
- Making the best use of the creativity of scientists and engineers
- Linking Korea's domestic innovation system to the global system

- Enhancing public understanding of and interests in S&T
- Efficient use of R&D resources

In 2002, the Korean government established the National Technology Road Map (NTRM), which describes target technologies, timetables for development, and anticipated effects. The NTRM aims to reach a GDP level of US$20,000-$30,000 per person by 2012, allowing Korea to enter the ranks of the top 10 in the world in national competitiveness. The NTRM selected 49 strategic products and 99 core technologies that are required to be developed. The NTRM includes six potential advanced technology development programs: Information Technology (IT), Bio Technology (BT), Nanotechnology (NT), Space Technology (ST), Environment Technology (ET), and Culture Technology (CT). The Road Map will be updated periodically to take changes in S&T into consideration.

5. R&D BUDGET FOR 2006

Total Korean R&D expenditures in 2004 were KRW 28.3 trillion, showing an increase of 13.2% from the KRW 25 trillion spent the previous year. The proportion of R&D to GDP was 2.85%, up 0.22% in 2003. Per capita R&D expenditures in 2004 were KRW 588,000. The national government and public sector provided about 25% of the total R&D funding in Korea in 2004, down by 1% from the previous year. The private sector financed the remaining 75%. Research institutes spent 13.4% of total R&D funds, while universities and colleges disbursed 9.9% and companies expended 76.7%.

For 2006, the Korean government announced that 4.05%, or KRW 8.97 trillion, of the federal budget would be the public sector's contribution to R&D. This is an increase of 15% from the previous year. Overall Korean R&D expenditures are forecast to be KRW 35 trillion in 2006.

In 2004, the Korean science-based ministries spent a total of KRW 3.29 trillion on six selected technologies. This amount does not include private sector expenditures.

- IT - KRW 1.37 trillion
- BT - KRW 771.7 billion
- ET - RW 546.8 billion
- ST - KRW 255 billion
- NT – KRW 304.1 billion
- CT - KRW 53.1 billion

Table 1 below lists the R&D budgets for major government ministries.

Table 1: R&D Budgets for Major Korean Government Organizations

(Unit: KRW 1 billion)

Organization	Budget for 2005	Budget for 2006	% Increase
Ministry of Science & Technology (MOST)	1,960	2,178	11.1
Ministry of Commerce, Industry & Energy	1,767	2,002	13.3
Ministry of National Defense	929	1,107	19.1
Ministry of Education & Human Resources Development	877	975	11.1
Ministry of Information & Communication	697	805	15.6
Rural Development Administration	304	312	2.7
Ministry of Construction & Transportation	151	296	94.9
Small & Medium Business Administration	231	268	16.1
Ministry of Health & Welfare	165	191	15.6
Ministry of Maritime Affairs & Fisheries	140	184	30.9
Ministry of Environment	134	143	7.0

MOST is the largest financial contributor to public sector R&D with KRW 2.12 trillion, followed by the Ministry of Commerce, Industry and Energy (MOCIE) with KRW 2.0 trillion and the Ministry of National Defense (MND) with KRW 1.1 trillion.

MOST plans to spend KRW 9 billion from the S&T Promotion Fund to help facilitate international joint research projects in 2006.

Table 2 below shows MOST's major R&D related budgets:

Table 2: Major R&D Budgets for MOST

(Unit: KRW 1 billion)

	Item	Budget for 2005	Budget for 2006	% Increase
1	Basic Research & Strategic Technology Development	677	765	13.0
	-Basic Research	520	525	0.9
	-Space Development	157	240	53.2

2	S&T Innovation Infrastructure	61	46	-24.0
	-International S&T Cooperation	43	12	-71.5
	-Regional S&T Promotion	18	34	89.0
3	Atomic Energy R&D and Safety Infrastructure	51	38	-26.0
	-Atomic Energy R&D	45	29	-35.8
	-Atomic Safety Infrastructure	6	9	43.1
4	Support to R&D Institutes	999	1,089	9.0
	-Korea Research Council for Fundamental S&T	178	203	13.7
	-Korea Research Council for Industrial S&T	244	271	11.0
	-Korea Research Council for Public S&T	290	311	7.5
	-MOST Institutes	287	304	6.0

6. S&T ORGANIZATIONS IN 2006

The structure of the S&T system in Korea is somewhat convoluted and the government is trying to streamline the entire system to improve its effectiveness.

In order to set priorities for the allocation of S&T budgets, and to effectively review and coordinate national S&T policies and R&D programs, the government established the National S&T Council (NSTC) in January 1999. The NSTC is chaired by the President of the Republic of Korea, and deputy chaired by the Deputy Prime Minister of S&T, and is composed of 13 Ministers of S&T-related Ministries and 9 representatives from the S&T community. The NSTC holds ultimate power over the coordination of R&D programs and budgets within Korea. MOST serves as the secretariat for the NSTC through its newly established Office of S&T Innovation (OSTI), taking responsibility for the overall management and coordination of S&T policies, national R&D projects, industry and human resources policies related to S&T innovations, and regional technology innovation policies.

The OSTI, headed by a Vice Minister, will focus on the following:

- Forming a S&T R&D system in preparation for the future
- Promoting efficient investment and budget allocation
- Supporting development of future growth engine industries
- Developing a realistic long-term plan for a national R&D program
- Developing human resources in S&T and activate regional S&T

A second advisory board, the Presidential Council on S&T (PCST), is primarily comprised of non-governmental scientific experts and corporate leaders representing various areas of S&T. In the past, the PCST was irrelevant to the centrally controlled, government-driven central planning exercise. Currently, however, it is becoming more important as the government loosens its grip on the planning process. The government would like to have its scientific policy satisfy more of the private sector's needs and is accordingly more open to that sector's views.

MOST is responsible for implementing the national coordination of S&T efforts within the country. This includes R&D initiatives, human resource development and education, and internationalization policies, as well as coordinating activities amongst the science-based Ministries and government-supported research institutes. MOST oversees compliance with the various national initiatives. The S&T Framework Law (No. 7218) implemented in September 2004 consolidated the authority for inter-ministerial S&T policy and R&D coordination within MOST to help establish an institutional system that would foster an innovation-driven culture in Korean society. The new law contains important provisions for the establishment of policies and plans for the overall support mechanism for related R&D projects and agencies. It also replaces the basic laws covering systematic S&T promotion and education at the national level.

MOST is also responsible for the Centers of Excellence (COE) in Korea, including: Science Research Centers (SRCs), Engineering Research Centers (ERCs), Medical Science and Engineering Research Centers (MRCs), and National Core Research Centers (NCRCs). These COEs were created to implement programs encouraging basic research in major universities. The SRCs and ERCs, founded in May 1990, focus on innovative research in basic sciences and new technologies, while the MRCs, which started in 2002, emphasize research in physiology, diagnostics, treatment, public health, neurology, and psychology. The NCRCs started in 2003 and currently have research centers on nano-application, environment and biotechnology, bio-dynamics, and nano-medical systems. The SRCs and ERCs are selected on the basis of creativity and research capability. MRCs are selected from medical schools and funded in three phases. NCRCs are selected to promote future-oriented S&T fusion research. Once the centers are selected, they receive government funding for five to nine years, provided that the interim evaluations demonstrate good progress. In 2006, MOST plans to fund 65 SRCs/ERCs (up to KRW 980 million per year, per center), 18 MRCs (up to KRW 1 billion), and six NCRCs (up to KRW 2 billion).

In order to produce scientists and engineers of top quality, the transformation of current teaching-oriented universities into research-oriented universities is critical. To stimulate such a transformation, the government is providing financial support to those universities with excellent research performance. Many of the major universities in Korea have responded to the government policy by preparing and launching various reform programs that are anticipated to bring about drastic changes in university education in Korea.

The Korean Advanced Institute of S&T (KAIST) serves as a good example of the type of research-oriented university that Korea is pursuing. KAIST was established by the Korean government in 1971 in order to producing world-class, quality engineers. Since its inception, KAIST has been receiving preferential funding from the government, and has been able to recruit the nation's best students. No less important, however, is its research performance record, which attracts abundant industrial research funds. Based on the KAIST model, the government founded the Gwangju Institute of S&T (GIST) in 1995, and recently established

the Daegu-Gyungbuk Institute of S&T (DGIST) in 2004, to promote balanced regional development. Likewise, the Pohang University of S&T (POSTECH) was founded with similar aims by the Pohang Steel Corporation in 1986. POSTECH represents the first private sector initiative of its kind in Korea.

It is worth emphasizing that almost three quarters of Korea's R&D expenditures come from the private sector, including the massive private R&D institutes operating relatively independently of their parent companies, i.e., LG-Elite, an LG group R&D Institute, and the Samsung Advanced Institute of Technology (SAIT), a Samsung group R&D institute, which employ thousands of scientists and engineers. Many of Korea's large corporations (e.g., KT Corp., SK Group, Hyundai Motors, and Hynix) also have significant internal R&D centers based within their prime business units. SK Telecom and SK Chemical, for example, have specialized R&D operations in various centers across Korea.

Falling under the NSTC, there are three S&T-related research councils that oversee the operation of the Government-supported Research Institutes (GRIs) - the Research Council for Industrial S&T, the Research Council for Public Technology, and the Research Council of Fundamental S&T (see Table 3 below). This new system is expected to improve research productivity, strengthen linkages between institutes, and to increase transfer and commercialization of research results. However, ten GRIs still remain directly under MOST to support or carry out specific duties relative to the Ministry's mandate.

Table 3: Korea's Government-supported Research Institutes (GRIs)

Name of GRI	Field of Research	Budget for 2006 (in KRW Billion)	Website
Ministry of S&T: http://www.most.go.kr			
Korea Advanced Institute of Science and Technology (KAIST)	S&T Education	110.8	http://www.kaist.ac.kr/
Korea Institute for Advanced Study (KIAS)	Basic Science	10.9	http://www.kias.re.kr
Gwangju Institute of Science and Technology (GIST)	S&T Education	46.9	http://www.gist.ac.kr
Korea Atomic Energy Research Institute (KAERI)	Atomic Energy	52.6	http://www.kaeri.re.kr
Korea Institute of Radiological & Medical Sciences (KIRAMS)	Cancer & Radiation Medicine	20.7	http://www.kirams.re.kr
Korea Institute of Nuclear Safety (KINS)	Nuclear Safety	11.6	http://www.kins.re.kr

National Nuclear Management & Control Agency (NNCA)	Nuclear Control	7.7	http://www.nnca.re.kr
Korea Science and Engineering Foundation (KOSEF)	Support to Basic Science	23.4	http://www.kosef.re.kr
Korea Institute of S&T Evaluation and Planning (KISTEP)	S&T Evaluation and Planning	9.2	http://www.kistep.re.kr
Daegu-Gyungbuk Institute of Science & Technology (DGIST)	S&T Education	10.1	http://www.dgist.ac.kr
Korea Research Council of Fundamental Science and Technology (http://www.krcf.re.kr)			
Korea Basic Science Institute (KBSI):	R&D Facilities	35.4	http://www.kbsi.re.kr
National Fusion Research Center (NFRC)	Nuclear Fusion Research	11.1	http://www.knfp.net
Korea Astronomy & Space Science Institute (KASI)	Astronomy	16.3	http://www.kasi.re.kr
Korea Institute of Science and Technology (KIST)	National Projects	84.1	http://www.kist.re.kr
Korea Research Institute of Bio-science and Biotechnology (KRIBB)	Bio-Science	45.5	http://www.kribb.re.kr
University of Science and Technology (UST)	S&T Education	2.0	http://www.ust.ac.kr
The Korea Research Council for Industrial Science and Technology (http://www.koci.re.kr)			
Korea Institute of Oriental Medicine (KIOM)	Oriental Medicine	12.9	http://www.kiom.re.kr
Korea Institute of Industrial Technology (KITECH)	Industrial Technology	59.4	http://www.kitech.re.kr
Electronics and Telecommunications Research Institute (ETRI)	Electronics & Telecommunication	20.2	http://www.etri.re.kr
National Security Research Institute (NSRI)	Information Security	31.8	http://www.nsri.re.kr
Korea Food Research Institute (KFRI)	Food	15.4	http://kimchi.ksri.re.kr

Korea Research Institute of Machinery and Materials (KIMM)	Machinery and Materials	39.8	http://www.kimm.re.kr
Korea Research Institute of Chemical Technology (KRICT)	Chemistry	35.2	http://www.krict.re.kr
Korea Institute of Toxicology (KITOX)	Toxicology	13.3	http://www.kitox.re.kr
Korea Electrotechnology Research Institute (KERI)	Electricity	32.7	http://www.keri.re.kr
Korea Research Council for Public Technology (http://www.korp.re.kr)			
Korea Institute of Science & Technology Information (KISTI)	Information	55.0	http://www.kiniti.re.kr
Korea Institute of Construction Technology (KICT)	Construction	24.6	http://www.kict.re.kr
Korea Railroad Research Institute (KRRI)	Railroad	16.2	http://www.krri.re.kr
Korea Ocean Research & Development Institute (KORDI)	Ocean	39.9	http://www.kordi.re.kr
Korea Polar Research Institute (KOPRI)	Polar Research	18.0	http://www.kopri.re.kr
Korea Research Institute of Standards and Science (KRISS)	National Standards	53.7	http://www.kriss.re.kr
Korea Institute of Energy Research (KIER)	Energy	31.1	http://www.kier.re.kr
Korea Institute Of Geoscience and Mineral Resources (KIGAM)	Resource	35.6	http://www.kigam.re.kr
Korea Aerospace Research Institute (KARI)	Aerospace	25.7	http://www.kari.re.kr

7. INTERNATIONAL S&T ACTIVITIES

Korea has accomplished considerable S&T development through international linkages. In the past, most of the country's relationships with foreign partners were limited to technological imports or assistance of a reciprocal nature. Partnerships were limited to such advanced countries as the United States, Japan, and several European countries. However, as a newly industrialized country, Korea now recognizes the need for a new approach to international cooperation. Korea is seeking a more prominent role in the international S&T community, and is actively pursuing both bilateral and multilateral cooperation.

As of 2005, Korea has signed 44 intergovernmental agreements ranging from Joint Cooperation Committees involving joint research funds, to overseas cooperation centers or exchanges of S&T missions and scientists. Korea has S&T Counselors in eight countries: the US, Japan, Austria, Germany, Russia, China, UK, and the Organization for Economic Co-operation and Development (OECD). Separate Nuclear Cooperation Agreements have been signed with 18 countries, including Canada. Under the auspices of the International Cooperation Program office of MOST, Korea entered into 138 S&T Cooperation Agreements in 2005. There are 107 bilateral R&D projects and 19 multilateral R&D projects. 12 joint R&D Centers have been opened in the United States, China, Russia, Mongolia, and Hungary.

7.1 Bilateral Cooperation

In general, bilateral cooperation with foreign countries is based on an inter-governmental S&T cooperation agreement. Korea has concluded such agreements with forty-four countries, as listed in Table 4 below.

Table 4: Countries in S&T Bilateral Cooperation Agreements with Korea

Area	Countries
Asia & Oceania	Australia, Bangladesh, China, India, Japan, Malaysia, Pakistan, Papua New Guinea, Philippines, Singapore, Sri Lanka, Thailand, Vietnam
Americas	Argentina, Brazil, Chile, Colombia, Costa Rica, Dominica, Mexico, Paraguay, Peru, United States, Venezuela
Europe	Albania, Czech Republic, Finland, France, Germany, Greece, Hungary, Italy, Kazakhstan, Poland, Russia, Slovenia, Spain, Ukraine, United Kingdom, Uzbekistan
Middle East & Africa	Egypt, Israel, South Africa, Tunisia

Following is a description of recent bilateral cooperative activities with some of these countries.

United States: As a part of the Korea-U.S. S&T Agreement signed in 1976, a wide range of joint research projects as well as exchanges of scientists and engineers have been carried out. The agreement as amended in 1999 stipulates the allocation of intellectual property (IP) rights resulting from joint research and strengthens the protection of IP

rights through mutual cooperation. The Korea-U.S. Joint Committee on S&T has been held every two years since 1993. The Korea-U.S. Special Cooperative Program in S&T, which was jointly created in 1995 by the Korea Science and Engineering Foundation (KOSEF) and the US National Science Foundation (NSF), has also been used to promote the exchange of scientists and engineers, as well as joint seminars. The Korea-U.S. S&T Cooperation Forum, held every year since 1993, expedites joint cooperation. Both sides also agreed to initiate a new joint nanotechnology forum at the 5th Joint Committee meeting held in October 2002 in Seoul. In 2003 and 2005, the Korea-U.S. Nano-Forum took place in Seoul (Korea) and Los Angeles (California, US), respectively. The Korean government also carries out S&T cooperation with individual state governments as well as the US federal government.

United Kingdom: Korea-U.K. S&T cooperation has been conducted under the auspices of the Korea-U.K. S&T Cooperation Agreement of 1985. Since 1996, both countries have held an annual meeting of the U.K.-Korea S&T Joint Commission, which has greatly contributed to the promotion of S&T cooperation between the countries. Both sides have conducted various collaborative activities, such as the joint research Focal Point Program for networking among scientists of two countries, and joint scholarship programs.

Japan: Korea's S&T policy relationship with Japan has been geared to redressing the trade imbalance with Japan through technology cooperation since the early days of the relationship. Therefore, the focus has been on promoting and encouraging cooperation in such areas as machine parts and materials, which are the main sources of the trade imbalance. In order to facilitate bilateral technology cooperation and to help correct the trade imbalance, the two countries set up the Korea-Japan S&T Cooperation Committee based on the Korea-Japan S&T Cooperation Agreement signed in 1985. This Committee facilitates the exchange of scientists, joint research, and other forms of scientific interaction between the two countries. For policy dialogue, the two countries have been holding the Korea-Japan S&T Forum every year since 1999. The Korea-Japan Special Cooperative Program in S&T between KOSEF and the Japan Society for the Promotion of Science (JSPS) provides funding on joint researches and also promotes joint seminars.

China: Under the provision of the Korea-China S&T Cooperation Agreement signed in 1992 a variety of cooperative activities, such as the exchange of various technological surveys, as well as scientific and engineering teams, post-doctoral training programs, and joint research projects, have been undertaken. S&T exchanges between the two nations are active and continuously expanding into new areas. China is one of Korea's most active S&T partners. The Korea-China Special Cooperative Program in S&T between KOSEF and the Chinese Academy of Sciences (CAS) as well as the National Natural Science Foundation of China (NSFC) has also been used to promote the exchange of scientists and engineers, and joint research and seminars.

France: With the Agreement on Scientific and Technological Cooperation concluded in 1981, a Korea-France S&T Joint Committee Meeting has been held regularly since 2002, independent of the existing Korea-France Cultural and Technical Joint Committee Meeting. Recently, Korea and France operated Focal Points conducting the exchange of scientists and technical survey missions, as well as holding joint seminars and workshops to promote cooperation in the fields of bioengineering, new resources, information and communications, and basic science.

Germany: The Korea-Germany S&T Cooperation Agreement, concluded in 1986, promoted cooperative activities in high-technology fields such as new materials, laser technology, and automation. In order to strengthen cooperation between their private sectors, Korea and Germany established the Korea-German Non-Governmental Committee on S&T in 1997, and it has been held for three consecutive years (1997-1999). Recently both sides agreed to establish the Korea-Germany Committee on Cooperation in Education, Research and Technology, attended by non-governmental groups and government officials from both sides. The first committee meeting was held in December 2003. The Korea-Germany Special Cooperative Programs in S&T between KOSEF and Deutsche Forschungsgemeinschaft (DFG), Deutscher Akademischer Austauschdienst (DAAD), Alexander von Humboldt Foundation (AvH), and Max-Plank Gesellschaft (MPG) promote the exchange of scientists and engineers, joint research and seminars.

Russia: Since the signing of the Korea-Russia S&T Cooperation Agreement in 1990, S&T cooperation between the two countries has been actively promoted through the exchange of scientists, joint research projects, and technology exhibitions. Moreover, the establishment of joint research centers in Russia in such areas as aerospace, materials, energy, and optics has greatly increased. Recently, the scientist exchange program has been expanded to meet the increasing demand for research collaboration. These cooperative activities have been reviewed by the Korea-Russia Joint Committee on S&T Cooperation, and have encouraged contacts between scientists and specialists of the two countries. Several hundred Russia scientists are currently working at institutes in Korea.

Italy: Korea has promoted its cooperation with Italy in S&T since the conclusion of an intergovernmental agreement on S&T cooperation in 1984. Both governments held the Korea-Italy S&T Forum and the 7th Joint Commission on S&T Cooperation in September 2003, and agreed to work out a variety of measures to foster mutual cooperation among academia, industry, and research institutes in both countries.

Israel: Since the conclusion of the Korea-Israel S&T Cooperation Agreement in 1994, four S&T Joint Committees and four Minister's meetings have been held. Based on the Memorandum of Understanding (MOU) between the Korea Research Institute of Bioscience and Biotechnology (KRIBB) and the Weizmann Institute of Science (WIS) in Israel, researchers from each institute are conducting research through exchange visits. Recently, Korea has been advancing its S&T cooperation with Israel, specifically in nanotechnology.

Switzerland: Since the inception of an MOU in 1995, the two countries have convened regular "S&T Round Table" meetings to forge cooperative networks in the field of S&T. The Swiss-Korea Outstanding Research Efforts Award (SKORE-A) program was established in 2000 to facilitate joint research projects by presenting awards to each potential research team in order to enhance S&T cooperation, and regular Korea-Swiss S&T Forums and personnel exchanges are currently under way to the effect of more solid S&T cooperation.

Canada: Canada-Korea S&T cooperation has been very active at the institutional level. More than 44 institutional level MOUs, collaboration agreements and/or Letter of Intent (LOIs) with partners in Korea were previously in place for collaborations and exchanges. On July 5, 2002, Canada and Korea entered into an Arrangement on S&T Cooperation between the Department of Foreign Affairs and International Trade of Canada and Korea's MOST. The first Canada-Korea Consultation Meeting was held in October 2003 in Seoul. Both parties discussed cooperative venues including joint policy research, scientist exchange, and forums or workshops in the area of biotechnology (BT), space technology

(ST) and nanotechnology (NT). The Canada-Korea Joint Study on S&T Cooperation commissioned by both parties as discussed during the first meeting was completed in October 2004. The second meeting was held in May 2006; topics of discussion concerned recommendations contained in the study.

7.2 MOST International Joint Research Program

The *International Joint Research Program* of MOST, started in 1985, has served as a major source of funding support for international joint research projects initiated through bilateral, inter-governmental and inter-institutional agreements. Thus far, the program has funded 1,896 joint projects. The international joint projects have been small in scale, and have been used more as a means to facilitate international scientific interactions (i.e., as scientific exchanges rather than as projects for serious R&D). The major partner countries have been the US, UK, Japan, France, China, Germany, and Russia. Recently, the scope of partners has diversified and the nature of projects under the program has changed.

7.3 Multilateral Cooperation

In order to contribute to international efforts for the advancement of S&T and to solve issues of global concern such as climate change, global warming, and acid rain, Korea has been actively participating in the international S&T activities of multilateral international and regional organizations, particularly the OECD and the Asia-Pacific Economic Cooperation (APEC).

APEC: As a founding member, Korea seeks active regional S&T cooperation through its activities at various APEC forums, such as the *Industrial S&T Working Group, Marine Resources Working Group*, and *Human Resources Development Working Group*. Korea hosted the *Second APEC Minister's Conference on Regional Cooperation in S&T* in 1996. Korea also hosted the *First APEC Science Youth Festival* in August 1998. In addition, Korea is currently implementing the APEC S&T Network Program, which aims at the promotion of scientific exchange through R&D management training, information sharing, and the sharing of research facilities. Starting in 2002, Korea assumed the role of the *Shepherd of the Industrial S&T Working Group* (ISTWG).

OECD: Korea joined the *OECD Committee for Scientific and Technological Policy* (CSTP) in 1994, and then joined the OECD in 1996. Since then, Korea has been actively involved in OECD S&T programs. Korea hosted the OECD Seoul Conference on "Facilitating International Technology Cooperation in a Globalized Knowledge-Based Economy" in 1997. Korea also coordinated a focus group on "National Innovations Systems in Catching-up Economies" under the OECD/CSTP NIS Program. Recently, Korea hosted the OECD Seoul Conference on "Roles and Activities in International S&T Cooperation for Sustainable Development" in 2000. Korea is to host the 88th CSTP meeting in Seoul in October 2006.

ISTC: Korea joined the governing board of the International S&T Center (ISTC) in May 1998. As per the agreement and other regulations, Korea has taken part in international efforts to support the research projects of weapons scientists and engineers of the Russian Federation for peaceful purposes. Korea has actively participated in all of the activities of the ISTC, supporting research projects and sharing the ISTC administrative budget. Korea has maintained close and cooperative ties with all ISTC members, including the US, Japan,

the European Union (EU), Russia, and Norway. The government also dispatched staff to support ISTC Secretariats.

EU: Since the conclusion of the *Arrangement on S&T Co-operation* in 1992, five S&T Joint Seminars have been held, and Korea-EU scientists and students have been exchanged between the two parties. Since 1996, Korea has stationed officials in the Joint Research Center (JRC) and the European Commission to get first-hand experience in the EU's advanced S&T system and to find ways to enhance cooperation. In addition, Korea has participated in the EU contest for Young Scientists since 1997. In 2003, Korea and EU laid a solid foundation through a Korea-EU S&T Ministerial meeting held on May 16 regarding Korea's participation in the International Thermonuclear Experimental Reactor (ITER) project on May 30 under the EU's 6th Framework Program and the signing of an S&T cooperation agreement with the EU.

Inter-Korean Cooperation: The summit meeting between South and North Korea held in Pyongyang in June 2000 has opened a new era for S&T cooperation. The main objective for inter-Korean S&T cooperation is to facilitate co-economic development. One short-term objective is assistance by South Korea into North Korea with the resolution of such issues as food and energy shortages. In the long-term, R&D cooperation is expected to improve the S&T capabilities for both North and South Korea and enhance economic benefits. MOST is currently conducting 11 R&D projects under agreements between research institutes in South and North Korea that have been in place since 1998. In the near future, an official channel for S&T may be established for systematic and effective implementation. South Korea desires improved relations with the North for many well-publicized reasons, including economic. For example, plans for long-term industrial growth include rail cargo ship off-loading and trans-shipment via the huge new Port of Incheon from Japan to Europe. It has been claimed that such a route would be quicker and more cost effective than the much longer alternative sea routes. To that end, cargo must transit through North Korea. South Korea has been operating with a "sunshine" policy regarding North Korea (i.e., to be helpful to the extent that the North recognizes the obvious benefits of cooperation and conciliation). However, recent events such as North Korea's nuclear testing may have called this policy into question, and it is certainly being discussed inside Korean government circles.

8. CONCLUSION

This report is based on information obtained from the Canadian organization, International Trade Canada, dated April 2006; the content has been updated, revised and reorganized by ATIP for the current report. This report presents the Korean government's S&T R&D programs, primarily those administered by MOST. Korean S&T organizations, policies, budgets, and international activities are described within. In order to further develop the level of Korean S&T, the government has designated six focus areas (IT, NT, BT, ET, ST and CT) and aggressively plans to increase R&D budgets in these topic areas. IT, NT and BT are the major R&D focus areas, and three government agencies -- MOST, MOCIE and MOIC -- are the top organizations charged with the administration of Korea's national R&D programs.

MOST is the leading organization in Korean S&T R&D, and its R&D strategy/plan is focused on basic research activities for future (i.e., long-term) potential. MOCIE's R&D strategy/plan is more oriented towards technology and product development that can be directly connected

to commercialization and market development on a short- or mid-term basis. MOIC's strategy/plan is especially focused on information and communication technology development, and its R&D budget is expected to be increased up to the same level as those of MOST and MOCIE in the near future, since the Korean government is strongly pursuing the notion of an ubiquitous IT society.

There are several on-going national R&D programs associated with each of these organizations. Although they each have different R&D goals, some activities overlap which results in some redundancy and competition. The present report highlights the leading organization, MOST.

Although the Korean government designs its total annual R&D budget plan to intensely support MOST, MOCIE and MOIC, the budget for national defense is still high, due to the current political situation with North Korea. If political issues can be resolved in positive manner in the future, the South Korean government will be able to concentrate more on financial support of it's S&T R&D programs.

Korea participates in a number of international programs aimed at fostering collaboration with foreign countries, in addition to local university, institute, and industry-linked international-programs. However, in practice, the impact of international programs is currently not substantial; rather, programs with local industry are the most active. Since government funding is not sufficient for core technology localization, most R&D programs are also dependent on and supported by local industry. Therefore, there is a natural tendency for R&D programs to aim at short-term achievements that are easy to commercialize. This is an important reason why Korea's basic S&T infrastructure is still not competitive in comparison with other advanced countries such as Japan or the US.

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