RESEARCH MATERIAL No. 164

AAAS Symposium

East Asian Science Policies and New Global Realities

(Feb. 14, 2009, U.S. Chicago)

Feb 2009

National Institute of Science and Technology Policy (NISTEP)

Ministry of Education, Culture, Sports, Science and Technology (MEXT)

AAAS Symposium
East Asian Science Policies and
New Global Realities

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Ministry of Education, Culture, Sports,
Science and Technology (MEXT)

caption

From the left:
Dr. June Seung Lee, President of KISTEP; Ms. Yaeko Mitsumori, Coordinator of International Research Cooperation of NISTEP; Dr. Kumi Okuwada, Director of Science and Technology Foresight Center at NISTEP; Dr. SukJoon Kim, President of STEPI; Dr. Christopher Hill, Professor of George Mason University; Mr. Tomoaki Wada, Director General of NISTEP; Mu Rongping, Director General of CAS/IPM; Mr. Hiroshi Nagano, Professor of National Graduate Institute for Policy Studies & an affiliated fellow of NISTEP

Preface

Staff of the National Institute of Science and Technology Policy (NISTEP), a unit of the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) organized a symposium titled "East Asian Science Policies and New Global Realities" at the Annual Meeting of the American Association for the Advancement of Science (AAAS) in Chicago on Feb 12-16, 2009.

The symposium which was held on Feb 14, 2009 was one of the most recent collaborative initiatives among Japan, Korea and China. Representatives from leading research institutes in China and Korea in the area of science and technology policy studies joined two representatives from NISTEP as speakers at the symposium. The participating institute from China was Institute of Policy and Management of the Chinese Academy of Sciences (IPM/CAS). Participating institutes from Korea were the Korea Institute of Science and Technology Evaluation and Planning (KISTEP) and the Science and Technology Policy Institute, Korea (STEPI). Ms. Yaeko Mitsumori of NISTEP served as the organizer of this symposium and Prof. Christopher T. Hill of George Mason University moderated the symposium.

The purpose of the symposium were (a) to share information about the current status of science and technology policy studies in each country; (b) to identify the achievement, challenges and problems of each country; and (c) to discuss future directions. The symposium was also intended as a forum for sharing the three countries' experiences with attendees from the Unites States and other countries.

Overview

Session Description

This symposium will discuss how the S&T policies of China, Korea, and Japan—the leading nations in the East Asian region—address new global realities, including environmental challenges (climate change, energy conservation, sustainable development) and changing patterns of private investment in R&D around the world.
These three countries have been reexamining their S&T policies so as to more fully utilize their S&T capabilities in light of the new realities.
First, senior representatives of each country's S&T policy-making agencies will assess achievements over the past decade. China is changing and developing S&T capability more rapidly than any other major nation in the world. Korea has successfully transitioned from being a "catch-up" nation to a nation that is one of the most advanced contributors to S&T in the world. After its painful "lost decade," Japan has re-emerged to become once again a leading nation in S&T. The focus of each nation's S&T policies is encouraging technological innovation in hopes that each will achieve a leading position in innovation compared with other nations of the world
Next, speakers from each country will report on their strategies for success in a world characterized by the new realities. The World is carefully watching how China—one of the world largest economies—tackles these issues. Korea, a small country with a very strong technology based-economy, is moving forward under new leadership that has a strong grounding in achieving success in the new global economy. Japan, the world's second largest economy, despite having endured the Lost Decade, is equipping itself with the most advanced technologies and the most creative approaches to address these challenges with S&T.

Organizer
Yaeko Mitsumori
Coordinator of International Research Cooperation
National Institute of Science and Technology Policy (NISTEP)
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

Program

"East Asian Science Policies and New Global Realities"

Date: Feb 14, 2009 (Saturday) 13:30 – 16:30
Site: HRC Grand C North

Organizer: Yaeko Mitsumori, Coordinator of International Research Cooperation NISTEP
Moderator: Dr. Christopher Hill, Professor of George Mason University International Affiliated Fellow, NISTEP

JAPAN – NISTEP
Speaker: Mr. Tomoaki Wada,
Director General, NISTEP,
"Recent Developments in S&T Policies After the Lost Decade"

KOREA-- KISTEP
Speaker: Dr. June Seung Lee,
President, KISTEP
"Korea's Science and Technology Policy"

JAPAN -- NISTEP
Speaker: Dr. Kumi Okuwada,
Director, Science and Technology Foresight Center, NISTEP
"Sustainable Development Through Scientific and Technological Innovation"

CHINA--IPM,CAS
Speaker: Dr. Mu Rongping
Director General, IPM, CAS
"Innovative Policy for Sustainable Development in China"

KOREA -- STEPI

Speaker: Dr. SukJoon Kim,

President, STEPI

"Strategy for Low-carbon Green Growth in Korea"

Opening Remarks

Opening Remarks

【Mitsumori】 Thank you for attending the Japan/China/Korea Symposium at the AAAS Annual Meeting at Chicago. My name is Yaeko Mitsumori, the organizer of this symposium.

The topic of today's symposium here is: East Asian Science Policy and New Global Realities. Today, we have five distinguished speakers. I will introduce them now.

Mr. Tomoaki Wada, Director General of NISTEP.

Dr. June Seung Lee, KISTEP.

Dr. Kumi Okuwada, NISTEP

Dr. Mu Rongping from CAS/IPM.

and Dr. SukJoon Kim, STEPI.

Dr. Yang from CASTED, unfortunately couldn't come to Chicago. This year, we again asked Dr. Christopher Hill, professor of the George Mason University, to take the role of moderator, and he has kindly accepted this. Thank you Dr. Hill.

Before we start, I have one short announcement.

Today, we'll have a reception at the sushi bar in the Fairmont Hotel, starting at 6:30 pm. So, if you wish to attend the reception, please come to me after this symposium.

Now, I'm going to hand over the microphone to Dr. Hill. Thank you.

【Hill】 Good afternoon. It's wonderful to welcome all of you here for this symposium this afternoon. We could view this as the third symposium organized by NISTEP with participation by representatives from there, and more recently also from China and Korea. These symposia are important contributions to the AAAS Annual Meeting to help reflect the true international nature of the AAAS. I am very appreciative to those people who came a lot further than I did to be here at this meeting this afternoon.

In the interest of time, and because the speakers have interesting things to say, I will simply begin by saying that it is my impression from my own years of study and analysis and exchange with folks, particularly in Japan but also more recently in Korea and China, that we have a lot to learn in the United States from activities in leading Asian countries regarding the organization of science and technology, regarding the determination of priorities, the setting of policy, the flexibility of the instruments of policy. They can teach us, in the United States at least, a great deal. So I hope, this afternoon, that we'll not only pay attention, but learn, from what we hear.

At the same time, we can use this opportunity to celebrate the capacity that has emerged between these three very important nations—China, Korea and Japan—to cooperate and collaborate in the formulation and discussion and analysis of science and technology policies. The three countries, which, from a U.S. point of view, might all seem to be similar, are, of course, countries with diverse national interests that don't always agree. Their conversation around science and technology policy matters is, I think, something that we should all encourage, support and be interested in.

Speaker: Mr. Tomoaki Wada,
Director General, NISTEP,
“Recent Developments in S&T Policies After the Lost Decade”

【Hill】 I would like to begin this afternoon by further introducing the speakers. Our first speaker is the director general of the National Institute of Science and Technology Policy, in Japan, an organization that last fall celebrated its 20th anniversary as the key analytic body serving all branches of the Japanese government by helping to formulate science and technology policies. The Director General since 2008 has been Mr. Tomoaki Wada, who will be our first speaker, and let me just say a couple of things about his background.

He's been in the Cabinet Office as director of science and technology policy and was involved in creating the 3rd Science and Technology Basic Plan. For those who are not students of Japan, the 3rd Science and Technology Basic Plan is now working its way toward its conclusion; work on the 4th Plan has begun. And Mr. Wada is at the center of that planning. Earlier, he served as director general of the Nuclear Fuel Cycle Backend Department at the Japan Atomic Energy Agency. To be concerned about the management of nuclear waste is a difficult job in any country. He was also in charge of industrial promotion in Okinawa, which is also a very challenging position.

Now he's at NISTEP, and we look forward to his discussion of: Recent Developments in Science and Technology Policies after the Lost Decade. Mr. Wada, the microphone is yours.

【Wada】 Thank you very much, Dr. Hill. I am very pleased to have this opportunity to present the science and technology policies of Japan in this symposium. The title of my speech is: Recent Developments in Science and Technology Policies after the Lost Decade.

(Slide 2)

This is a figure of the future change of Japan's population. Japan is characterized by a rapidly decreasing population and highly aged society, compared to other countries in the world. Japan's population size began declining in 2005. It has been projected that in 2025, elderly people aged over 65 will comprise of one third of Japan's population.

(Slide 3)

This is the statement by Prime Minister Taro Aso. Four Japanese scientists won Nobel Prizes last year. This message was released by Prime Minister Aso on November 11th last year, the day after the award's ceremony. The prime minister intends to assume personal leadership in promoting the science and technology policy in order to strengthen Japan's international competitiveness, create a research environment for enhancing a creative mindset, attract the highest-caliber foreign scientists and promote young people's appreciation of science and technology.

(Slide 4)

The Council for Science and Technology Policy, CSTP, was established in 2001, comprises of Prime Minister Aso, six relevant ministers, seven executive members and the president of the Science Council of Japan. CSTP is charged with addressing three tasks. First is making the fundamental policy on science and technology; second, allocation of resources for science and technology, including budget; and third is evaluating R&D programs, which are critical at a national level.

(Slide 5)

Japan has implemented the 1st and 2nd Basic Plans. Each plan covers the 5-year period. Since the inception of the 2nd Plan, we have strongly promoted the prioritization of R&D investment, doubling of competitive research funding and enhancement of industry-academia-government cooperation with some degree of the success. The key points in the 3rd Basic Plan are shown in the right column, which places emphasis on science and technology to be supported by the public and to deliver benefits to society and fostering human resources and competitive research environments. That means a shift of emphasis from hard to soft in areas such as human resources and greater significance of individuals in institutions. The 3rd Basic Plan also sets three ideas and six concepts as more practical policy goals, and the investment target is 25 trillion Japanese yen for 5 years.

(Slide 6)

This one shows the goals and ideas of the 3rd Science and Technology Basic Plan. In discussion on the 3rd Basic Plan, the three ideas in the 2nd Plan were considered appropriate for the 3rd Plan also because they cover the overall science and technology policy. However, these conceptual ideas are not sufficient to justify government R&D investment in various areas and to direct energies toward specific policies. Thus, the 3rd Basic Plan sets forth specific policy goals, which should be targeted by the science and technology policy together with the three ideas.

(Slide 7)

This is the science and technology budget. The budget has been roughly the same for four years in the period of the 3rd Basic Plan, due to the government's difficult financial situation. The proposed budget for fiscal year 2009, which is currently under discussion in the Diet, is 3.55 trillion yen. For the 3rd Basic Plan, 16 trillion yen has been invested for 3 years, corresponding to 64% of 25 trillion yen. This 25 trillion yen figure was estimated assuming GDP nominal growth rate of 3.1%. So, attainment of this target is becoming increasingly difficult.

(Slide 8)

This is the budget ministry by ministry and by organization. The major portion of the total science and technology budget is allocated to MEXT. The MEXT budget is large because it includes funding for the operation of national university corporations.

(Slide 9)

These are the focused policies of the science and technology government investment. You can understand the left side is the basic research. The budget for basic research is about 1.5 trillion yen, and for mission-oriented R&D is 1.7 trillion yen. Basic research is categorized into two types; one is basic research that is conducted based on the original ideas of researchers; another is basic research, which aims at future development of applications based on policies.

(Slide 10)

This is a part of the science and technology indicators summarized by NISTEP. We have distributed the science and technology indicators books outside the room today. Left side, this shows that Japan's total R&D investment for 2006 was 18.5 trillion yen, an increase of 3.5% compared to 2005. This figure represented 3.6% of Japan's GDP. Right side, this shows Japan ranks fourth in the world in terms of numbers of both published science and technology papers and citations. However, the number of citations is relatively small compared to the number of papers. Thus, Japanese scientific papers are not so influential from the international perspective of science.

(Slide 11)

This one is the Science Map series developed by our institute. It's aimed at providing periodic observations of dynamic change in natural science. Using the top-1% highly cited research papers published between 2001 and 2006, these highly cited research papers were clustered in two stages by using co-citation. Science Map 2006 is the latest map, and the numbers on this map denote hot research areas. On this map, blue color indicates 5% Japanese share of papers, while red color represents a share of over 30%. We can understand that there are some hot areas where the Japanese paper share is substantial. On the right side, ID80 is construction of artificial photosynthesis model. Here, the Japanese papers share rises to 80%. And the Japanese share continues to be significant, this ID53 and 58 in the superconductivity. You know, last year, one Japanese scientist, Dr. Hosono, found a superconductive material including iron. On the left side, Japan's share is growing in elementary particles and cosmology and in innate immunity.

(Slide 12)

I would like to explain the research activities of Japanese Nobel Prize winners by using this Science Map. Papers by the three winners in physics were published in the 1960s and 1970s. The research results derived from these three scientists' achievements are marked as hot areas on Science Map 2004. Red circles denote a rapid increase in the number of citations. These two red circles for CP violation in B meson include papers produced in relation to Japan's B Factory, which commenced operation in 1999. Japan proposed the Kobayashi-Maskawa theory, and this B Factory proved the theory. This is definitely one research area in which Japan is leading. As for the Nobel Prize winner in chemistry in GFP, which had been identified by Dr. Shimomura in 1962, was used as a tool to analyze the functions of protein. It was shown as a hot research area on Science Map 2002. These show that it took a long time to become hotly discussed in the science society since the fundamental and basic papers were published in 1960s or 70s.

(Slide 13)

So, this is the B Factory in KEK, Tsukuba. In the B Factory experiment, CP violation was observed at the B meson collapse point. As a result, the Kobayashi-Maskawa theory was proved experimentally. We have invested 38 billion yen in this B Factory. We think we need to continue to invest in large-scale research facilities like this in future in order to promote basic research. Taking into consideration the fact that four Japanese researchers won the Nobel Prize, this year, MEXT has started to discuss the new measures to further promote basic science in Japan. The results will be summarized by July or August this year.

(Slide 14)

I will now show the four priority fields and four promotion fields in the 3rd Basic Plan. The four priority fields are: life science, information and communications, environmental sciences, nanotechnology & materials areas. And four promotion fields are listed here. As compared to the 2nd Plan, the 3rd Basic Plan is characterized by prioritization within each of four priority fields and four promotion fields.

(Slide 15)

CSTP has decided the most important policy issues in fiscal year 2009. Innovative technologies have been decided to start in 2009. Innovative technologies are those in which Japan has world-class ranking and which are expected to have significant positive impacts on both the economy and society. CSTP has already selected 23 technologies. They will receive intensive allocation of funding. CSTP has organized a network of scientists and engineers, and the network has determined sustainable technologies for strategic investment.

Speaking of the low-carbon technology, in the second column, in May 2007, Prime Minister Abe released the long-term strategy Cool Earth 50, which is aimed at halving worldwide emissions of greenhouse gases by 2050. This low-carbon technology plan was formulated to drive the strategy. This plan lays out a new challenge to develop innovative technologies for reducing emissions of carbon dioxide and introducing uptake of those technologies throughout all societies.

(Slide 16)

So, this is a list of 23 innovative technologies. These are the current technologies. CSTP will review them constantly. Total budget is 52 billion yen for 2009. And I would like to show two examples.

(Slide 17)

The first one is a regenerative medical technology with iPS cells, created by Professor Yamanaka of the Kyoto University. MEXT is intensively promoting iPS cells research by establishing a center for iPS cells application and four research centers working toward realization of regenerative treatment and regenerative medicine. They are now producing excellent results day by day; 2.7 billion yen is to be allocated in the 2009 budget.

(Slide 18)

One achievement that has been made by last year is the technology for extracting human skin cells, establishing iPS cells from them, and ultimately producing heart cells successfully. I would like to mention this technology does not use either human embryo or embryonic stem cells.

(Slide 19)

Another example of innovative technologies is the elements strategy project by MEXT. Here I have listed the themes relating to the Elements Strategy Project. The purpose of this project is to develop high-functionality substances and materials without using rare or hazardous elements, by clarifying the formation mechanism of the functions and characteristics of them. In 2007, these seven themes were adopted. I would like to introduce one, which is research development of high-performance magnets.

(Slide 20)

This is a projection of the supply and demand relationship for dysprosium, Dy, which is used in the production of the rare earth magnets. Presently, rare earth magnets are employed in hard discs, industrial motors, and hybrid cars, etc. Given the increasing use of rare earth magnets, it is inevitable that the supply and demand relationship for Dy will tighten. A project aimed at developing new magnetic materials without needing to use heavy rare earth elements, such as Dy, has been underway since 2007. The R&D objective is to produce anisotropic nano-composite magnets based on analysis of the mechanisms involved in magnetic properties.

(Slide 21)

So, this is the key technology of national importance, which is defined in the 3rd Basic Plan as follows. The national government organizes the promotion structures for the technologies. The technologies require long-term and large-scale promotion. The technologies require intensive investment in order to maximize socioeconomic benefits, including national security. CSTP has already chosen five key technologies, listed here, of which a next-generation supercomputer and X-ray free electron laser are now in the planning and developing phase.

(Slide 22)

I would like to show one key technology of national importance: the X-ray free electron laser, XFEL project. Total budget is 35 billion yen over five years. Since the wave length is very short, about the same size as an atom, it will be useful in observing minuscule objects, such as atoms and electrons. Also, since the laser beams have very short pulses, XFEL will make it possible to observe matter using ultra-fast imaging.

(Slide 23)

These are the major science and technology system reform items in the 3rd Basic Plan. It is crucial that we motivate both more young researchers and more female researchers. In Japan's case, female researchers make up only 13% of all researchers. This is the lowest percentage among OECD countries. We plan to double this number. As for the reforms of the university system, there is an urgent need to not only strengthen the research potential through such means as world-class research centers, but also to enhance human resources development by strengthening the graduate university system and providing more financial support to Ph.D. candidates.

(Slide 24)

This is the WPI project. The 3rd Plan aims at establishing 30 world-class research centers. Currently, there are five centers that have been in operation since 2007; a total 7.1 billion yen is invested in them annually. Two of them are centers that focus on materials science; two are dedicated to bioscience, while the fifth, established at Tokyo University, is oriented towards understanding dark matter and dark energy in the universe. For example, Tohoku University consolidates teams of world-class domestic and foreign researchers in materials theory, materials design and manufacturing and practical application respectively. These groups of the researchers have been producing excellent results. These centers are intended to operate over a period of ten years. We expect them to produce world-class research results.

(Slide 25)

Industry-academia-government cooperation has been promoted as a critical issue since the 2nd Basic Plan. We can find a steady increase in the activities of industry-academia cooperation between 2003 and 2006.

(Slide 26)

These are the knowledge clusters in local areas, which have been promoted since the 2nd Basic Plan by MEXT. In the first stage, 18 clusters were established and 15 have already finished their project. In the second stage, 9 clusters were established and are currently active. Recently, as you know, the local economy in Japan is going to have hard time; the unemployment rate is increasing and the job opening ratio is decreasing; we need to boost the local economy driven by the science and technology activities of these clusters.

(Slide 27)

PISA 2006 results show that Japanese students showed less interest in science-related careers compared to those in other OECD countries. By the time they arrive at universities, they are likely to have become math-phobic and science-phobic, despite our strong convictions that many of these students have the potential talents to become outstanding scientists. Japan is going to take the new measures at elementary schools and lower secondary schools under a new course of study. The first point is: Providing more lessons on mathematics that apply knowledge of quantities and numbers to everyday life. Second point is: Providing more lessons based on scientific experiments in order to raise students' interest levels. The education according to this new course of study will commence at some schools from April this year.

(Slide 28)

Our NISTEP has been carrying out the follow-up studies of the 3rd Basic Plan now, by the request of CSTP for making the next Basic Plan. On the basis of the discussions made so far, I think in Japan we should have three future directions to be focused for science and technology. Although there are some other R&D activities, which should be continued, the first point is basic research; second point is development of advanced technology with international competitiveness; third point is contribution to solutions for global problems. By focusing on these areas, we should aim to realize the kind of societies, indicated on the right side. Thank you very much for your attention.

【Hill】 Thank you very much, Mr. Wada. We have time for one or two questions. If anyone in the audience has a question they would like to ask, just put up your hand. We don't have a microphone for you, but it's a fairly small room, so I hope you can be heard.

While you are thinking, let me ask a question.

As reflected in your discussion of the 3rd Basic Plan and the beginning of the conversation for the 4th Basic Plan, Japan has now accumulated approximately 15 years of experience with a kind of broad, comprehensive strategic plan for national investments in science and technology. And this is something many of us in the U.S. have watched very carefully, because we don't do this in America. And I'm wondering if you can say anything about the success of the planning effort. Does it make Japanese science and technology stronger? And if you say yes, how do you know that?

【Wada】 It's a very good question, but a difficult question. We have already made three basic plans, but I think the strategic changes and drastic changes began since the

2nd Basic Plan, because in 2001, CSTP was established; CSTP has controlled all the science and technology on the government side; before that, only CSTP did not have so much power. So, I think from the 2nd Basic Plan we have made a very strategic plan and carried out the strategic plan; for example, doubling of the competitive fund and also the academia-industry cooperation. Something like that was strongly promoted from the 2nd Basic Plan. So we would like to continue that activities for the 4th Plan and also we would add some new directions to the 4th Plan. We are now discussing this internally within the government.

【Hill】 Thank you. Any other questions? We should have time for some questions at the end. So, thank you very much, Mr. Wada.

Recent Developments in S&T Policies After the Lost Decade

Tomoaki Wada
Director General
National Institute of Science & Technology Policy
MEXT, Japan
Feb, 2009

1

Megatrends

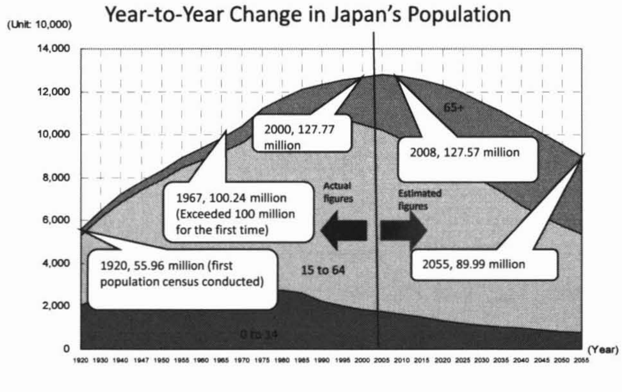
Japan as a highly aged society

	Now		2025
・Population	**128 million**	⇨	**121 million**
・Elder/Young	**1/4**	⇨	**1/2**

※Elder: aged over 65, Young: aged 15-64

Source: National Institute of Population and Social Security Research

Year-to-Year Change in Japan's Population



2

"Promotion of S&T Policies" Statement by Prime Minister Taro Aso

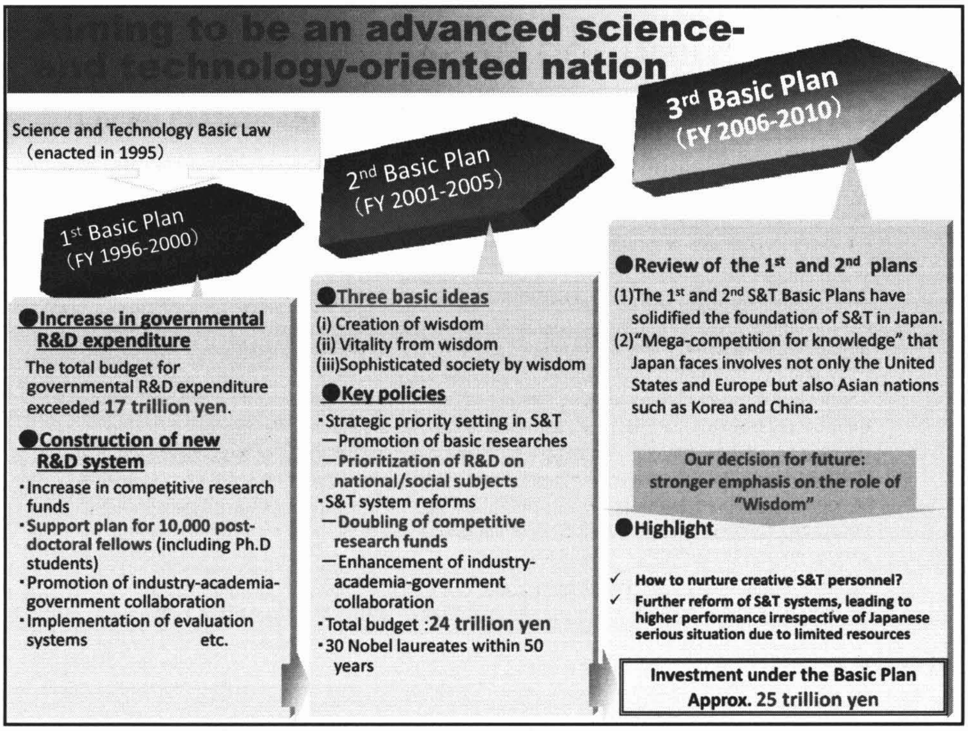
(on Dec. 11, 2008)

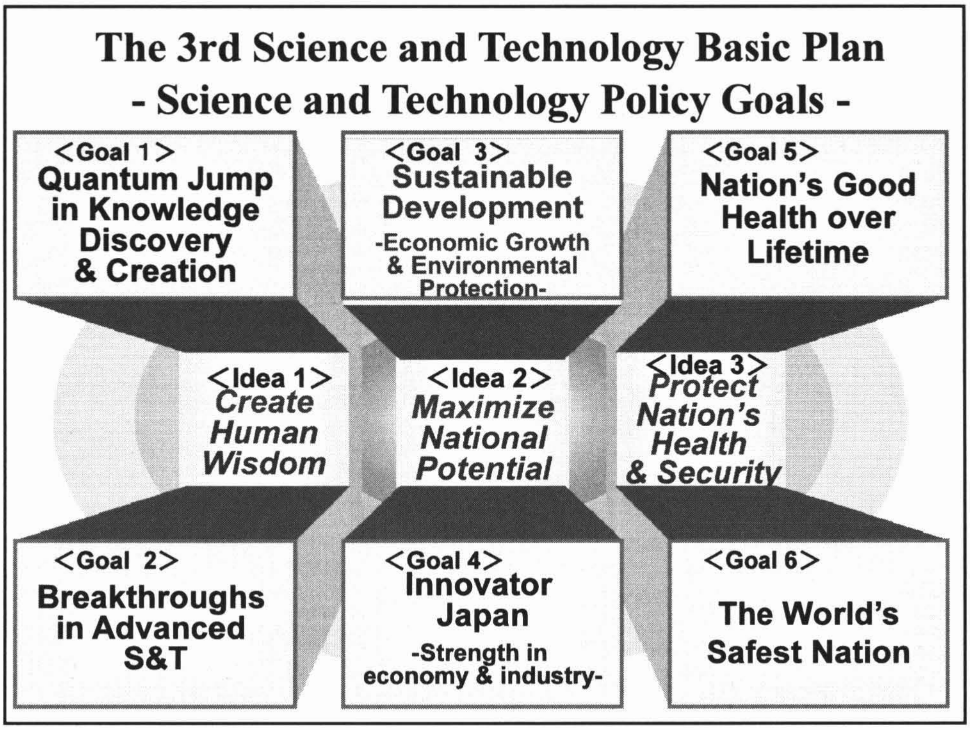
- In 1949 just after World War II, Dr. Hideki Yukawa won the Nobel Prize in Physics, an achievement that gave hope to the Japanese general public. In fact, it was promotion of Japanese science and technology that supported rapid economic development after WWII in Japan.
  We are committed to promoting science technology studies in order to maintain and promote Japanese international competitiveness under the recent circumstances where newly emerging nations have been rapidly gaining their power and the global economy has been affected by a financial crisis.
- It is human resources which support Japanese development. Science and technology derive their power from human resources with original and diverse ideas. We are committed to creating conditions that will help people to develop original research outcomes. We are also committed to establishing a research environment that can attract the world's top scientists to come to Japan. In addition, we are committed to implementing a variety of policies which encourage children to study science and engineering and help these children to develop competency in these fields.
- Advanced research and technologies are Japan's strengths. I will take the initiative in promoting science and technology policies aimed at advancing the strength of Japan.

3

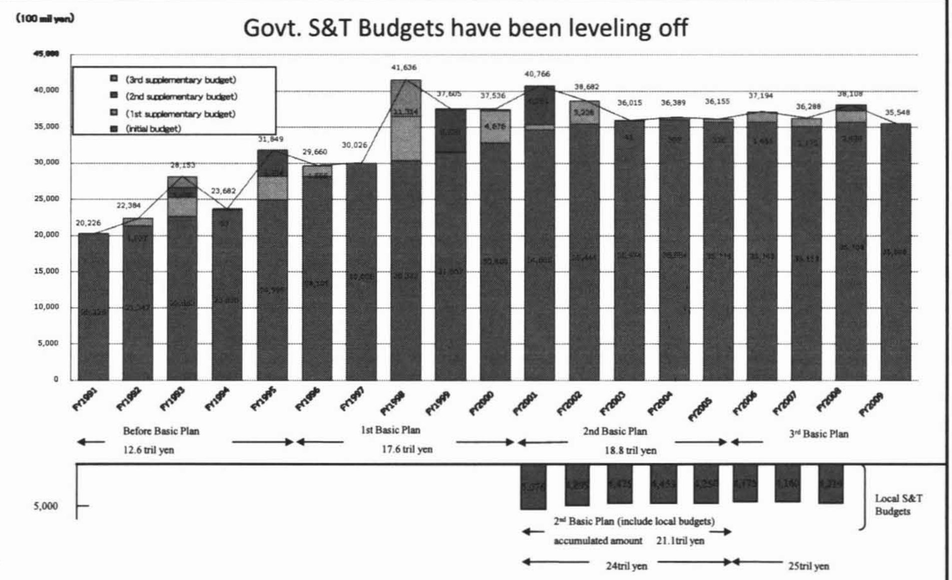
CSTP Members

Chairperson	Mr. Taro ASO	Prime Minister
Cabinet Members	Ms. Seiko NODA	Minister of State for S&T Policy
	Mr. Takeo KAWAMURA	Chief Cabinet Secretary
	Mr. Kunio HATOYAMA	Minister of Internal Affairs and Communications
	Mr. Shoichi NAKAGAWA	Minister of Finance
	Mr. Ryu SHIONOYA	Minster of Education, Culture, Sports, Science and Technology
	Mr. Toshihiro NIKAI	Minister of Economy, Trade and Industry
Executive Members (academia/industry)	Dr. Masuo AIZAWA (Full-time)	Former President, Tokyo Institute of Technology
	Dr. Tasuku HONJO (Full-time)	Visiting Professor, Kyoto University
	Dr. Naoki OKUMURA (Full-time)	Former Representative Director and Executive Vice President, Nippon Steel Corporation
	Dr. Takashi SHIRAISHI	Vice President and Professor, National Graduate Institute for Policy Studies
	Mr. Sadayuki SAKAKIBARA	President, Toray Industries, Inc.
	Dr. Yoko ISHIKURA	Professor, Graduate School of International Corporate Strategy, Hitotsubashi University
	Dr. Toyoko IMAE	Professor, Keio Advanced Research Centers, Keio University
Science Council	Dr. Ichiro KANAZAWA	President of Science Council of Japan


to be an advanced science-
technology-oriented nation
Science and Technology Basic Law (enacted in 1995)
1st Basic Plan (FY 1996-2000)
2nd Basic Plan (FY 2001-2005)
3rd Basic Plan (FY 2006-2010)
●Increase in governmental R&D expenditure
The total budget for governmental R&D expenditure exceeded 17 trillion yen.
●Construction of new R&D system
・Increase in competitive research funds
・Support plan for 10,000 post-doctoral fellows (including Ph.D students)
・Promotion of industry-academia-government collaboration
・Implementation of evaluation systems etc.
●Three basic ideas
(i) Creation of wisdom
(ii) Vitality from wisdom
(iii)Sophisticated society by wisdom
●Key policies
・Strategic priority setting in S&T
—Promotion of basic researches
—Prioritization of R&D on national/social subjects
・S&T system reforms
—Doubling of competitive research funds
—Enhancement of industry-academia-government collaboration
・Total budget :24 trillion yen
・30 Nobel laureates within 50 years
●Review of the 1st and 2nd plans
(1)The 1st and 2nd S&T Basic Plans have solidified the foundation of S&T in Japan.
(2)"Mega-competition for knowledge" that Japan faces involves not only the United States and Europe but also Asian nations such as Korea and China.
Our decision for future: stronger emphasis on the role of "Wisdom"
●Highlight
✓ How to nurture creative S&T personnel?
✓ Further reform of S&T systems, leading to higher performance irrespective of Japanese serious situation due to limited resources
Investment under the Basic Plan Approx. 25 trillion yen


The 3rd Science and Technology Basic Plan
- Science and Technology Policy Goals -
<Goal 1> Quantum Jump in Knowledge Discovery & Creation
<Goal 3> Sustainable Development -Economic Growth & Environmental Protection-
<Goal 5> Nation's Good Health over Lifetime
<Idea 1> Create Human Wisdom
<Idea 2> Maximize National Potential
<Idea 3> Protect Nation's Health & Security
<Goal 2> Breakthroughs in Advanced S&T
<Goal 4> Innovator Japan -Strength in economy & industry-
<Goal 6> The World's Safest Nation

Trend of Japanese S&T Budget



・Local S&T Budgets is included since FY2001

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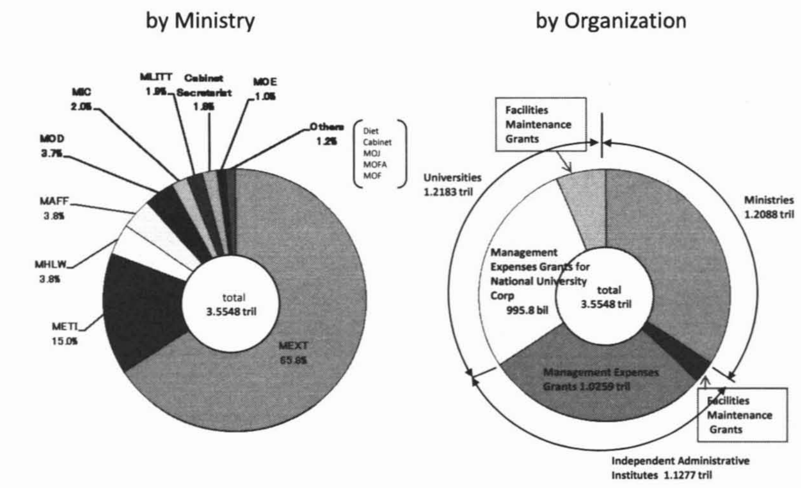
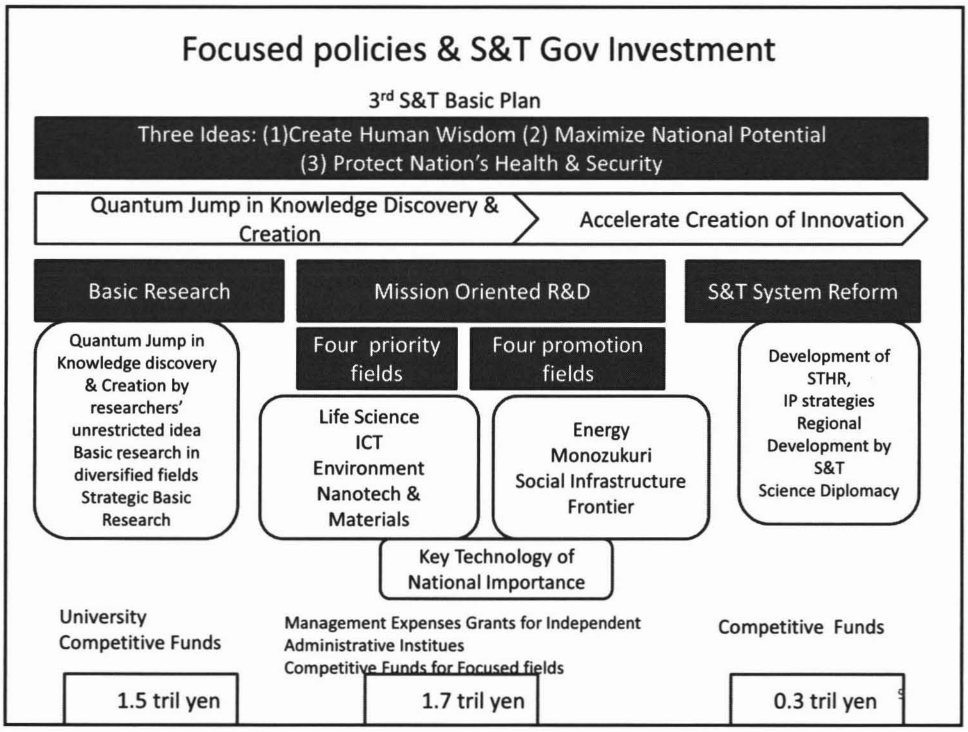
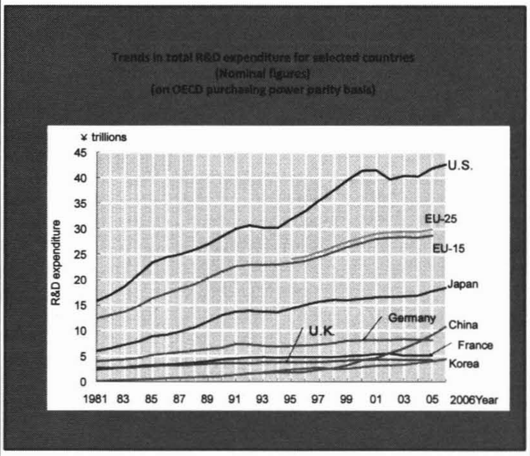
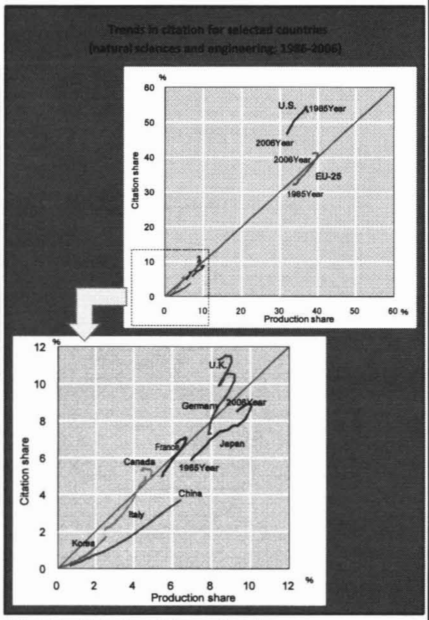
Science & Technology Budget for FY2009



NOTE: compiled by Cabinet Office based on data sumitted by each related ministry. The figures are initial figures subjected to change due to future re-examination. The figures for Special Account for Social Capital Improvement are excluded.







Notes: 1) The data do not include the social sciences and humanities.
2) A five-year-window has been used for the values in the respective years to ensure a comparison of citation data on the same basis.
3) Papers published by authors from different countries have been double-counted according to each author's national affiliation.

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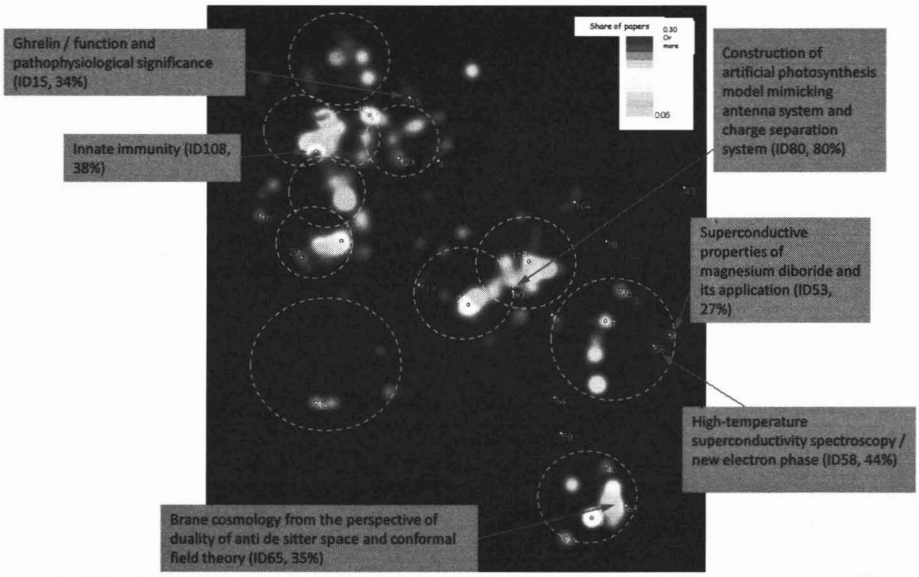
Science Map 2006
Depicting the scientific activity of Japan



Note: Whole count method is applied for calculation of paper share. Blue indicates 5% of paper share, and red means more than 30% of paper share.
Source: Compiled by NISTEP based on "Essential Science Indicators" published by Thomson Scientific.

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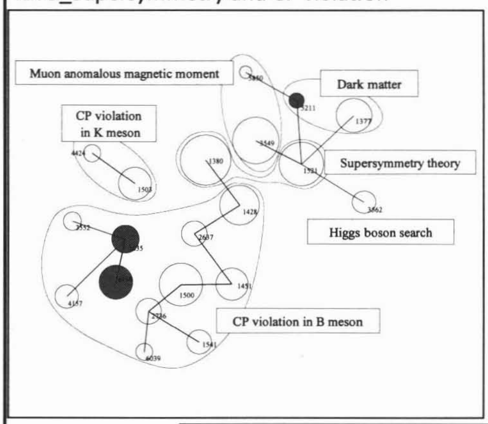
The 2008 Nobel Prize in Physics and Chemistry

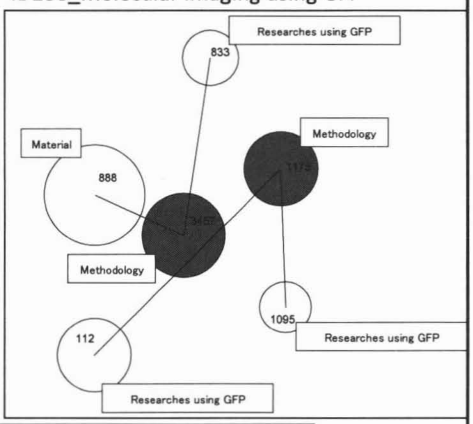
Science Map 2004 (1999-2004)

ID79_Supersymmetry and CP violation



Science Map 2002 (1997-2002)

ID106_Molecular imaging using GFP



- Each circle: Single RF
  - Red circles: Hot RFs
  - Yellow circles: New RFs (emerged in 2002)
  - Radius: Number of citing papers
- The relative locations of circles reflect how strongly they are linked to one another (Only the strongest are shown)

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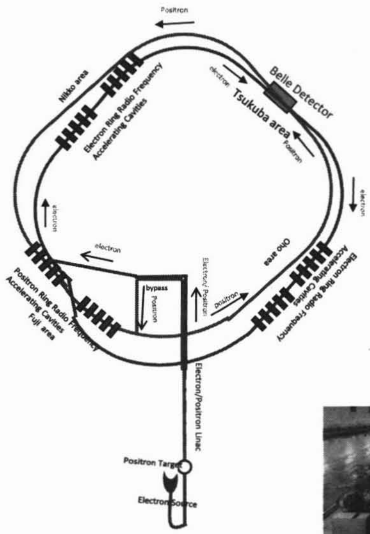
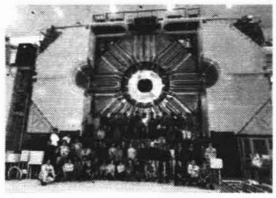


B Factory

B Factory is an electron-positron collider. The KEK B factory experiment (Belle) was initiated in 1999. Using a large data sample that corresponds to an integrated luminosity of ~0.8 ab^{-1} or 900 million B anti-B meson pairs, which is the highest value in the world, the Belle experiment has verified the Kobayashi-Maskawa theory that explains CP violation and quark mixing in the weak interaction. This research eventually led to a Nobel prize for Kobayashi and Maskawa in 2008.



4 priority fields and 4 promotion fields under the 3rd Basic Plan

*The 2nd Basic Plan emphasized R&D on 4 priority fields and **4 promotion fields.** The 3rd Basic Plan Intends to allocate resources preferentially to those fields based on the following requirements of infra-sectoral prioritization*

1) The level of contribution to the 3 Ideas (relating to S&T, economy and society).
2) People's expectations and interests are high according to the results of awareness surveys
3) Trends of S&T strategies in other countries are taken into account
4) Must be appropriate from practical perspectives, such as continuity of strategy and adoption by research site

- 1) Life Sciences
- 2) Information and Communications
- 3) Environmental Sciences
- 4) Nanotechnology/Materials
- 5) Energy
- 6) MONOZUKURI (manufacturing) technology
- 7) Social Infrastructure
- 8) Frontier

Major R&D Themes

3) Environmental Sciences →

- Climate change
- Hydro-logical cycles and solute transport in watersheds
- Ecosystem management
- Chemical risk and safety management
- "3R"(reduce, reuse, recycle) technologies
- Biomass utilization technologies

7) Social Infrastructure →

- Technologies to monitor and manage national land and mitigates disasters
- New technologies to support activities at disaster sites
- Technologies for rebuilding infrastructure and urban areas
- New technologies for traffic and transport systems to make a major rehabilitation of the aging infrastructure and to respond to a society in which there are fewer children and more elderly people

Prioritization of the most important policy issues

S&T related budget allocation policy for FY2009

O Innovative Technologies(23 technologies) (Y52.3 bil)

-World-leading technologies

-Technologies with the prospect of having significant positive impacts on the economy and society

OLow-carbon Technology (Y164.0 bil)

-By realizing an international low carbon society, we will achieve 1)Energy securities, 2)Harmonization of the environment and economy 3)Contrinbution to developing countries

OScience and Technology Diplomacy (Y46.7 bil)

-Advanced cooperation between S&T and diplomacy and focus on S&T diplomacy to produce "Synergy" in the future

ORegional Empowerment through Science and Technology (Y69.3 bil)

-Promotion of S&T in regions contributes to building regional innovation systems and creating vital regions

OThe Pioneering Projects for Accelerating Social Return (Y19.5 bil)

-Acceleration of the selected projects by CSTP based on the collaboration of the public and private sectors within 5 years

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Innovative Technology

Total budget for FY2009: 52.3 bil yen

- All Optical Networking Technology
- Spintronics Technology
- 3-Dimensional Semiconductor Technology
- Carbon Nanotube Technology (Capacitor Development)
- Integrated MEMS Technology (Micro Electro-Mechanical System)
- 3-Dimensional Image Technology
- Highly Reliable/Productive Software Development Technology
- Highly Efficiency Photovoltaic Power Generation Technology
- Hydrogen Energy System Technology
- Life Support Robot Technology
- Self-Support Technology for Elderly /Handicapped People (Brain Machine Interface)
- Low Invasive Medical Device Technology (Build-in Touch Sensor Endoscopes)
- Heart Function Prosthetic Device Technology
- iPS Cell Regeneration Medical Technology →→→→→→ →→→→→→ **Example 1**
- Toxicological Evaluation Technology using iPS Cells
- Vaccine Development Technology for Infectious Disease (Malaria)
- Noncontact Visualizing Analysis Technology (Terahertz)
- Environmental Technology /High Yielding Technology for Chief Crop (wheat and soybeans)
- Complete Cultured Technology for Wide-Area Migratory Fish (Eel and Tuna)
- Rare Metals – Alternative Materials/Recovery Technologies →→→→→→ →→→→→→ **Example 2**
- Production Technology by Using Genetic Recombination Microbial (Energy/Chemical Engineering Material)
- New Catalyst Chemical Manufacturing Process Technology (Underwater Function Catalyst)
- New Superconducting Materials Technology (Superconductors incorporating Magnetic Element etc)

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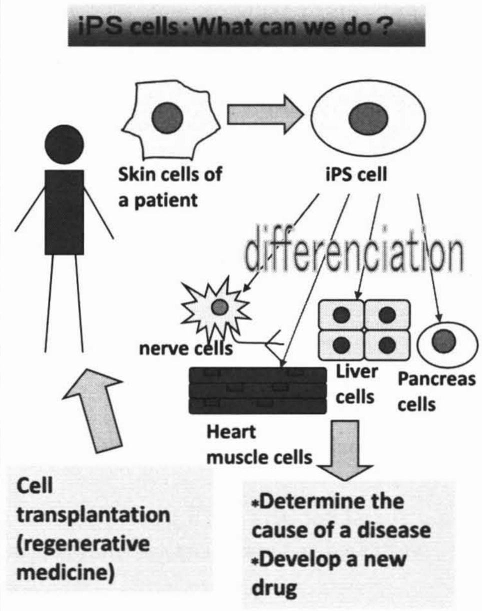


Achievements of Prof. Shinya Yamanaka (Kyoto University)

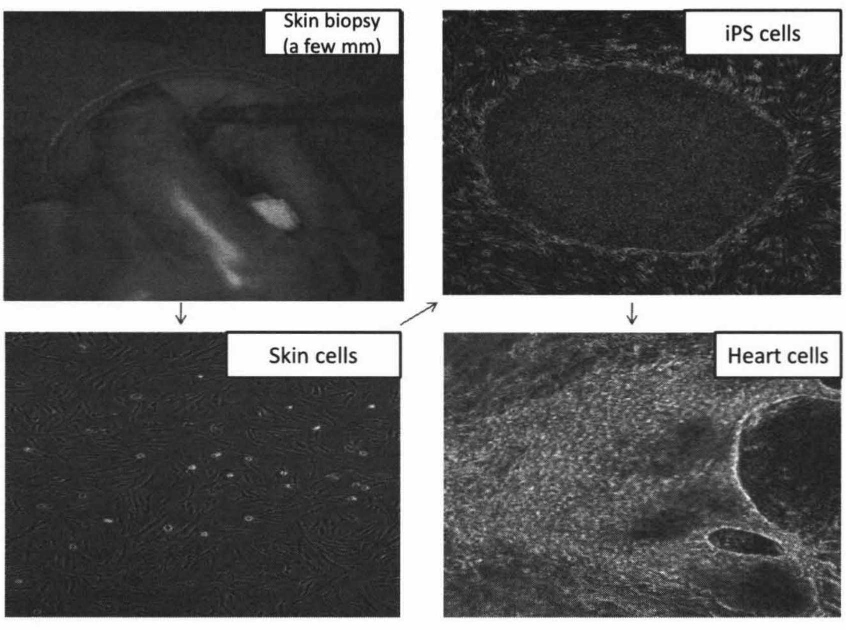
Achievements
- ✓Nov. 2007: derived world first human iPS cells
- ✓Aug. 2006: derived world first mouse iPS cells

Method
- ✓by introducing 4 genes

Applications
- ✓regenerative medicine (cell transplantation)
- ✓effectiveness of a new drug & identify causes of diseases

Japanese initiatives for iPS
➔ "accelerate iPS research nationwide "
- ✓Set up "Center for iPS Cell Research and Application (CiRA)"
- ✓MEXT: launches Project for Realization of Regenerative Medicine
- ✓Designated 4 iPS research bases (Kyoto University, Keio University, Tokyo University, RIKEN)
- ✓Ministry of Health, Labour and Welfare to establish guidelines and criteria for iPS studies

iPS cells successfully derived from human skin cells



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Elements Strategy Project urged by MEXT (FY2007- 2011)

The purpose of this project is to develop high-functionality substances and materials, without using rare or hazardous elements, by clarifying the formation mechanism of the functions and characteristics of substances and materials. **Budget ¥688M (FY2009)**

Themes adopted in FY2007	Representative organizations
Development of steel plate surface treatment by molten Al alloy plating in place of zinc	Tokyo Institute of Technology
Development of next-generation nonvolatile memory using aluminum anodized film	National Institute for Material Science
New hydrogen-induced function in subnano-lattice materials	Tohoku University
New excavation of nanoparticle self-generating catalysts aimed at eliminating precious metals from catalysts	Japan Atomic Energy Agency
Creation of barium-based new giant-piezoelectric-effect materials for developing piezoelectric frontirers.	Yamanashi University
Development of TiO_2 -based transparent electrode materials as a substitute for ITO	Kanagawa Academy of Science and Technology
Development of high-performance anisotropic nanocomposite magnets with low rare element composition	Hitachi Metals Ltd.

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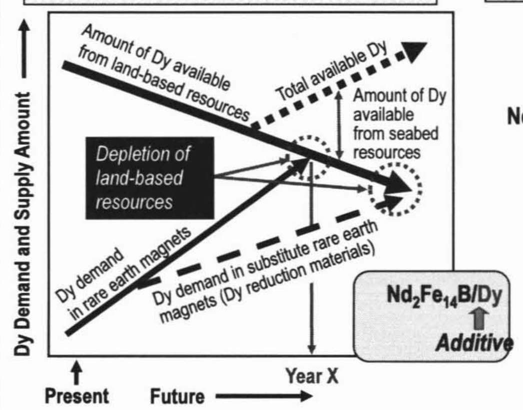
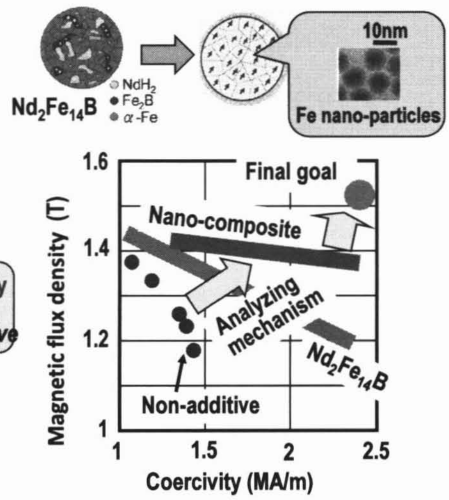
Development of High-performance Nano-composite Magnets without a Rare Earth Element such as Dy

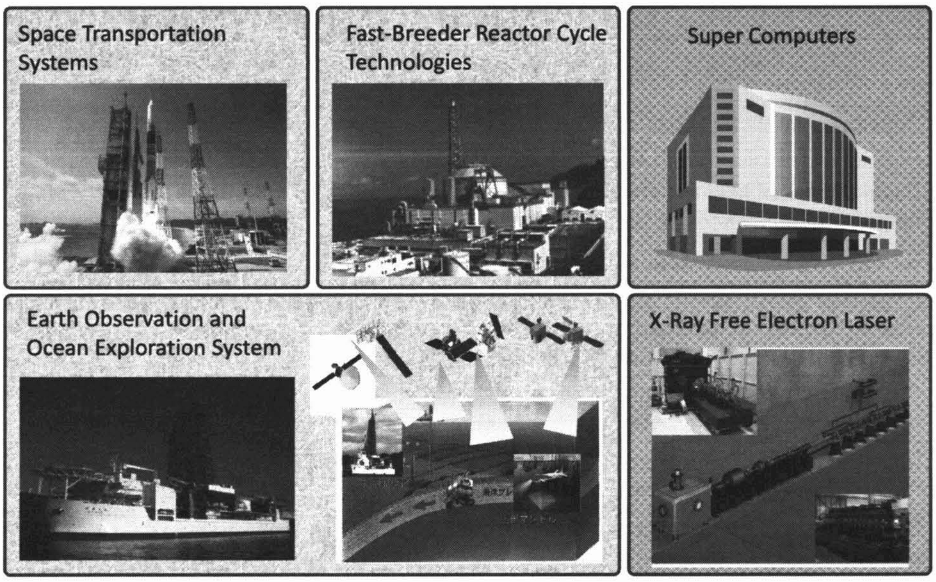
Anticipated view for the supply and demand relationship of Dysprosium (Dy) in a rare earth magnet



Development of magnets by analyzing the mechanism on anisotropic high coercivity and high magnetic flux density

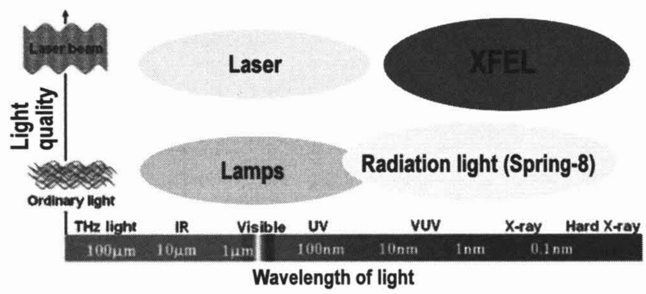


Five Key Technologies of National Importance



Development of XFEL

X-ray Free Electron Laser (XFEL) is an X-ray combining the features of lasers at the free electron state, and the dream light source that has both laser and radiation light characteristics. It may be the most promising light source for the next generation of scientific exploration and discovery. Total budget ¥35,500M (FY2006 - 2010)



Short wavelength
⇒Can be used to observe very small objects

Laser beams have very short pulses
⇒Can be used to observe ultra-fast imaging

22

S&T Systems reforms

- **Encourage young researchers.**
- **Expand opportunities for female researchers.**
  (Setting a target of 25 % share)
- **Attract foreign researchers to Japan.**

- **Further reform of university system for ensuring greater competitiveness**
  - Produce 30 world-class research centers of excellence
- **Enhance industry-academia-government collaboration**

World Premier International Research Center (WPI) Initiative

Implementing World Premier International Research Center

Background

In order to enhance the level of science and technology in Japan and continuously trigger innovation that serves as a catalyst for future growth, it is necessary to boost the nation's basic research capabilities. To this end, Japan needs to create centers where the world's finest minds meet and superb human resources flourish, thereby generating outstanding research results.

Outlines

Aimed at establishing " globally visible research centers" with excellent research environment that attract the world's top researchers.

○Topics
Interdisciplinary field of basic research
○5 centers were selected in FY2007
Period: 10～15 years (evaluated every 5 yrs)
Funds : Y500 mil -2 bil, average 1.4 bil yen
○Attractive research environment of top international standard
・Director with strong leadership
・Rigorous evaluation system & rewards based on the evaluation results
・English as the primary language for work
○Excellent research level
・Establish critical mass of outstanding researchers

Kyoto University
Institute for Integrated Cell-Material Sciences (iCeMS)

Tohoku University
Advanced Institute for Materials Research **(AIMR)**

NIMS
International Center for Materials Nanoarchitectonics (MANA)

Tokyo University
The Institute for the Physics and Mathematics of the Universe (IPMU)

Osaka University
Immunology Frontier Research Center (IFReC)

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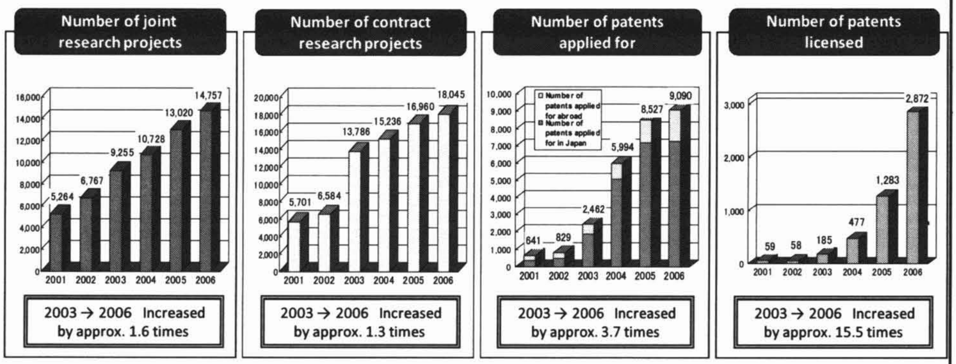
Joint research projects, contract research and patent application at Universities



* Universities: Inter-university research institutes, junior colleges, and national colleges of technology are included.
* The number of patents licensed includes only patent rights (including rights to obtain). The data includes the number of patents licensed and the number of patents transferred. * The figures for 2001 and 2002 include national universities only. The figures for 2003 and after include national, public, and private universities.

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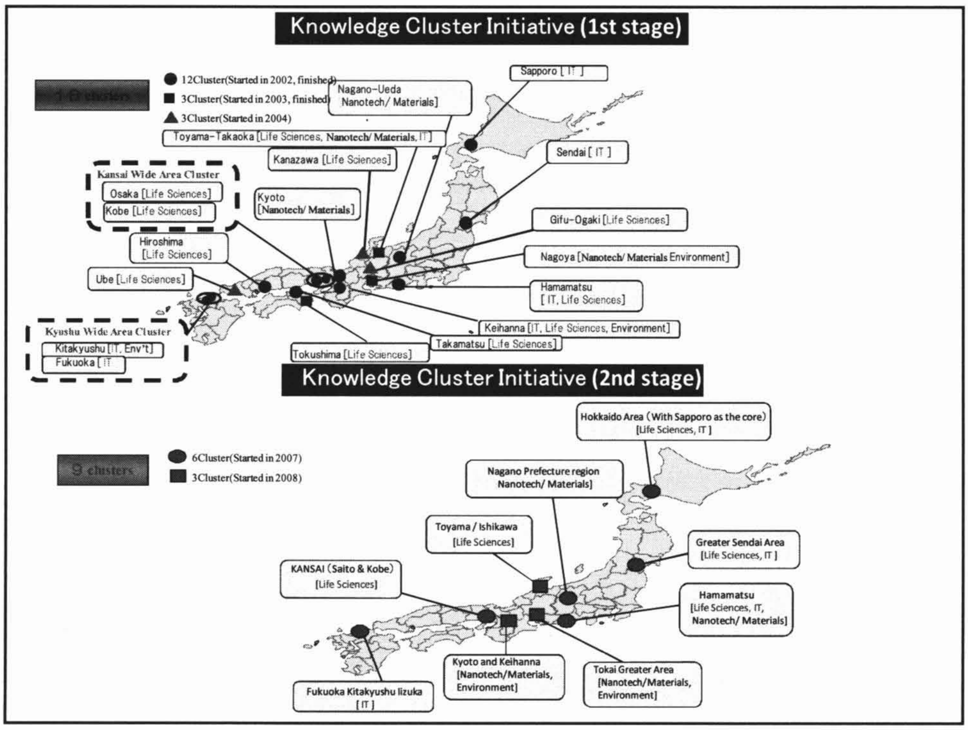

PISA 2006 Results

(The Programme for International Student Assessment by OECD)

Index of general interest in science

Percentage of students reporting high or medium interest in the following	Japan(%)	OECD(%) average
Human Biology	65	68
Topics in Astronomy	55	53
Topics in Chemistry	48	50
Topics in Physics	40	49
The Biology of Plants	58	47
Ways Scientists Design Experiments	34	46
Topics in Geology	33	41
What is Required for Scientific Explanations	25	36

Index of Enjoyment of Science

Percentage of students agreeing or strongly agreeing with the following statements	Japan(%)	OECD(%) average
I enjoy acquiring new knowledge in science	58	67
I generally have fun when I am learning scientific topics	51	63
I am interested in learning about science	50	63
I like reading about science	36	50
I am happy doing science problems	29	43

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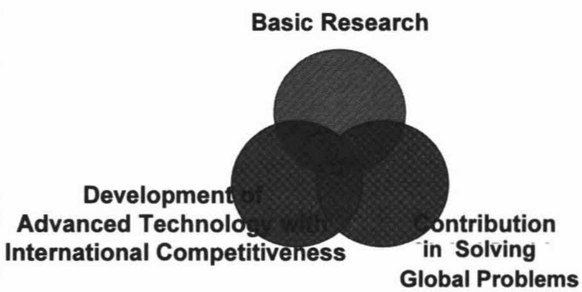
Direction of Japanese S&T for the next S&T Basic Plan

☆Focused Areas



☆Societies to be realized

- Low carbon society, new energy system society
- Advanced Medical system
- Advanced system for education and human resource development
- Contribution for global problems such as global warming & infectious diseases
- Maintaining R&D Japanese capability under economic recession
- S&T collaboration structure in Asia

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Speaker: Dr. June Seung Lee,
President, KISTEP
"Korea's Science and Technology Policy"

【Hill】 Now, we hear from another country. I'm pleased to welcome Dr. June Seung Lee, who is president of the Korean Institute of Science and Technology Evaluation and Planning, known as KISTEP in Korea. He has many important positions in Korean science, providing leadership through the National Science and Technology Council of Korea, the board of directors of the Korea Federation of Science and Technology Societies, and many other important roles, too many to discuss now. So, please, Dr. Lee.

【Lee】 Thank you very much for offering a good introduction for me.

Good afternoon, ladies and gentlemen. I'm very grateful to have such a good opportunity to talk with you, but I'm very worried that it may be an uninteresting presentation right now, and also I do not have such exciting information. But I will try my best.

(Slide 2)

Today, I will give you a presentation on the Korea's science and technology policy. I will start with the history of science and technology development in Korea, then the challenges that we are now coping with, and finally, the new national R&D strategy and policy to transform from the catch-up growth model to an innovation-led growth model.

(Slide 3)

Firstly, we are going to take a look at science and technology development in Korea.

(Slide 4)

Korea's science and technology policy trends have been changing from industry-oriented policy to a high-technology-oriented policy. In the 1960s and 1970s, Korea started building R&D infrastructure, Ministry of Science and Technology, Daedeok Science Town, and many other government-funded research institutes were established during this time. In terms of industry, primary goods and light industry goods took the most part of the industry, and R&D was focused on these sectors. In the 1980s and 1990s, Korea concentrated on the quantitative growth of R&D. We enforced major national R&D programs and promoted university-based research. The focus of the industry had transformed from heavy industry, such as automobiles and shipbuilding and the electronic industry, to such as mobile phone and display industries. In the 1990s and since 2000, we have been more focusing on the qualitative growth of R&D based on technology innovation. We have been increasing the efficiency of R&D investment and planning a national roadmap for science and technology. We have been making various efforts to create a next-generation growth engine. Growth in electronics, communications and Internet are the major outcomes during this period.

(Slide 5)

This graph shows the major outcomes. Total R&D investment has increased from US$4 million in 1963 to US$33.7 million in 2007, taking seventh place in the world. The percentage of R&D investment in GDP has also increased by 3.47%. The total number of researchers increased from 3,000 to 300,000 in the same period. Korea ranked 4th in terms of numbers of U.S. patents and 12th in terms of number of SCI theses. The industrial technology level reached 76.8% compared to that of the world's best.

(Slide 6)

R&D has led to key national industry developments in the initial stage of industrialization. The government invested so aggressively in R&D that shipbuilding, semiconductor and mobile phone industries are currently the leading groups in the world.

(Slide 7)

Based on these achievements so far, now I will talk about the challenges that we are currently facing and what we should do about them.

(Slide 8)

Knowledge-based economy and innovation-led growth are a worldwide trend. The percentage of technology innovation that contributes to the economic growth rose from 20.8% in 1970s to 41.5% in 2000s. Technology innovation is now a new growth engine, which will overtake the limit of the catch-up strategy.

(Slide 9)

We have four strategies to cope with the challenges of technology innovation. Firstly is to increase the efficiency of R&D investments. In case of a 1% increase of R&D investments, Korea's economic growth is 0.37%, while developed country's economic growth is 0.52%. Korea also falls behind the U.S. in terms of contribution of TFP, Total Factor Productivity and R&D to GDP growth.

(Slide 10)

The second strategy is to readjust the portfolio of national R&D investments. We should increase investment in basic research and university research and increase investments in future growth engine-related R&D, which is now concentrated on IT. And also we need to make more investments to strengthen local R&D, which is currently focused on the national capital region (City of Seoul) and Daejeon city.

(Slide 11)

The next strategy is to nurture human resources. We are short of high-quality manpower. According to the research results of KISTEP, we are expecting a shortage of 4,500 Ph.D.'s in 2015. We are also going through a serious brain drain problem. Korean researchers tend to leave their country more than researchers in U.S, Iceland or Japan. We should foster creative core manpower and nurture R&D-oriented universities through selection and concentration. We should also strengthen the networking of researchers to create a brain circulation.

(Slide 12)

Finally, we should focus on globalization of science and technology. Among the diverse factors that constitute technology innovation, level of science and technology globalization is the lowest among OECD countries. It's very shameful.

(Slide 13)

Based on these four strategies, Korea has developed a new science and technology strategy and policy.

(Slide 14)

The four major directions of new science and technology strategy and policy are: efficient allocation and utilization of R&D resources; second, strengthening of innovation capabilities; third, collaboration among the industry, academia and GRIs; fourth, openness. Based on these directions, we are trying to make a transition from imitation and closed mode to innovation and open and network mode.

(Slide 15)

Let me introduce the up-to-date action plan, which is the new science and technology policy of President Lee Myung Bak's administration. It's a so-called 577 Initiative.

(Slide 16)

This slide shows the framework of the 577 Initiative. The plan is to invest 5% of GDP in R&D and nurture seven major core areas and ultimately to become one of the seven major science and technology powers in the world.

(Slide 17)

The seven major areas of the 577 Initiative are as follows: key industrial technologies; emerging industrial technologies; knowledge-based service and technologies; state-led technologies; national issues-related technologies; global issues-related technologies; and basic and convergent technologies.

(Slide 19)

Another goal of the 577 Initiative is to advance the seven major science and technology systems as shown in this slide.

(Slide 20)

This index describes the goals that we are trying to achieve by the 577 Initiative; for example, No. 5 in scientific and technological competitiveness of IMD (International Institute for Management Development) and also No. 12 in frequency of thesis being quoted. We aim to grow in both quantity and quality.

(Slide 21)

Korea is now planning to create a new paradigm, the Green Growth Model, based on science and technology innovation, efficiency improvements and based on the future growth engine and basic research. We are pursuing a sustainable Green Growth Model.

Thank you very much.

【Hill】 Thank you. Let me ask again if we have any questions from the audience. If we do have some questions and statements from the floor, I may restate them because we don't have a mike back there for you. Yes, Sir.

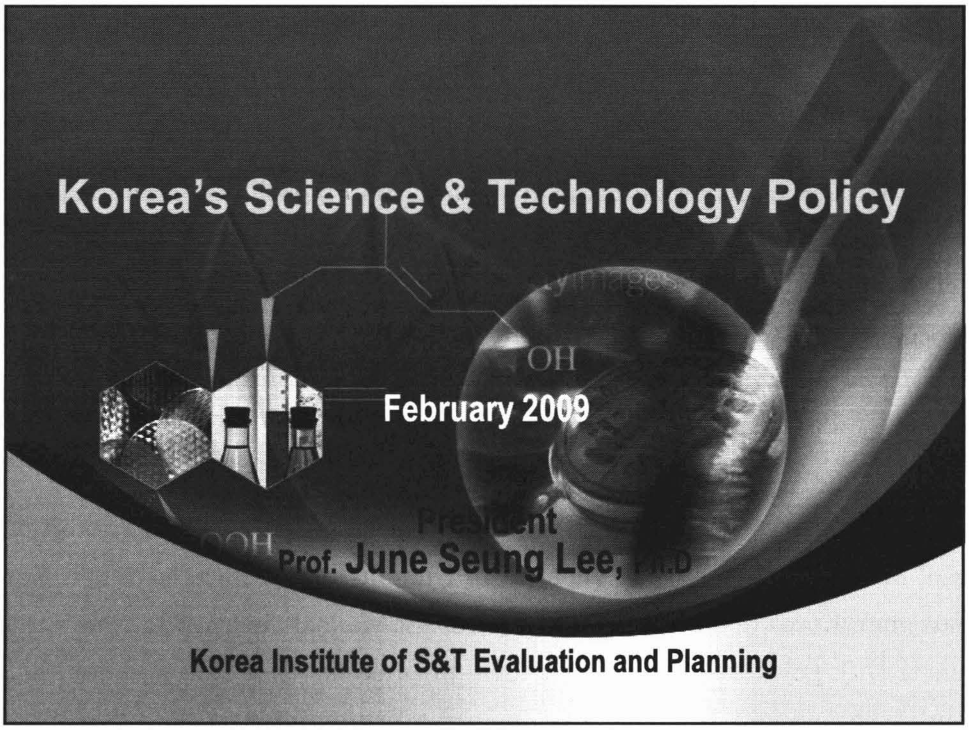
【Question】 (re-stated by Prof. Hill) You commented on the goal of 4,500 new Ph.D. researchers in the face of a community that already has some 26,000 in the community now. Isn't this ambitious ?

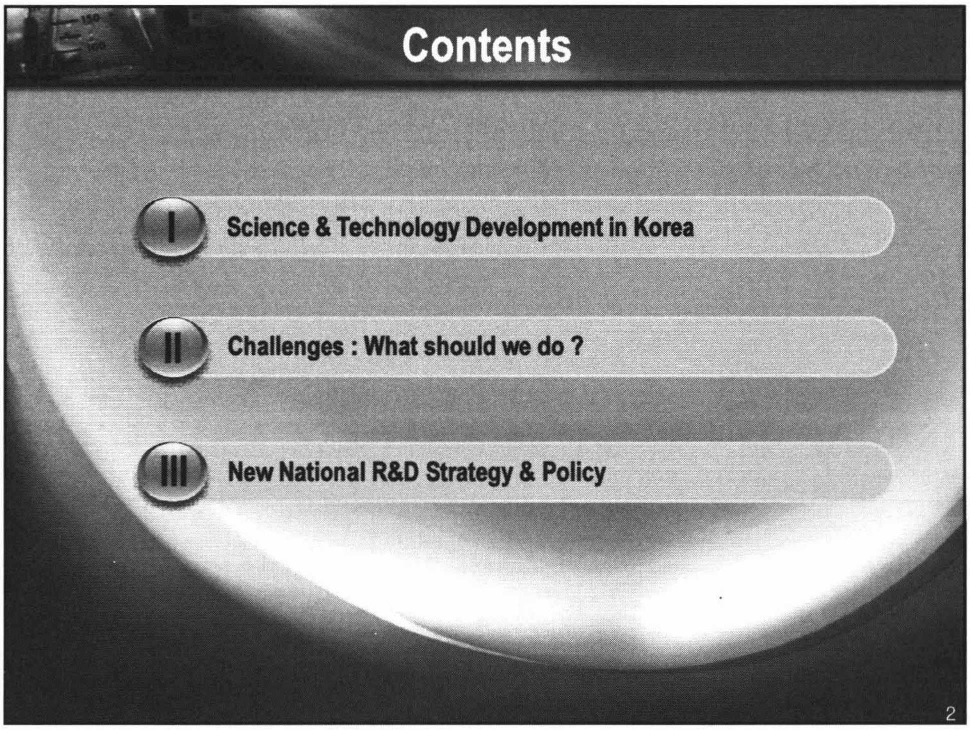
【Lee】 It's really ambitious, yes.

【Question(Okuwada)】 I'm also interested and surprised to see your rapid increase of the Ph.D.'s or graduate school students, but please explain the effect for industry or merits and demerits of the rapid increase of Ph.D.'s and graduate school students?

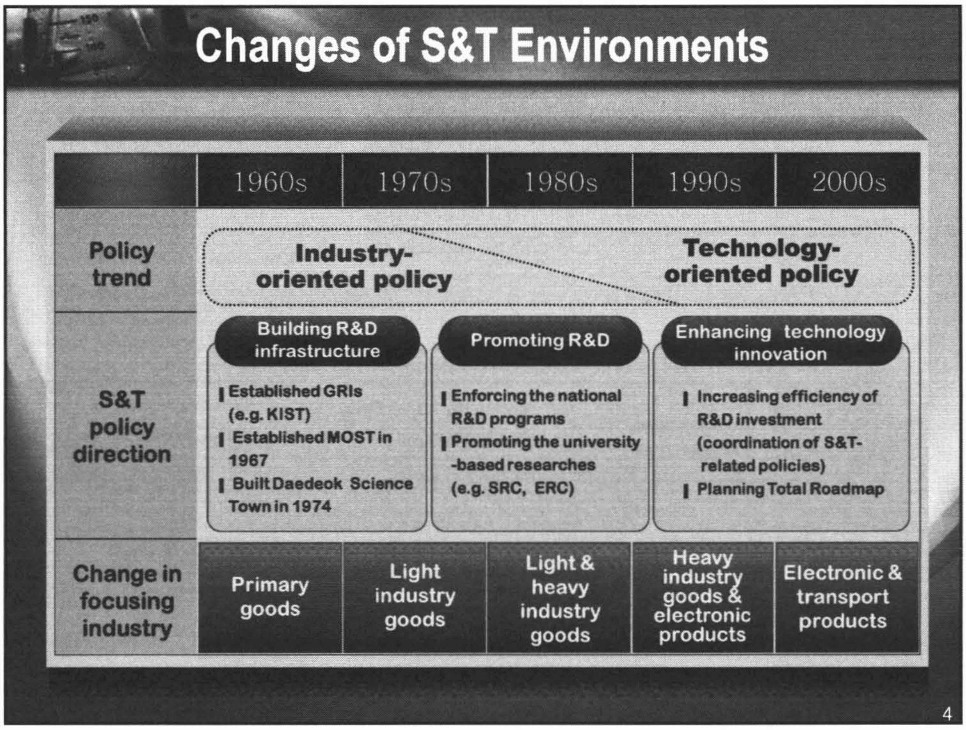
【Lee】 I'm sorry, it's very difficult to explain. As I mentioned to you before that we will have a shortage of Ph.D. researchers in near future. At this moment, we do not have intensive programs. However, we have to be ready for brain drain problem. Therefore, we are focusing on some of our new (initiative) programs and investing big money from this year, for example, the Worldwide Class University (WCU) and we also intend to produce as much Ph.D.'s as possible.

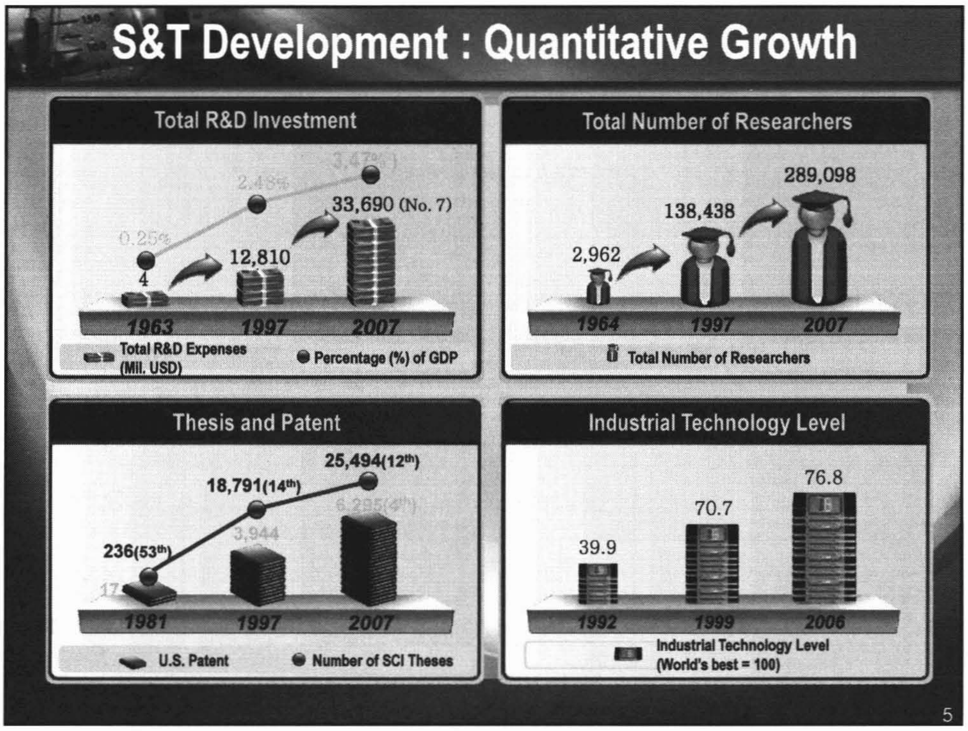
【Hill】 Thank you very much, Dr. Lee. You have stated some very ambitious goals for Korea, and the only thing we should say from our experience is: When Korea sets ambitious goal, Korea achieves ambitious goals. So we look forward to your success, but also from a U.S. point of view, we're a little bit anxious that Korea should become so successful. It looks like a very strong competitive situation for us.

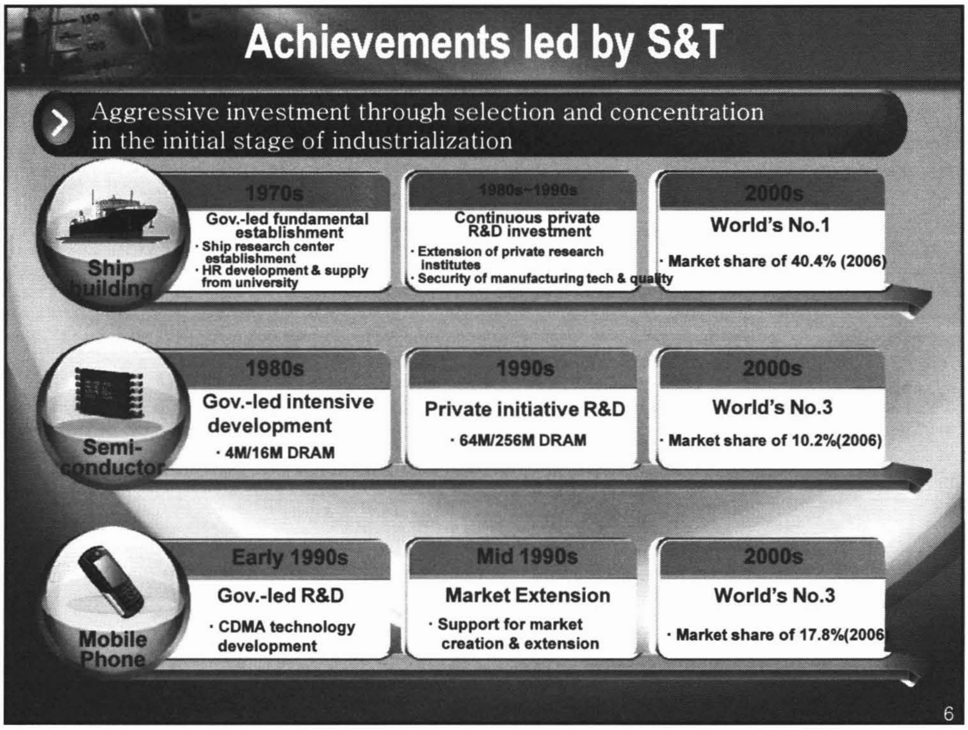

Korea's Science & Technology Policy
February 2009
President
Prof. June Seung Lee,
Korea Institute of S&T Evaluation and Planning

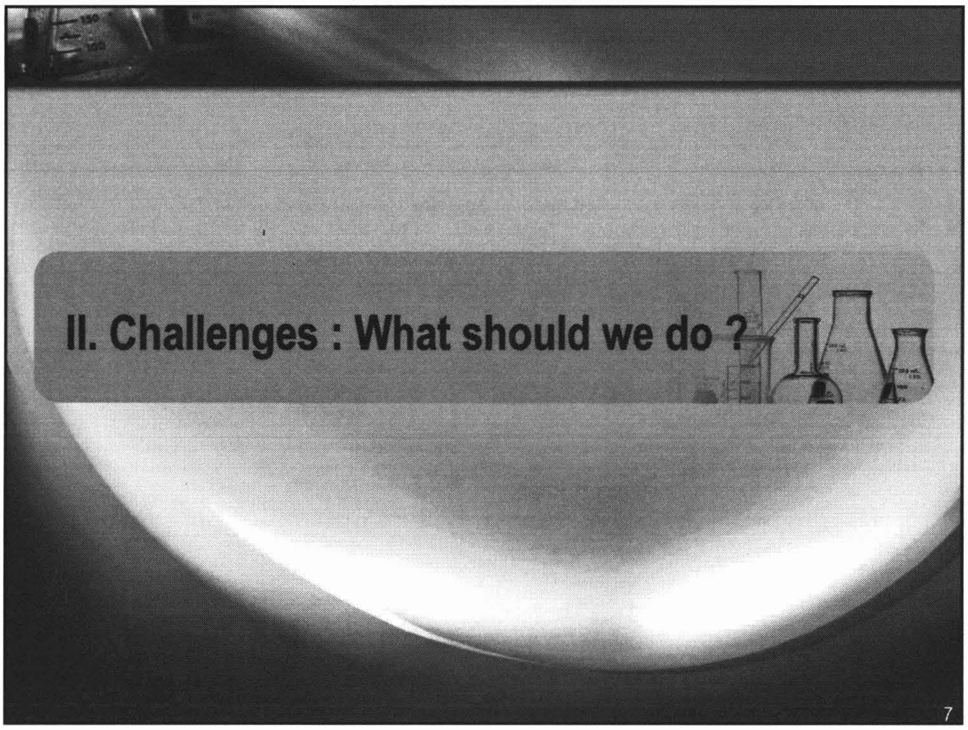

Contents
I Science & Technology Development in Korea
II Challenges : What should we do ?
III New National R&D Strategy & Policy
2

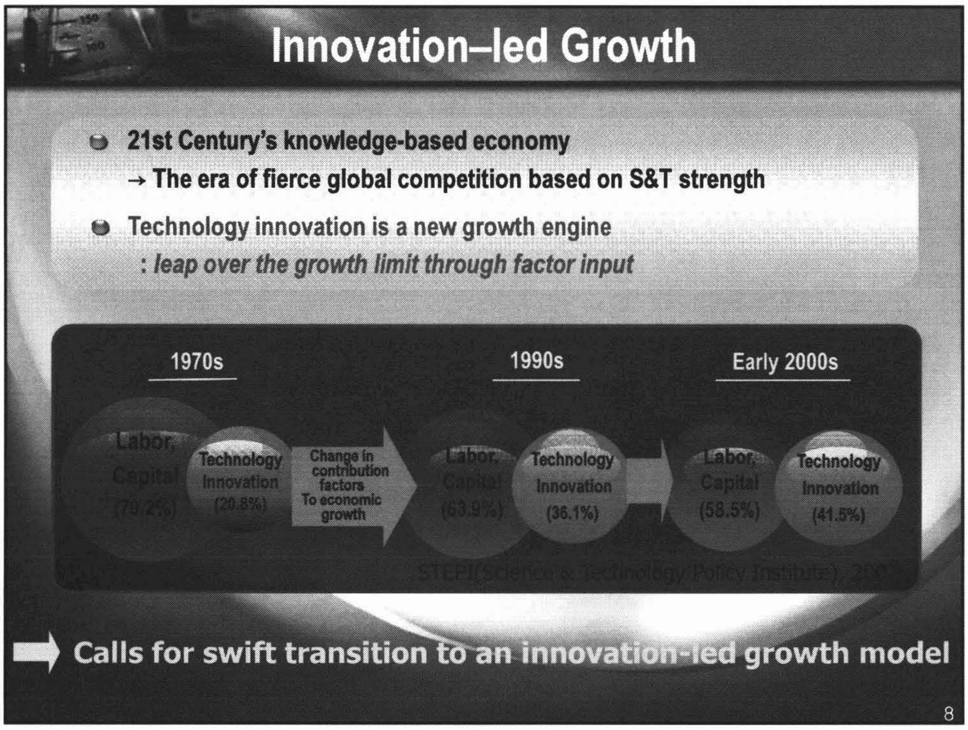

I. Science & Technology Development in Korea
3


Changes of S&T Environments
1960s
1970s
1980s
1990s
2000s
Policy trend
Industry-oriented policy
Technology-oriented policy
S&T policy direction
Building R&D infrastructure
Established GRIs (e.g. KIST)
Established MOST in 1967
Built Daedeok Science Town in 1974
Promoting R&D
Enforcing the national R&D programs
Promoting the university-based researches (e.g. SRC, ERC)
Enhancing technology innovation
Increasing efficiency of R&D investment (coordination of S&T-related policies)
Planning Total Roadmap
Change in focusing industry
Primary goods
Light industry goods
Light & heavy industry goods
Heavy industry goods & electronic products
Electronic & transport products
4


S&T Development : Quantitative Growth
Total R&D Investment
0.25%
2.48%
4
12,810
33,690 (No. 7)
1963
1997
2007
Total R&D Expenses (Mil. USD)
Percentage (%) of GDP
Total Number of Researchers
2,962
138,438
289,098
1964
1997
2007
Total Number of Researchers
Thesis and Patent
236(53th)
18,791(14th)
25,494(12th)
3,944
17
1981
1997
2007
U.S. Patent
Number of SCI Theses
Industrial Technology Level
39.9
70.7
76.8
1992
1999
2006
Industrial Technology Level (World's best = 100)
5


Achievements led by S&T
Aggressive investment through selection and concentration in the initial stage of industrialization
Ship building
1970s
Gov.-led fundamental establishment
· Ship research center establishment
· HR development & supply from university
1980s~1990s
Continuous private R&D investment
· Extension of private research institutes
· Security of manufacturing tech & quality
2000s
World's No.1
· Market share of 40.4% (2006)
Semi-conductor
1980s
Gov.-led intensive development
· 4M/16M DRAM
1990s
Private initiative R&D
· 64M/256M DRAM
2000s
World's No.3
· Market share of 10.2%(2006)
Mobile Phone
Early 1990s
Gov.-led R&D
· CDMA technology development
Mid 1990s
Market Extension
· Support for market creation & extension
2000s
World's No.3
· Market share of 17.8%(2006
6


II. Challenges : What should we do ?
7


Innovation–led Growth
21st Century's knowledge-based economy
→ The era of fierce global competition based on S&T strength
Technology innovation is a new growth engine
: leap over the growth limit through factor input
1970s
Labor, Capital (79.2%)
Technology Innovation (20.8%)
Change in contribution factors To economic growth
1990s
Labor, Capital (63.9%)
Technology Innovation (36.1%)
Early 2000s
Labor, Capital (58.5%)
Technology Innovation (41.5%)
STEPI(Science & Technology Policy Institute), 200
Calls for swift transition to an innovation-led growth model
8

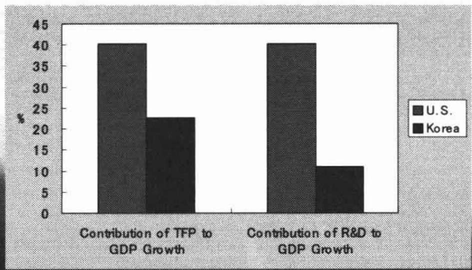
Challenges : What should we do ?

1 Increasing the Efficiency of R&D Investment

- Growth rate of economic contribution index against 1% increase of R&D input index

  ❑ Developed country : 0.52% , ❑ Korea 0.37% (KISTEP, 2005)

- Decrease in contribution of R&D to economic growth



9

Challenges : What should we do ?

2 Portfolio of National R&D Towards Innovation - led Model

	Present Situation (2006,%)	Future targets
Research Stage	Basic (15.1), Applied (19.9), Developing (65.0)	Increase of basic research
Research Entity	Research institute (12.8), University & college(10.0), Companies(77.2)	Increase of university research
Technology	IT (35.6), BT(6.6), NT(13.4), ET(6.4), ST(1.8), CT(1.2), etc(35)	Mitigation of imbalanced investment on IT Future growth engine related R&D
Region	National capital region(63.4), Daejeon(11.2), etc(25.4)	Strengthening of local R&D

10

Challenges : What should we do ?

3 **Nurturing Human Resource (HRD)**

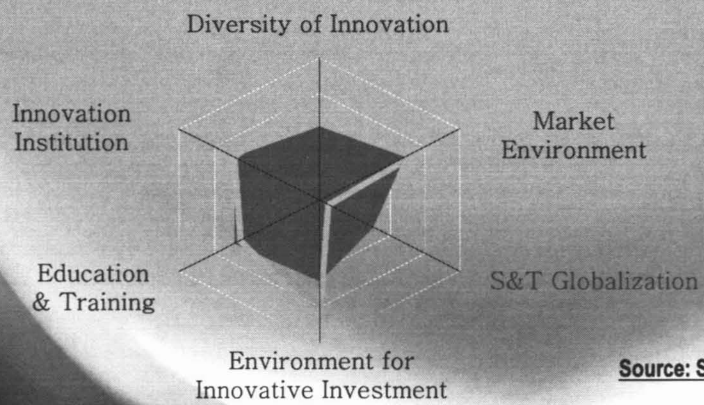
- **Mismatch between demand & supply**
  - -Shortage of high quality manpower is expected to continue until 2015
  - : Shortage of 4,500 Ph.D.'s (KISTEP, 2005)
- **Brain drain index of IMD (2006):**
  - ❑ U.S : 8.96 ❑ Iceland : 8.36 ❑ Japan : 6.75 ❑ China : 3.22 ❑ Korea : 4.91
  - * scale of 0 to 10: 0 indicates a strongest tendency for highly-educated people to leave a country

HRD	Fostering creative core manpower
Selection & concentration	R&D-oriented university
Strengthening of network	Brain Circulation

11

Challenges : What should we do ?

4 **Active Globalization of S&T**

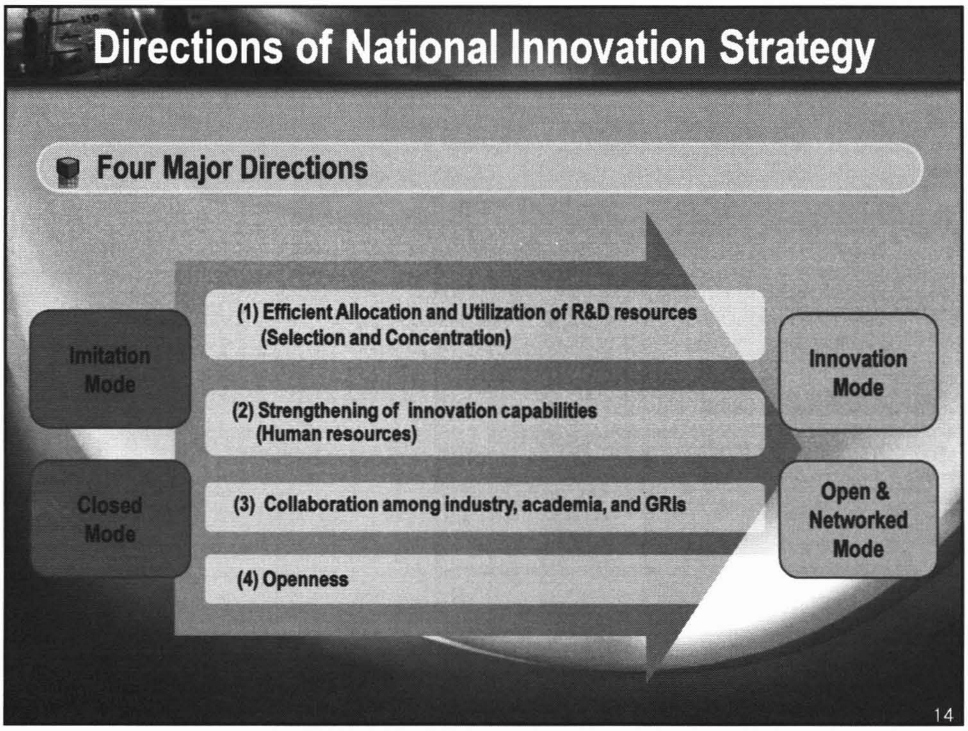


Source: STEPI (2006)

Korea's overall capacity for technological innovation is relatively high while ... globalization is the lowest among OECD ...

12


III. New National R&D Strategy & Policy
13


Directions of National Innovation Strategy
Four Major Directions
Imitation Mode
Closed Mode
(1) Efficient Allocation and Utilization of R&D resources (Selection and Concentration)
(2) Strengthening of innovation capabilities (Human resources)
(3) Collaboration among industry, academia, and GRIs
(4) Openness
Innovation Mode
Open & Networked Mode
14

Directons of S&T Policy in LeeMyungBak Administration

「577 Initiative」 (2008~2012)

- 「577 Initiative」 was established in order to systematically pursue the science and technology policy of LeeMyungBak Administration.

1. Science and Technology shall open the doors to the future

"The new administration plans to turn Korea into a S&T power nation that will lead the world with strong will to nurture science and technology."

"We plan to expand gross domestic expenditure on R&D(GERD) from 3.2% of GDP in 2006 up to 5% by 2012."

2. We will invest national R&D in strategic areas

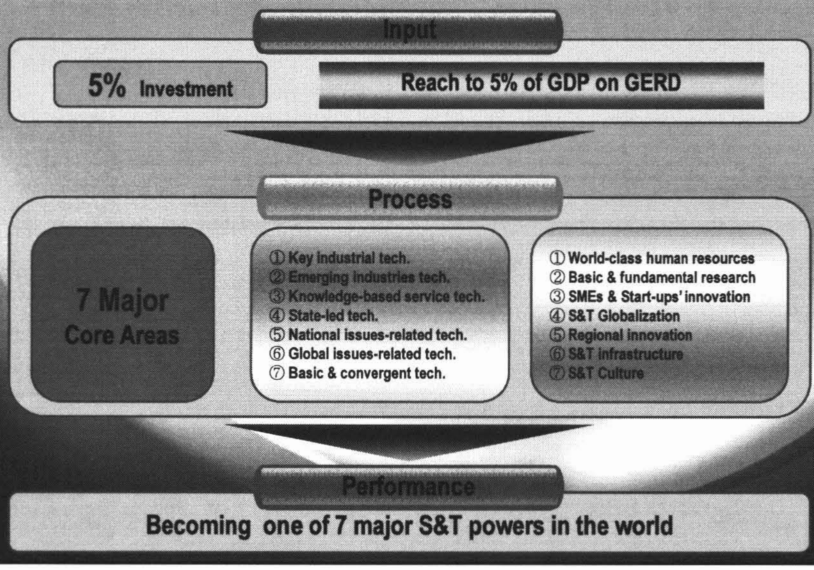
"Government needs to support R&D areas such as basic science, fundamental technology and large scale technologies(LST) with long-term plans."

"We will become a leading nation in the Green Market, which will reach market size of 3,000 trillion Korean won(equivalent to about $ 2.5 trillion USD) by 2020, by increasing R&D investment in green technology by more than doubled."

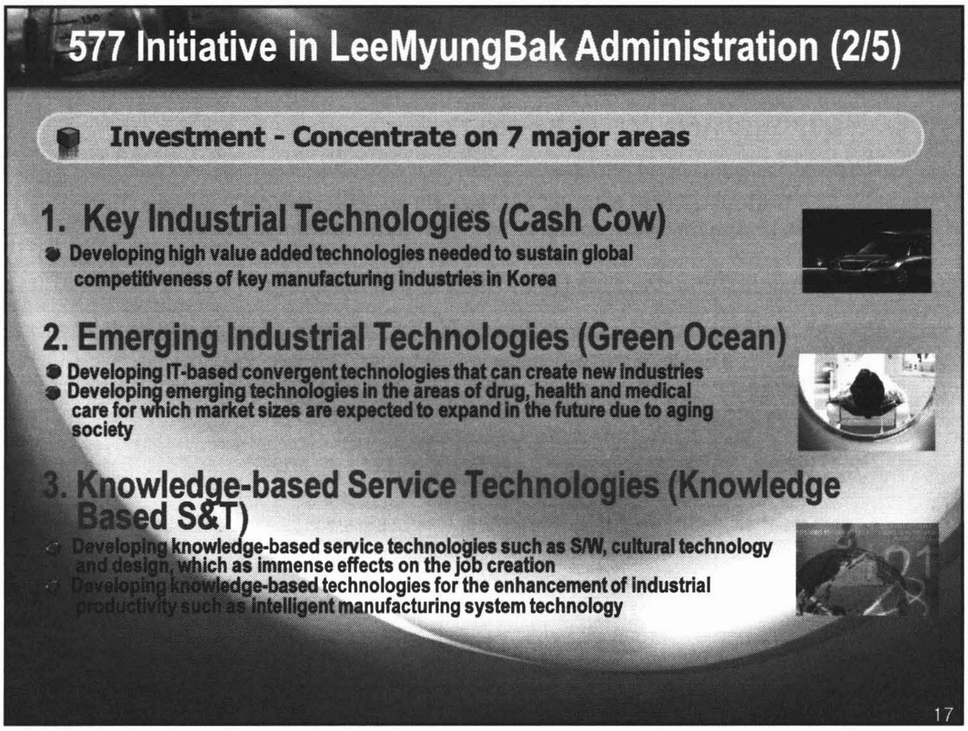
15

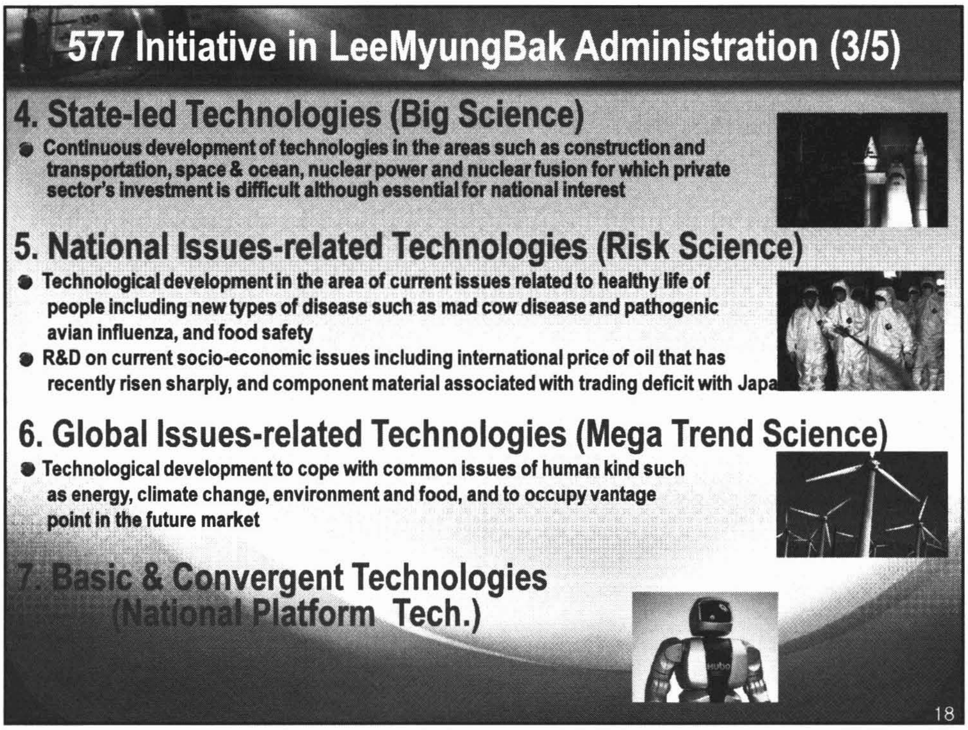
577 Initiative in LeeMyungBak Administration (1/5)

Framework



16


577 Initiative in LeeMyungBak Administration (2/5)
Investment - Concentrate on 7 major areas
1. Key Industrial Technologies (Cash Cow)
Developing high value added technologies needed to sustain global competitiveness of key manufacturing industries in Korea
2. Emerging Industrial Technologies (Green Ocean)
Developing IT-based convergent technologies that can create new industries
Developing emerging technologies in the areas of drug, health and medical care for which market sizes are expected to expand in the future due to aging society
3. Knowledge-based Service Technologies (Knowledge Based S&T)
Developing knowledge-based service technologies such as S/W, cultural technology and design, which as immense effects on the job creation
Developing knowledge-based technologies for the enhancement of industrial productivity such as intelligent manufacturing system technology
17


577 Initiative in LeeMyungBak Administration (3/5)
4. State-led Technologies (Big Science)
Continuous development of technologies in the areas such as construction and transportation, space & ocean, nuclear power and nuclear fusion for which private sector's investment is difficult although essential for national interest
5. National Issues-related Technologies (Risk Science)
Technological development in the area of current issues related to healthy life of people including new types of disease such as mad cow disease and pathogenic avian influenza, and food safety
R&D on current socio-economic issues including international price of oil that has recently risen sharply, and component material associated with trading deficit with Japa
6. Global Issues-related Technologies (Mega Trend Science)
Technological development to cope with common issues of human kind such as energy, climate change, environment and food, and to occupy vantage point in the future market
7. Basic & Convergent Technologies (National Platform Tech.)
18

577 Initiative in LeeMyungBak Administration (4/5)

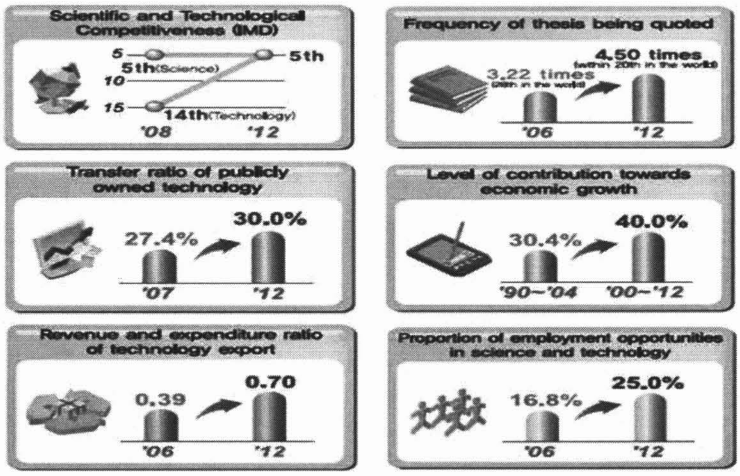
Advancement of 7 major S&T systems

1. Cultivation and Utilization of World-class Human Resources
2. Promotion of Basic, Fundamental Research
3. Support for SMEs and Start-up Innovation
4. S&T Globalization
5. Enhancement Regional Innovation Capacity
6. Advancement of S&T Infrastructure
7. Spread of S&T Culture

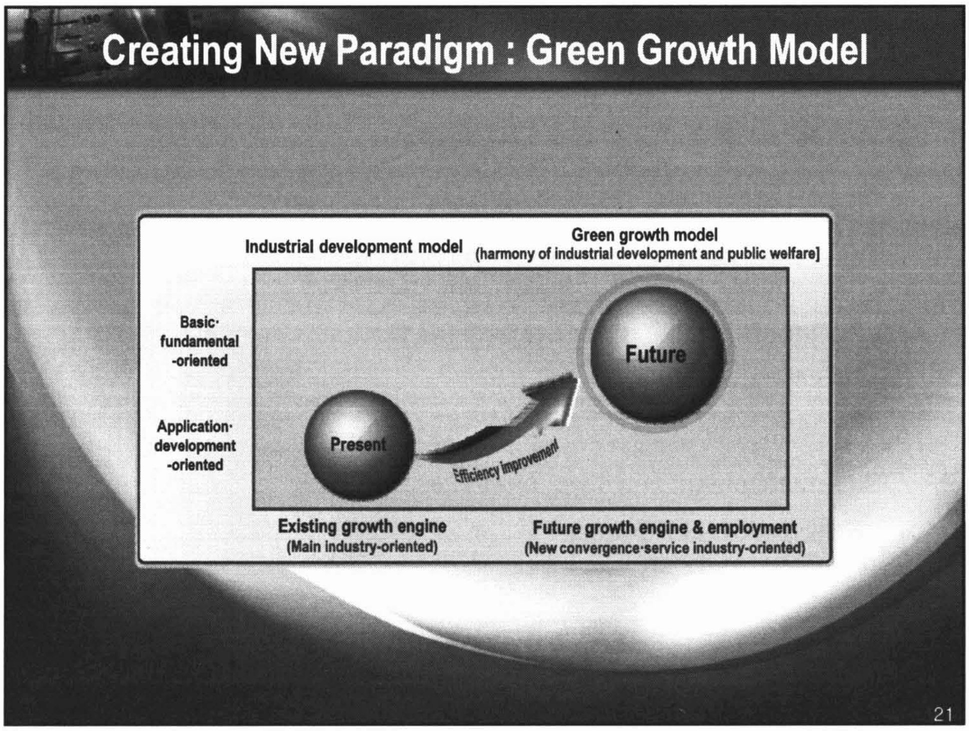
19

577 Initiative in LeeMyungBak Administration (5/5)

Index of Performance



20


Creating New Paradigm : Green Growth Model
Industrial development model
Green growth model
(harmony of industrial development and public welfare]
Basic·
fundamental
-oriented
Application·
development
-oriented
Present
Future
Efficiency improvement
Existing growth engine
(Main industry-oriented)
Future growth engine & employment
(New convergence·service industry-oriented)
21


Thank You !
22

Speaker: Dr. Kumi Okuwada,
Director, Science and Technology Foresight Center, NISTEP
"Sustainable Development Through Scientific and Technological Innovation"

【Hill】 Some of you know that the United States established, about 15 years ago, a Critical Technologies Institute, based on a law that was passed by Congress. Later, this institute became the Science and Technology Policy Institute.

One of the things that stimulated the formulation of the original critical technologies planning process and institute was observations about what Japan was doing with its foresight in science and technology exercises. And we learned a little bit from Japan about doing foresight in science and technology.

Our next speaker has had a lot of responsibility for the most recent of the science and technology foresight activities. Dr. Kumi Okuwada is managing the Science and Technology Foresight Center within the National Institute of Science and Technology Policy in Japan. She formerly worked in the Toshiba Corporation as a materials and process engineer researcher, so she has some real-world experience in this business. We welcome you here to the podium. Thank you.

【Okuwada】 Thank you, Dr. Hill. Today, I'll talk mainly about long-term strategy and foresight. As you know, Japan has continued foresight program, so we would like to contribute toward sustainable development of Japan through our foresight program.

(Slide 1)

I would like to tell you that it's time we need long-term strategy and foresight. As you all know, current economic recession has brought about increased uncertainty for us in short- and middle-term. However, the world should be in recovery sometime. Dawn will come sometime. It is important thing that the world will shift to quite different structure when it recovers. From a long-term viewpoint, keys for sustainable growth for every country or every area are not only when and how we will recover from slumps, but also what they will transform into. So, it's time we need long-term strategy. And scientific and technological innovation has been more and more expected. Basically, science and technology is investment for the future. It is no doubt science and technology policy will be a noticeable factor for sustainable growth. That is why science and technology policy needs long-term strategies and foresight.

(Slide 3)

In Japan, policymakers have rarely focused attention on long-term strategies. But recently, the government has started to discuss about what should be done for the long-term strategies. It's just my opinion, but one reason is that we have emerged globally important issues, such as global warming or global economic recession. And it is a special thing for Japan that the social system of Japan is dynamically changing now. Japan aims sustainable development nonetheless for the long-term trend in population decline, owing to aging and low birthrate; it was shown in Mr. Wada's slides.

(Slide 4)

I'll show here recent examples of long-term strategic guidelines in Japan. For example, "the long-term strategic guidelines Innovation 25" was decided by Cabinet in 2007. Shapes and innovation that society should aim for in 2025 were discussed and they were followed by the strategic roadmaps. A concept of "Cool Earth 50" was born from the strategies, and as a result, "Low-carbon technology plan" was also decided by Cabinet Office. "Innovation 25" was probably a first long-term strategic guidelines, that, firstly, they set the vision of Japan in 2025 and then three pillars — roadmap and other system reforms — were set to aim to realize the vision of Japan in 2025.

(Slide 5)

It is an example of statement in it, that, Japan would like to aim to strengthen science and technology diplomacy. We believe that Japan still now has high-level science and technology, so we would like to take up it as a diplomacy tool.

(Slide 6)

It is a schematic view showed by our Council of Science and Technology Policy. It is a very important thing for us that framework was changed after the strategy set. We are now in the third fiscal year of the 3rd Science and Technology Basic Plan. After establishment of "Innovation 25", each Science and Technology Basic Plan became to aim to realize the vision of "Innovation 25". So, we can say that such basic plans are a kind of roadmap in the innovation strategy.

(Slide 7)

Our NISTEP contributed to the "Innovation 25" discussion, using the latest foresight program and its results. We organized expert panels and we held many workshops by themes. The discussion in such expert panels and workshops were summarized as a report of "Social Vision toward 2025".

(Slide 8)

It is one of the results in our report. The topic in Theme 6 was "Effort against Global Environmental Issues and toward Coexistence in the World." From technological viewpoint, the visualization of green information is most important thing. As a result, green business or dissemination of green consciousness will be established. And then, reduction of the CO2 emission by half or sound water cycle will be realized. It is our desirable society. And we aim that Japan's presence will go up in the world, using green technology, green consciousness and green business.

(Slide 9)

We would also like to contribute to Asian countries. For example, Asian youths will tackle establishment of their economic system that will bring both about economic and green effects, with experiences in Japanese universities. Japan would be a model in this area by solving environmental issues. For example, visualization of environmental information or low-environmental impacted transportation system will lead to the dissemination of green consciousness. Human resources as high-tech environmental leaders will realize a situation that young people from around Asia come to Japan to study the solutions.

(Slide 10)

Let's see history of foresight program. Japan has continued foresight programs from 1970s. I'm not sure why Japan has continued such activities in the same way for long time. The foresight activities have become more popular and more extensive in the world. For example, EU countries use foresight program to make some consensus in EU countries. In this case, foresight is a good communication tool. In Asia, China, Korea and APEC Center have accumulated experiences of foresight activities. Japan or Asian countries' foresight programs have a tendency to be more scientific and more technological ones, compared with the EU ones.

(Slide 11)

This schematic view is a relationship of the development of national foresight and development of science and technology policy in Japan. As I said before, we have continued the foresight program from 1970s, but linkage between the foresight activities and development of science and technology has not been strong. But from the 8th foresight program, they have had a relatively strong linkage. We had a success to contribute in the discussion for the 3rd Basic Plan's planning and in planning for "Innovation 25". We would also like to contribute to the next Basic Plan using the next foresight results.

(Slide 12)

Let's go to see some past foresight results. We believe the past foresight results are our knowledge assets. We can now evaluate the early surveys. So, we can say that continuing foresight activities would be important. These are the results of such evaluation at the 8th foresight program. We can say that, totally in average, 60 - 70% of early topics have been partially or alternatively realized.

(Slide 13)

And international collaboration has also been fruitful to accumulate the knowledge. NISTEP did the international collaboration between Japan and Germany in 1990s. We could know from these schematic views that the realization time is nearly equal among countries, but importance has some bias. Recently, internet has more and more accelerated our communication speed. As a result, future image of science and technology experts will be less different in the world. But there will still be a large difference on importance among regions or countries.

(Slide 14)

Furthermore, we can see topics in these early stages. We can find what the people in 1990s were thinking. This is an example which shows topics surrounding internet technologies in early surveys. So, totally, we can say that concepts can be imaginable, but they could not imagine how.

(Slide 15)

This is a schematic view of development in the Science and Technology Basic Plan in Japan. As I said before, NISTEP is now preparing for the discussion in the 4th Basic Plan, which will start from 2011. We can now mainly discuss about whether the prioritization is changeable or not. As I said before, we would like to contribute in the discussion for the next Basic Plan, so we have paid attention to relevance between the long-term strategy and the Basic Plan. What kinds of benefit to the world and to our daily life in Japan will be brought forth by scientific or technological developments? And, of course, transformation in meaning of prioritization in the Basic Plan is important issues for us. The 2nd Basic Plan was prioritized by field, and the next current Basic Plan was prioritized within field. We cannot say now about the next Basic Plan, so it's just my opinion, but fields would have less meaning.

(Slide 16)

At NISTEP, we are now preparing next foresight design or methodology. It may be more outcome-oriented foresight through some integrated methodology. It is a total design of the latest foresight program. I have reported it at 2005 AAAS Annual Meeting.

(Slide 17)

It was the first Japanese multi-methodology foresight consisted of the improved Delphi survey and complementary three others.

(Slide 18)

We have continued Delphi surveys from 1st to 8th. It was in the center of our 8th foresight program. But at next one, the integration or convergence will be a key. We are now thinking of them through international conference or international collaboration research.

(Slide 19)

Furthermore, from the latest foresight program, we could understand that we could make more political message by coupling review and foresight. The review means to see hindsight. So, coupling of hindsight and foresight will again be more fruitful for us to make more political message.

(Slide 20)

Now, we are doing 12 research projects, consisting of follow-up for 3rd Basic Plan and preparing the next foresight. They are mainly aimed at assessment for the current Basic Plan, but we added a preparation for the next foresight to it.

(Slide 21)

I would like to summarize here. It's time we need long-term strategy and foresight to solve the global issues and to help Japanese changing. The expectation for the scientific and technological innovation has become bigger and bigger. Of course, strategies in each East Asian country and their synergy will lead to our sustainable development in this region as a whole. Especially, China, Korea and Japan have closely exchanged information each other. And we also believe that we could promote it through our foresight experiences. For example, our country is eagerly fostering young generation of Asian countries or other developing countries, with dispatch of the lectures or something.

Thank you.

【Hill】　Thank you very much, Dr. Okuwada. Do we have some questions for Okuwada-san? Yes, please.

【Question】　My name is Thomas Youn from the Korea Institute of Science and Technology Evaluation and Planning in Korea. My question is very simple. Since NISTEP has a very long history of technology foresight activities, such as Innovation 25 and etc. I was just wondering could you give us any good advice for those countries that are following Japan, such as Korea, China and some other countries, just very simple, good advice for those countries?

【Okuwada】　Advice? We are not sure we can continue the contribution for the policymakers in the future. But, from our experiences, timing and clear target are important to design the foresight program. As I said before, to tell the truth, 1st – 7th programs and results were not so successful ones in the meaning of contribution to the policymaking. But from the 8th foresight program, we had set a clear target and clear timing of the end of the foresight program, because we would like to contribute more, in the best condition, to have a linkage with the policymaking process. So we have just finished the program just one year before the next Basic Plan, for example. So, we would now like to think about the next foresight program to prepare for the next Basic Plan, which will start in 2011. Is that okay?

【Question】　I'm from Korea and I have one more question. You mentioned several kinds of methodology you're doing on technology foresight. But depending on the time period you expect the methodology must be different. For example, after 5 years or after 10 years or after 15 years, probably you have to use somewhat different types of methodology when you do the foresights, because after 5 years you clearly know, probably you can highly expect some technology can be realized, but after 10 years and after 20 years or after 50 years, probably you have a lot of somewhat.... Probably technology can be changed or the needs for technology would be different. Do you have any idea that you may use a different methodology for the technology foresight depending on time period you expect?

【Okuwada】　Of course, there are no perfect foresight methodologies. But we have to design more suitable program for the future or next generation. For example, as I said before, 60 - 70% of the topics are realized in average, when we saw the early topics. It is important number because it is over 50%. If it is 50%, it may be the same thing of throwing a coin or something. If you look at these graphs closely and in detail, one third of the topics were realized, but another one third has been realized partially or alternatively. So the modification will be important and necessary. But the remaining one third will be not imaginable. So, basic science or something will be needed important for the remaining one third. But totally, we can say that thinking about the future or making a strategy is useful or meaningful for you. Generally, we can say so. But, as I said before, perfect foresight is not existed. We have no idea for the perfect one.

【Hill】 Thank you very much. I think we could have many other questions about the methodology and data of the last talk. Maybe we'll have an opportunity at the end of the day, if we have some time remaining.

Sustainable Development Through Scientific and Technological Innovation

Symposium : East Asian Science Policies and New Global Realities

AAAS annual meeting 2009

Kumi Okuwada Ph.D.
Director,
Science and Technology Foresight Center
NISTEP, Japan

1

The time to need Long-term Strategy and foresight

➢ Current economic recession has brought about increased uncertainty about short and middle-term prospects through the world, including East Asia.

➢ However, the world should be in the time of recovery sometime, when it will shift to quite different structure.

➢ From a long-term viewpoint, keys forward sustainable growth for every country / area are not only when and how they will recover from slumps, but also what they will transform into. It is the time to need long-term strategy.

➢ So, scientific and technological innovation has been more and more expected.

➢ Science and technology have been considered " investment to the future " for human beings. It is no doubt that S&T policy of each country / area will be a noticeable factor for the sustainable growth.

➢ That is why S&T policy needs long-term strategies and foresight which support policy-making process, everywhere in the world, in both developed and developing countries / areas.

2

In Japan, policy-makers have rarely focused attention on long-term strategies. However, recently, the government has started to discuss about what should be done with the intention to make long-term strategies.

One reason is that there have emerged globally-important issues such as global warming. The other reason is that the social system of Japan is facing to extensive renovation because Japan aims at sustainable development nonetheless for long-term trend in population decline owing to aging and low-birth rates.

Recent examples of long-term strategic guidelines in Japan

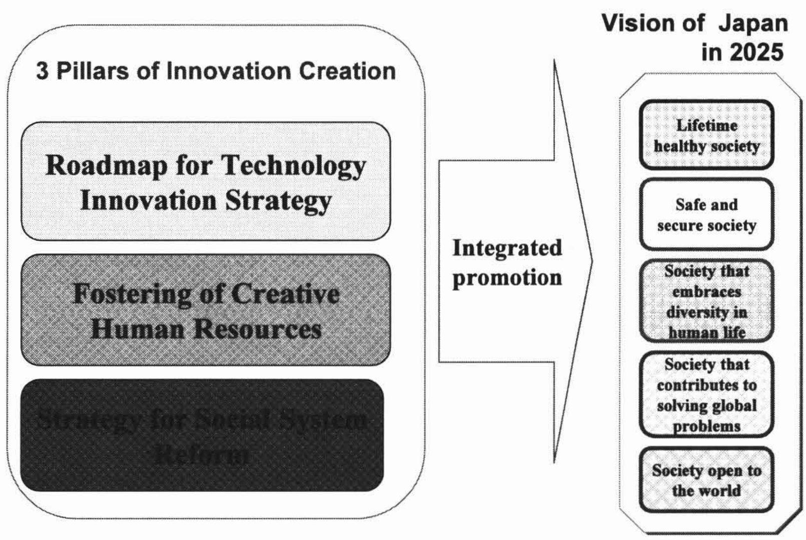
- The long-term strategic guidelines "Innovation 25", The Cabinet Decision (June 2007), "Shape and innovation that society should aim for in 2025" with the strategic roadmaps
- A concept of "Cool Earth 50", Proposal at the G8 summit (July 2007) "Reducing to half in global warming gas by 2050"
- Low Carbon Technology Plan, Council for Science and Technology Policy (May 2008),
- Scenario writing for 2020, description in "The medium- to long-term fiscal policy and an economic and fiscal outlook for next ten years", the Cabinet Decision (January, 2009)

3

" Innovation 25 " in Japan

Long-term Strategic Guidelines "Innovation 25" , the Cabinet Decision (2007.6)

http://www.kantei.go.jp/foreign/innovation/innovation_final.pdf



4

Example of Statements in "Innovation 25"

Strengthening S&T Diplomacy

Definition (Purpose)

○ Introduction of Japan's proposal, "Beautiful Planet 50," by former Prime Minister Abe at the G8 Heiligendamm Summit. (= Reduce total global GHG emissions by half by the year 2050)

○ By actively addressing various global issues, making maximum use of Japan's scientific and technical capabilities, strengthen "S&T Diplomacy," which links research cooperation and technical cooperation with foreign diplomacy, and enhance Japan's "soft" power.

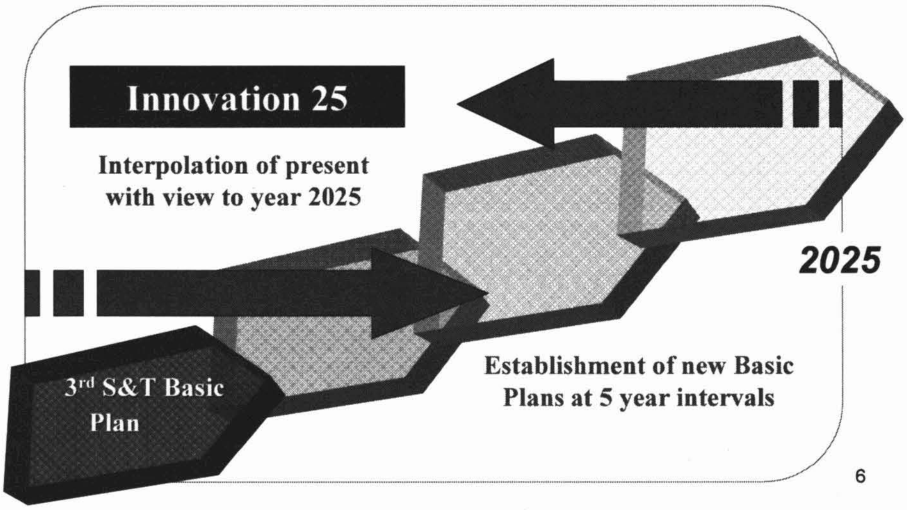
Outline of Policies

1. Strengthening of science and technology cooperation with developing countries
2. Strengthening of transmission and demonstration of Japan's excellent science and technology to the world
3. Development of world environmental leaders
4. Strengthening of international cooperation in advanced science and technology

5

Framework of Innovation Strategy

- Relationship between the long-term strategy and the S&T Basic Plan -



6

Contribution of NISTEP to "Innovation 25" made good use of the latest foresight

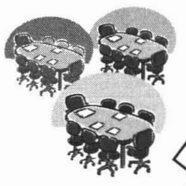
NISTEP Report No.101

Social Vision toward 2025
- Scenario Discussion
based on S&T Foresight -

http://www.nistep.go.jp/achiev/sum/eng/rep101e/pdf/rep101se.pdf

Theme 1	Staying healthy throughout your life
Theme 2	Information and telecommunications infrastructure to improve quality of life: benefit of ubiquitous computing
Theme 3	Assistance for activities of daily life based on the development of brain science
Theme 4	Safe and sustainable cities
Theme 5	Keeping yourself vigorous and open-minded: career choices, child-raising and diversification in seniors' lifestyles
Theme 6	Efforts against global environmental issues and toward coexistence in the world

Steering committee
- consisted of a chair and 15 members including social scientists;
- had two meetings;
- supervised the progress.



Experts panels by theme
Each panel
- consisted of a chair and around 10 members;
- had two meetings;
- looked toward the future of the relevant theme.

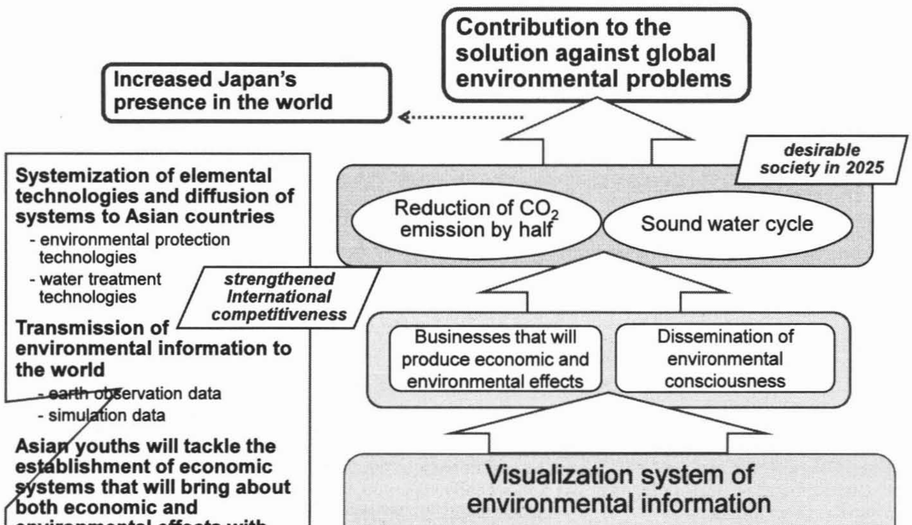
Workshops by theme
From 30 to 50 people joined each workshop.
Participants were; S&T experts, social scientists, younger researchers, users, etc.

*Around 300 experts joined the discussion.

7

Discussion at NISTEP : Results by theme

Theme 6: Efforts against global environmental issues and toward coexistence in the world



8

"Japan as a world-model in solving the environmental issue"

Visualization of environmental information
Low environmental impact transportation systems

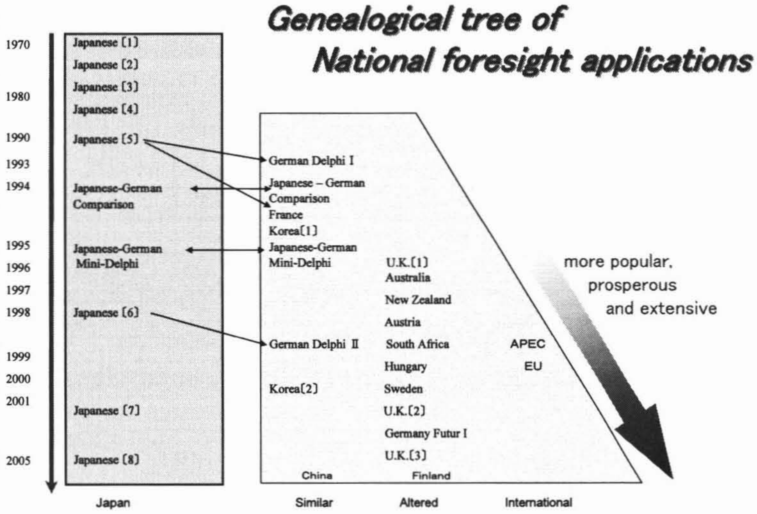
→Dissemination of environmental consciousness

Human resource as "High-Tech Environmental Leaders"

→Young people from around Asia, who come to Japan to study the solutions

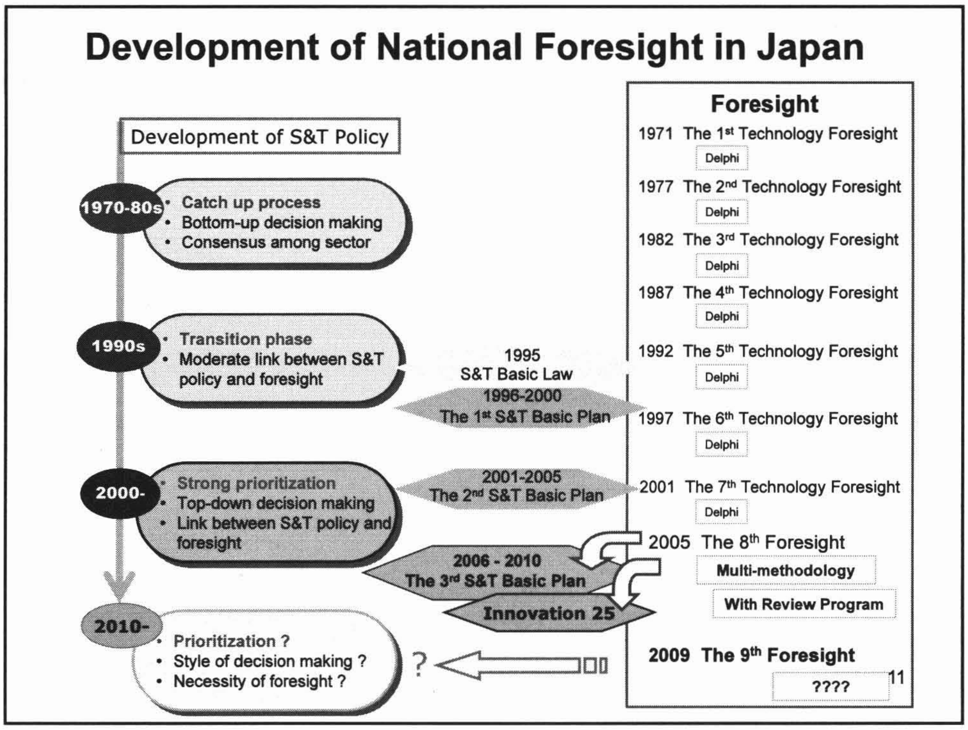
9

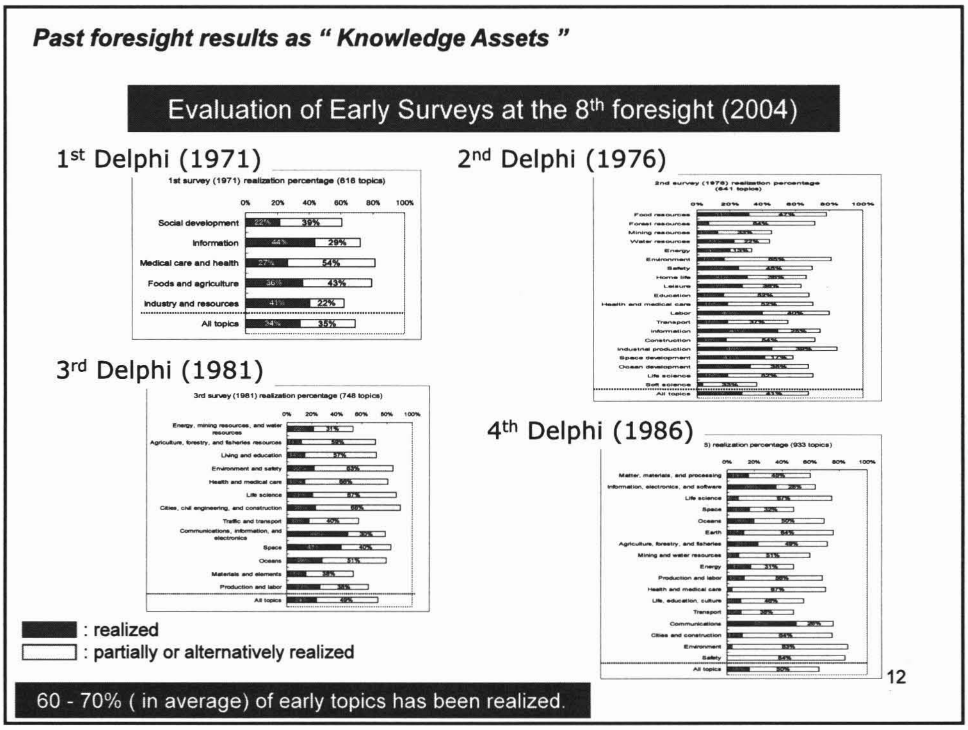
Genealogical tree of National foresight applications



ex. EU countries consider foresight as a useful communication tool to make consensus among wider regional areas and to make decision for innovative technologies.
ex. China, Korea and the APEC Center have accumulated the experiences of foresight activities. Some other East Asian countries have also started to learn the foresight methodologies and to carry on their own programs.

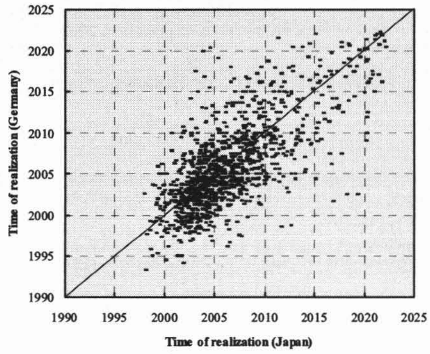
Foresight activities have tendency to strengthen linkage with policy making processes in the world.


Development of National Foresight in Japan
Development of S&T Policy
1970-80s
Catch up process
• Bottom-up decision making
• Consensus among sector
1990s
• Transition phase
• Moderate link between S&T policy and foresight
2000-
• Strong prioritization
• Top-down decision making
• Link between S&T policy and foresight
2010-
• Prioritization ?
• Style of decision making ?
• Necessity of foresight ?
1995
S&T Basic Law
1996-2000
The 1st S&T Basic Plan
2001-2005
The 2nd S&T Basic Plan
2006 - 2010
The 3rd S&T Basic Plan
Innovation 25
?
Foresight
1971 The 1st Technology Foresight
Delphi
1977 The 2nd Technology Foresight
Delphi
1982 The 3rd Technology Foresight
Delphi
1987 The 4th Technology Foresight
Delphi
1992 The 5th Technology Foresight
Delphi
1997 The 6th Technology Foresight
Delphi
2001 The 7th Technology Foresight
Delphi
2005 The 8th Foresight
Multi-methodology
With Review Program
2009 The 9th Foresight
????
11

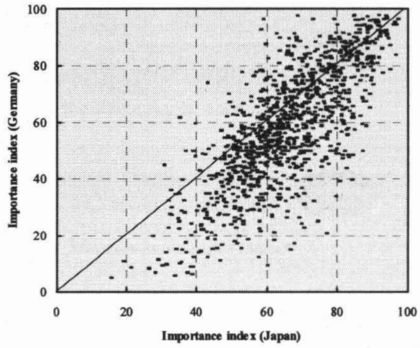

Past foresight results as " Knowledge Assets "
Evaluation of Early Surveys at the 8th foresight (2004)
1st Delphi (1971)
1st survey (1971) realization percentage (616 topics)
Social development
Information
Medical care and health
Foods and agriculture
Industry and resources
All topics
2nd Delphi (1976)
3rd Delphi (1981)
3rd survey (1981) realization percentage (748 topics)
4th Delphi (1986)
: realized
: partially or alternatively realized
60 - 70% (in average) of early topics has been realized.
12

Past foresight results as " Knowledge Assets "

International Collaboration (Japan 1992 - German 1993)



Realization Time



Importance

Internet has more and more accelerated communalization of the information.
As a result, future image of S&T experts will be less different in the world.
However, there will still be very large differences in "importance" among regions or countries.
What will be more important in 'your life' ?

Past foresight results as " Knowledge Assets "

Topics surrounding internet technologies in early survey (1970 – 1992)

○ Direct access to overseas data banks for giving and receiving data.
(topic in the 1st (1971), they forecasted as 1987 in average.)

○ Establishment of worldwide real-time reservation system for transportation or accommodation in big cities or major sightseeing areas. (topic in the 1st (1971), they forecasted as 1980 in average.)

○ Establishment of international data-communications network covering almost all the areas in the world, enabling automatic connection from domestic network to overseas ones.
(topic in the 3rd (1982), they forecasted as 1994 in average.)

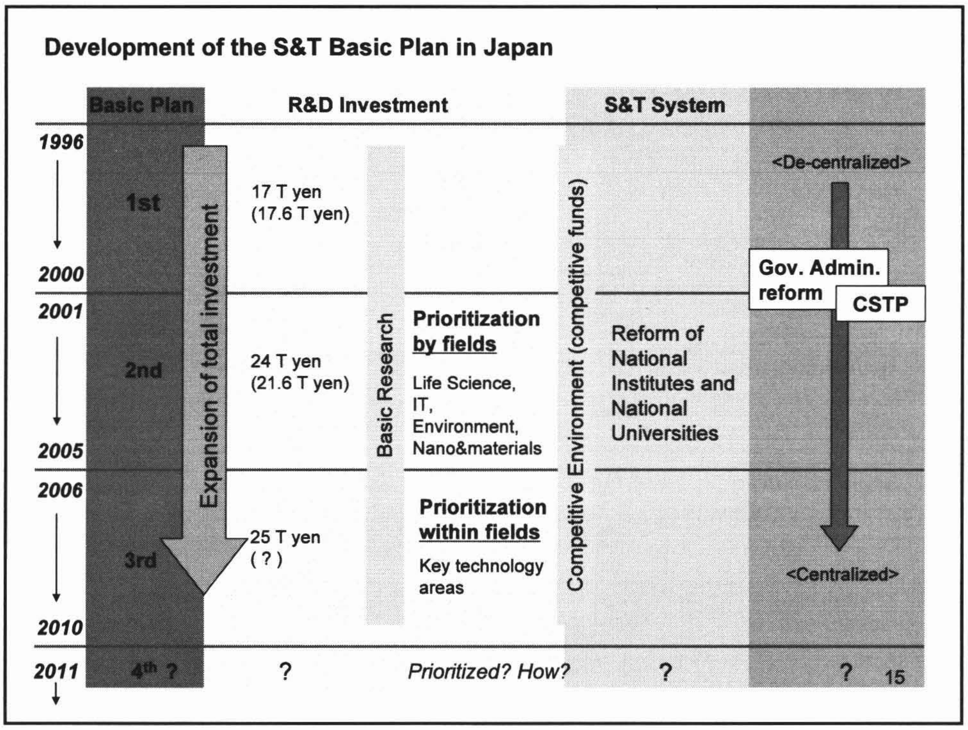
○ Practical use of automatic protocol conversion technology, enabling easy interconnection of various communications networks. (topic in the 4th (1987), they forecasted as 1996 in average.)

○ Widespread use of online rental service or exchange system for recycling used items.
(topic in the 4th (1987), they forecasted as 1995 in average.)

○ Widespread use of communication systems for retrieval of still or motion video information from electronic libraries (containing character data, books, still videos, movies, TV, documentary films, etc.) through broadband lines. (topic in the 5th (1992), they forecasted as 2005 in average.)

○ Widespread use of computer networks in which a virtual space can be shared in real time by a large number of unspecified, geographically dispersed persons.
(topic in the 5th (1992), they forecasted as 2005 in average.)

Can we imagine the future technology ?
→ Concepts can be imaginable, although we cannot say "how". 14



Can the next (9th) foresight program contribute to the discussion for the 4th Basic Plan in Japan?

- Relevance between the long-term strategy and the Basic Plan
  What kind of benefits to the world and to our daily life in Japan will be brought forth by S&T developments ?
- Transformation in meaning of prioritization in the Basic Plan
  the 2nd Basic Plan : by fields
  the 3rd Basic Plan : within fields
  the 4th Basic Plan : ???, "fields" have less meaning ?
- Desirable foresight for these discussions
  New design ? New methodology?

  → *More outcome-oriented foresight through some integrated methodology ?*

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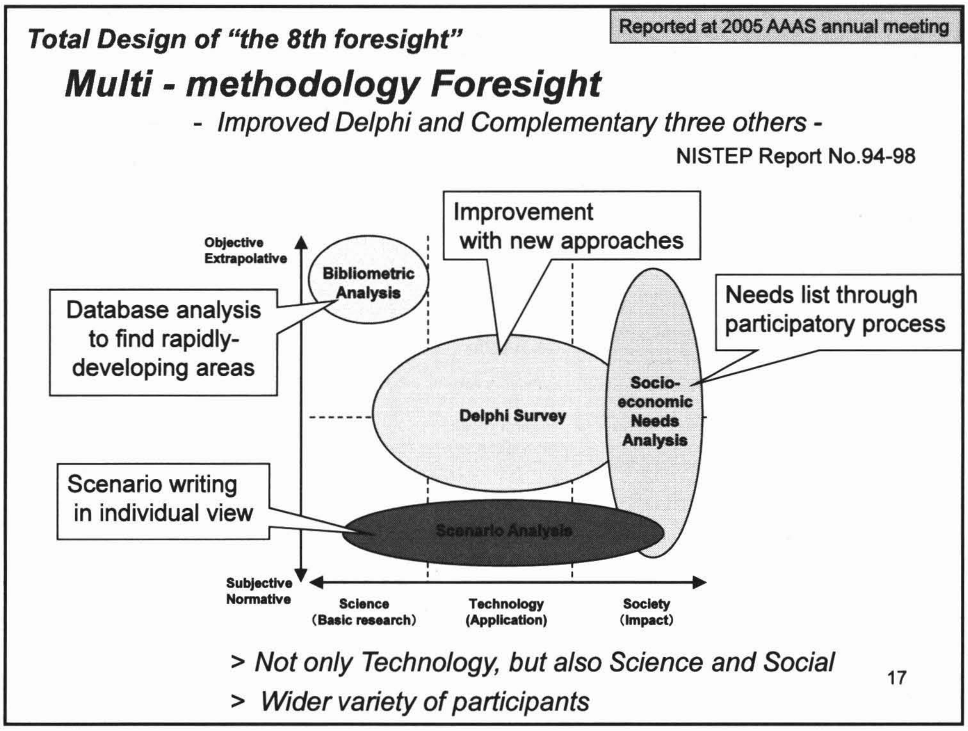
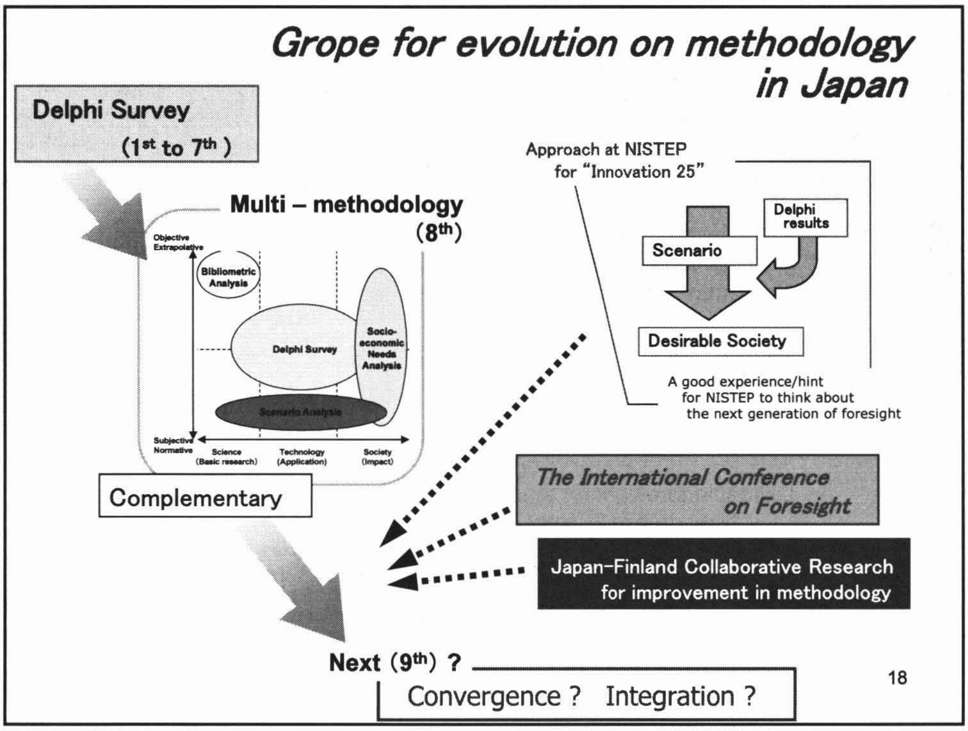

Total Design of "the 8th foresight"
Reported at 2005 AAAS annual meeting
Multi - methodology Foresight
- Improved Delphi and Complementary three others -
NISTEP Report No.94-98
Improvement
with new approaches
Objective
Extrapolative
Bibliometric
Analysis
Database analysis
to find rapidly-
developing areas
Needs list through
participatory process
Socio-
economic
Needs
Analysis
Delphi Survey
Scenario writing
in individual view
Scenario Analysis
Subjective
Normative
Science
(Basic research)
Technology
(Application)
Society
(Impact)
> Not only Technology, but also Science and Social
> Wider variety of participants
17


Grope for evolution on methodology
in Japan
Delphi Survey
(1st to 7th)
Multi – methodology
(8th)
Bibliometric
Analysis
Delphi Survey
Socio-
economic
Needs
Analysis
Scenario Analysis
Complementary
Approach at NISTEP
for "Innovation 25"
Delphi
results
Scenario
Desirable Society
A good experience/hint
for NISTEP to think about
the next generation of foresight
The International Conference
on Foresight
Japan-Finland Collaborative Research
for improvement in methodology
Next (9th) ?
Convergence ? Integration ?
18

More political message by coupling of "review" and "foresight"

2003-2004FY : Two research projects by NISTEP

consisted of "Review" until the 2nd Basic Plan and "the 8th foresight"

Review during 1st & 2nd Basic Plans

- S&T Indicators
- Evaluation of achievements
- Benchmarking
- Impact study etc.

\+

Multi - methodology foresight

- Delphi Survey
- Scenario Analysis
- Bibliometric Analysis
- Socio-economic Needs Analysis

2008FY - : 12 research projects by NISTEP

consists of "Follow-up" for the 3rd Basic Plan and "the 9th foresight"

Japan is now at the halfway point of the 3rd Science and Technology Basic Plan. The Council of Science and Technology Policy is preparing an interim report, referring to some NISTEP surveys reviewing achievements.

19

2008FY - : 12 research projects by NISTEP

consists of "Follow-up" for the 3rd Basic Plan and "the 9th foresight"

The 3rd S&T Basic Plan Follow-up Studies

- Analysis of science and technology policies in major countries
- Analysis of current status of Japan based on macro data
- Analysis of universities and public research organizations
- Analysis of S&T human resources
- Analysis of innovation systems
- Current situation of state-of-the-art research
- Research outcomes from S&T

Preparation for the 9th foresight

1. Analysis of science and technology policies in major countries

○Analysis on S&T policies of major countries (PR1)

2. Analysis of current status of Japan based on macro data

○Analysis on macro data (PR2)
○TFP analysis (PR3)
○Qualitative analysis (PR4)

3. Analysis of universities and public research organizations

○Analysis on internal structure and operation of public research organizations (PR5)
○Analysis on university groups (PR6)
○Study on research environment at university by analyzing research time (PR6)

4. Analysis of S&T human resources

○Survey on world-class HR (PR7)
○Mobility of researchers (PR7)
○Education at university and graduate school (PR8)

5. Analysis of innovation systems

○Creation of IPR and collaboration among the industry-academy-government (PR9)
○Regional innovation (PR9)
○Infrastructure of innovation (PR9)

6. Situation of state-of-the-art research ← (Preparation for the 9th foresight)

○Discussion on S&T areas & fields that the 4th Basic Plan should emphasize (PR11)

7. Research outcomes from S&T

○Achievements created by universities and research institutes (PR12)
○Roles of public research institutes and support from public organizations (PR12)
○Measurement of S&T impact on industry and general public's life (PR3)

20

Closing Remarks

➢ It is the time to need long-term strategy and foresight for the global issues and for the countries / areas.

➢ The expectation for scientific and technological Innovation has become bigger and bigger for the sustainable development.

➢ Strategies in each East Asian countries and their synergy will lead to sustainable development in the region as a whole. Especially, China, Korea and Japan have closely exchanged information each other.

➢ We also believe that we could help to promote it through our foresight experiences. Japan and Korea are eagerly fostering young generation with dispatch of the lecturers to share the experiences and with having training program for invited students. They would play an active part to realize the sustainable development through scientific and technological innovation in future Asia.

21

Speaker: Dr. Mu Rongping
Director General, IPM, CAS
"Innovative Policy for Sustainable Development in China"

【Hill】 Originally on our program, we were to have two speakers from China, but Mr. Yang Qiquan was not able to be with us today. Fortunately, although we have only one speaker from China, he's so well known to us that he almost counts as two speakers from China. Dr. Mu Rongping is well known to people who follow developments in science and technology policy in China. He wears several hats. One hat is director general and professor at the Institute of Policy and Management of the Chinese Academy of Sciences. He's also director general of the Academy's Center for Interdisciplinary Studies of Social and Natural Sciences and he holds various other high-level positions in publishing and academia in the science community in China. I'd like to welcome him to talk about: Innovative Policy for Sustainable Development in China. So, welcome.

【Mu】 Thank you, Professor Hill. I am very glad to be here for the second time. Five research institutes are here for this meeting to demonstrate experience and perspectives from three countries: China, Japan and Korea or Japan, Korea and China. All three of these countries are catch-up countries; 40 years ago, even Japan was a catch-up country. Today, these three countries are at three different levels of development. So, I think that their views regarding science and technology innovation policy are meaningful for other countries.

(Slide 2)

In China, sustainability is currently a very important topic. With that in mind, I will conduct my presentation here in four parts; first, I will begin with an introduction.

(Slide 3)

At present, there are three tasks for China to accomplish. First, China wants to be an innovation-driven country by 2020. China aspires to be a harmonized society and to pave the way with a new philosophy for scientific development.

To date, we have three national strategies in China: (1) sustainable development; (2) national reinvigoration by emphasizing the importance of science and technology education; and (3) national reinvigoration through the talents of our people by emphasizing the importance of human resources. Here, innovation and sustainability are separate entities. Last year, the government declared that innovation forms the core of our national strategies, so more attention has been focused on innovation. I think we need to bring innovation and sustainable development together. At this time, researchers of sustainable development and researchers of innovation policy work separately in China, even in our institute. Therefore, last year, we tried to bring these people together to think about innovation policy through discussions with researchers in the field of sustainable development; at the same time, we considered sustainable development through discussions with experts in the fields of science and technology innovation policies.

(Slide 4)

China was one of the earliest countries to be involved in the compilation of Our Common Future, a very significant document. In addition, China signed the Rio Declaration and the Agenda for the 21st century in 1992. The Chinese government released its Agenda for the 21st century in 1994. This is the first agenda for any one country, representing a government's White Paper on Population, Environment, and Development in the 21st Century.

(Slide 5)

Sustainable development became a single national development strategy in 1996. The concept of sustainable development has been transformed from a scientific agreement to an important government task on which concrete actions have been taken. Some ecological restoration programs such as the Natural Forest Ban and Land Conversion Programs have been in operation since 1998. Since 1999, the China Sustainable Development Strategy Report has been completed by our institute and is issued annually by the Chinese Academy.

(Slide 6)

The Chinese government proposed the New Industrialization Path in 2002, which emphasizes lower emissions, less pollution, and decreased consumption of resources, along with high value-addition. In 2003, the Chinese government also proposed a new philosophy for "balanced" scientific development. The strategies of Resource-Efficient and Environment-Friendly Society and Circular Economy were established in 2004. A harmonious society, involving man and nature, was proposed by the central government in 2005. In 2006, the Chinese government raised the mandatory target for energy efficiency and pollution reduction to 20% by 2010.

(Slide 7)

As for the administration of sustainable development, the Chinese government instituted a lead group for the China Agenda 21st Century Compilation and set up its office in 1992. The office later became the China Agenda 21st Management Center.

In 1998, the former State Bureau for Environmental Protection was elevated to the ministry level, thereby becoming the National Administration for Environmental Protection. Last year, in 2008, the National Administration for Environmental Protection was transformed into the Ministry for Environmental Protection, with a more important role in government administration.

(Slide 8)

This is a brief review of the changes in sustainable development strategy in China. During the past few years, many factors have resulted in high-speed development within China, not only in the economy but also in social development. Hence, in 2006, the Chinese government proposed the very ambitious goal of becoming an innovative country. Indicator systems were established, and attempts were made to monitor the progress in the construction of our innovation-driven country.

(Slide 9)

According to our researchers, since 2007, the index for national innovation capacity has rapidly increased. This system consists of 25 indicators that constitute four perspectives: of input/output, condition, infrastructure, and performance. The main contribution to this increase comes from scale expansion, or the so-called strength index, and from the efficiency—or effectiveness—of the national innovation capacity, which has also increased rapidly, but is still relatively lower, as can be seen from this chart.

(Slide 10)

We have chosen 38 countries for international comparison; most are developed countries, and the BRICS countries are also included. Here, in the year 2000, Japan ranked 2nd, Korea 11th, and China 28th. In 2006, there were some slight changes; Korea jumped to 6th place and China rose to 17th.

(Slide 11)

As for the growth rate of the National Innovation Capacity Index, both China and Korea rose rapidly.

(Slide 12)

The Strength Index of the National Innovation, to some extent, reflects the expansion of scale. There is also a slight change here: Korea moved from 8th to 6th, and

China went from 4th to 3rd. From the viewpoint of effectiveness, there is a much closer relationship with respect to efficiency. Japan is in 6th place and Korea ranks 9th; China ranks second from last in 37th place.

(Slide 13)

In terms of efficiency or effectiveness, China is far behind the developed countries.

(Slide 14)

However, the growth rate of China and India is relatively higher than the other countries. Korea has also increased very rapidly.

(Slide 15)

Another index, the Innovative Development Index, is described from five perspectives: (1) industrialization, which emphasizes energy consumption, carbon dioxide emissions, and so on; (2) informatization; (3) urbanization; (4) education and health; and (5) science and technology innovation development. Thus, from this chart, you can see a change, albeit a relatively small one.

(Slide 16)

The annual growth rate of the Innovative Development Indexes in China, Romania, and Turkey increased rapidly, but we have to point out that the annual growth rate of the Industrialization Development Index in China's case increased at a relatively slow rate, because of the increase in carbon dioxide emissions and energy consumption per GDP.

(Slide 17)

These two indicators, and others, show that the increase in China's case was very rapid, but the value is relatively small.

(Slide 18)

China has experienced an objective historical process featuring the intensification of resources, energy consumption, and pollutant discharges, marked by the rapid development of heavy industry and chemical manufacturing. By 2004, carbon dioxide emissions in China accounted for about 18% of the global total and 87% of the world average per capita.

(Slide 19)

The issue of resources security—especially the dependence on imports of oil, gas, and other resources along with other serious problems of sustainable utilization of resources—highlighted a strong requirement to examine the issues of technology and innovation. The rapid pace of urbanization, consumption of resources, and environmental problems resulting from urbanization also underlined the need to address both issues.

(Slide 20)

Growth in the manufacturing sector remains lackluster with a slow growth rate, and the sector is facing serious challenges such as restructuring and upgrading. The response to these challenges is, to a great extent, determined by the capacity for innovation in the enterprises themselves and by an innovation-friendly environment that enables the development of mechanisms for sharing innovation risk and protecting IPR.

(Slide 21)

The scale-wise expansion of innovation activities has become a major contributor, as I mentioned previously, to the evolution of innovation capacity building. Improvement in innovation effectiveness and efficiency has a less positive impact on innovation capacity building, which implies that there remains a large gap in innovation quality.

(Slide 22)

The speed of progress in innovative development is much slower than that in innovation capacity, especially in training, attracting, and utilizing talent, as well as in increasing the effectiveness, efficiency, and influence of innovation activities. The quality of human resources in science and technology innovation determines, to a great extent, the effectiveness of resources allocation, the efficiency of innovation organization, and the impact of innovation activities.

(Slide 23)

The innovation policies for sustainable development include policies for promoting science and technology innovation, as well as policies for improving management of sustainable development issues concerning natural resources, environment, and pollution, as I have mentioned. Innovation policy is related not only to innovation activities but also to constrained activities without innovations.

(Slide 24)

Therefore, China has formulated 30 laws that deal with population, resources, energy and the environment; these include the Environmental Protection Law, the Water Law, and the Energy Conservation Law. The State Council has issued more than 100 administrative rules and regulations on sustainable development. Several hundred regulations and standards have been developed by government ministries and commissions. However, it is still necessary to improve the legal system for sustainable development and to bring about greater uniformity in sustainable development policies so as to display the role of policy portfolio for sustainable development.

(Slide 25)

China has also made a series of institutional arrangements for implementing its sustainable development strategy. The Standing Committee of the National People's Congress has set up a Subcommittee on Environmental and Resources Protection, which has played a major role in drafting laws and inspecting their enforcement and implementation. So far, China has signed more than 50 multilateral international treaties and conventions on the environment. Besides, China has increasingly encouraged greater public participation so as to increase the effectiveness of policies.

(Slide 26)

China has implemented the "11th Five-Year Plan" for science and technology development and the Medium and Long-Term Plan for National Science & Technology Development with the goals of sustainable development in all areas. The Medium and Long-Term Plan includes ten key research fields, four of which are directly related to sustainable development, such as energy, water and natural resources, environment, urbanization, and city development. China has initiated 16 special mega-projects, three of which concern energy resources and environment; the other two are related to health and biotechnology.

(Slide 27)

By the end of 2008, China had issued supporting policies for implementing the Medium and Long-Term Plan for National Science and Technology Development, along with 76 detailed rules. The policy and detailed rules have effectively promoted the development of innovation capacity in enterprises and up gradation of industry as well as improvement in industry structures, all of which have had a profound impact on economic and social sustainable development. Our survey of more than 1,800 large-scaled enterprises provides evidence to support these trends. The innovation capacity and the structure have obviously been improved.

Thus, these are the innovation policies for sustainable development in China. Thank you for your attention.

【Hill】 Dr. Mu, thank you very much. I would like to ask the first question, if I might.

You described in a couple of different ways that the capacity for innovation and the capacity for addressing sustainable development issues and environmental quality has been growing very quickly in China, but perhaps the results are not coming as quickly as the capacity. And, at least many people in the U.S. would say this is because, while the policy framework is established in Beijing, the implementation takes place in the provinces and cities throughout the country, and the ability of Beijing to influence the country effectively is not complete. That is, there is a lot of local initiative and/or local resistance. Is that a fair interpretation of what might be going on here, that while the capacity of the central government to establish policy is quite high, the capacity of the regional and local governments to implement that policy is not so high?

【Mu】 Thank you for your question. I think that it is not for the reason you mentioned. I think the major reason for this result is that China now, in general, is still at a relatively lower level in terms of innovation capacity and investment. Therefore, I think that our proposed target is an ambitious one: it is much higher than our current economic capability. Thus, China has a long way to go in effectively harnessing innovation as a means to scientific development. It is not an easy task.

【Hill】 Thank you. Are there questions from the audience? Yes, sir.

【Question】 Despite all your efforts, I have noticed the China's per unit GDP; energy consumption is still way higher than the world's average. So, in order to save energy, have you considered achieving this goal through, for example, reinforcing your IPR protection and changing your patent policies?

【Mu】 Maybe. If you know, nowadays, the laws regarding IPR are quite good. But the issue is how to implement these laws more strictly. Nowadays, many enterprises pay attention to these issues. As a result, they are increasing investment in IPR, both generation and protection.

【Hill】 Another question?

【Question】 Are there any incentive systems to encourage innovation in China?

【Mu】 Yes, that is a good question. I will need one hour to explain.

【Hill】 One hour is okay. (laughter)

【Mu】 First, according to the new supporting policy, the Medium and Long-Term Plan for Science and Technology Development, China will increase investment in R&D and provide more opportunities for professors and researchers to conduct their research. Second, we have issued preferential policies concerning tax deductions and to encourage enterprises to invest more money in innovation. Thus, if more money is made available for innovation, greater opportunities will arise for industry, universities and research institutions to cooperate. That is the first mechanism on the supply side to increase R&D investment.

On the supply side, enterprises are being encouraged to expand their focus on and input into innovation.

【Hill】 Thank you very much, Dr. Mu. That's very interesting. It is always useful to have an update on the situation, and China keeps going up, we notice. Thank you.

AAAS 2009 Annual Meeting at Chicago

Innovative Policy for Sustainable Development in China

Dr. Phil. Mu Rongping
Director General, IPM

"East Asia Science Policy and Global Realities"

AAAS 2009 Annual Meeting at Chicago, Feb. 14, 2008

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Contents

1. Introduction
2. China's Strategy for Sustainable Development
3. Key Factors of S&T and Innovation
4. Innovation Policy for Sustainable Development

2

1. Introduction

1. Innovation-driven Country
2. Harmonized Society
3. Philosophy (Outlook) for Scientific Development

National Strategies

- Strategy for Sustainable Development
- Strategy for National Reinvigorating through S&T & Education
- Strategy for National Reinvigorating through Talents

Innovation is the core for national strategies.

3

2. China's Strategy for Sustainable Development

- China is one of the countries that were the earliest to get involved in the compiling of "Our Common Future". "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"
- China signed the "Rio Declaration"& "Agenda 21" in 1992
- Chinese government released its Agenda 21 in 1994

--Government's White Paper on Population, Environment and Eevelopment in the 21st Century

4

2. China's Strategy for Sustainable Development

- SSD became one national development strategy in 1996
- The concept of sustainable development has been turned from scientific consensus into an important part of government work and concrete actions.
- Some ecological restoration programs like the Natural Forest Ban and Land Conversion Programs since 1998
- *China Sustainable Development Strategy Report* annually issued by CAS since 1999

5

2. China's Strategy for Sustainable Development

- Develop a New Industrialization Path in 2002.
- Outlook for Scientific Development / balanced development in 2003.
- Resource-Efficient and Environment-Friendly Society (REEFS) and Circular Economy (CE) in 2004.
- Harmonious Society incl. man and nature in 2005.
- Mandatory targets of energy efficiency and pollution reduction in 2006.

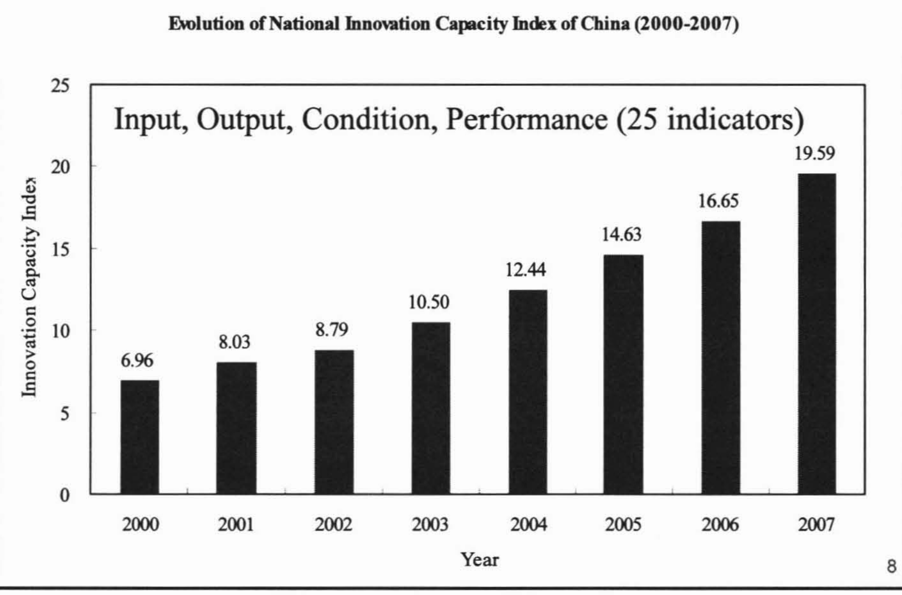
6

2. China's Strategy for Sustainable Development

- As to Administration of Sustainable Development, Chinese government set up a leading group for "China Agenda 21" Compilation and its office in 1992. The office later became the China Agenda 21 Management Center.
- In 1998, former State Bureau for Environmental Protection was elevated to ministerial level to become National Administration for Environmental Protection.
- In 2008, National Administration for Environmental Protection was transformed into the Ministry for Environmental Protection, with more important role.

7

3. Key Factors of S&T and Innovation



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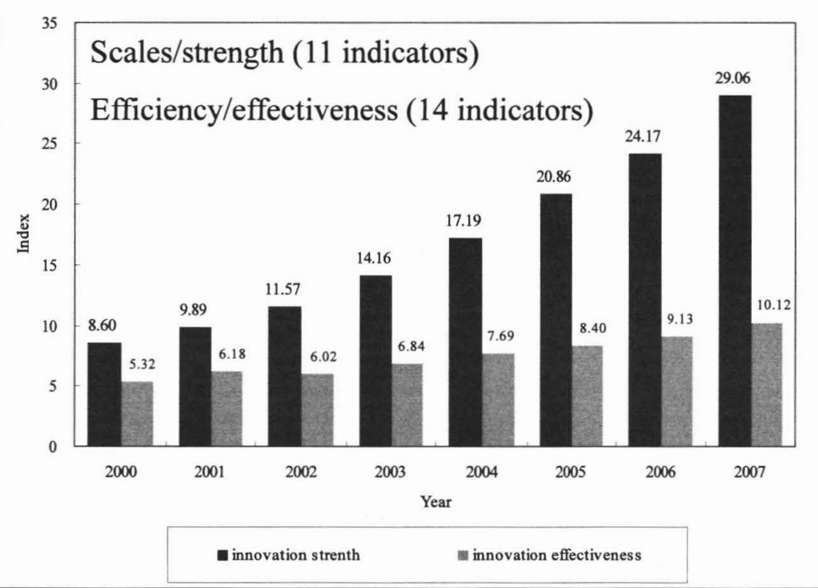
3. Key Factors of S&T and Innovation



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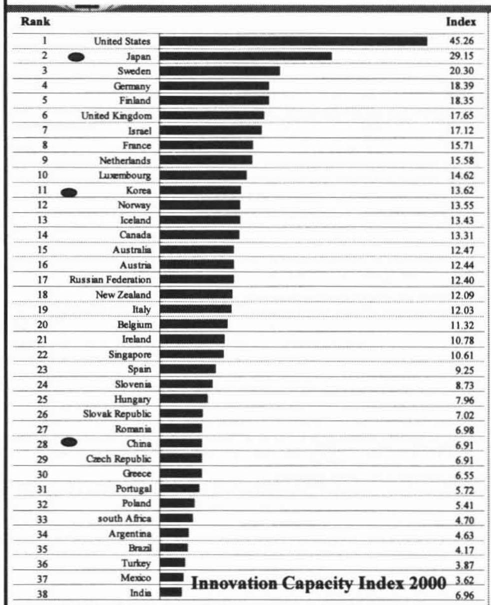
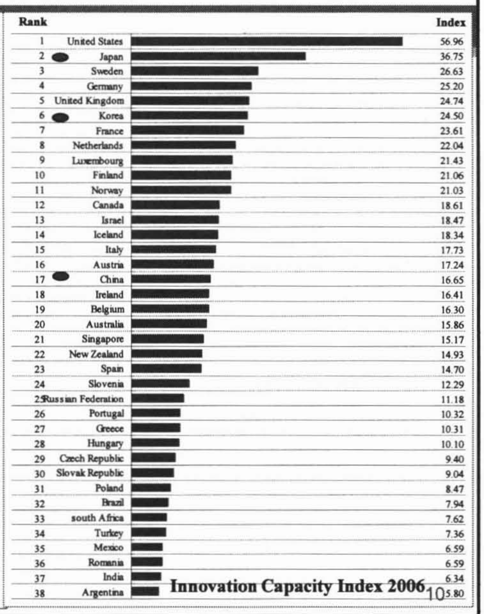
3. Key Factors of S&T and Innovation





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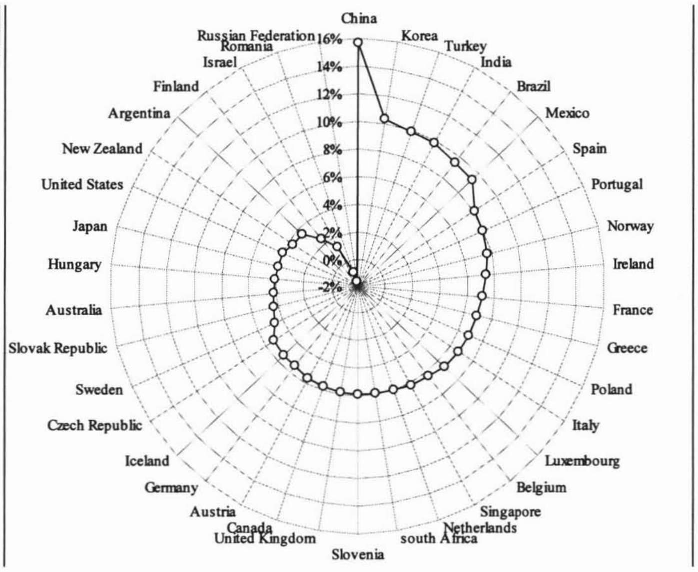
3. Key Factors of S&T and Innovation



Annual Growth Rate of National Innovation Capacity Index (2000-2006)

11

3. Key Factors of S&T and Innovation

Rank		Index
1	United States	57.03
2	Japan	26.39
3	Germany	10.72
4	China	8.60
5	United Kingdom	8.42
6	France	6.66
7	Russian Federation	5.56
8	Korea	4.62
9	Canada	4.02
10	Italy	3.92
11	Netherlands	2.58
12	Spain	2.41
13	Australia	2.25
14	Sweden	2.16
15	India	2.02
16	Brazil	1.93
17	Mexico	1.21
18	Finland	1.16
19	Belgium	1.14
20	Israel	1.07
21	Poland	0.99
22	Austria	0.88
23	Turkey	0.79
24	Argentina	0.72
25	Norway	0.67
26	south Africa	0.53
27	Greece	0.44
28	Ireland	0.44
29	Singapore	0.44
30	Portugal	0.39
31	New Zealand	0.38
32	Czech Republic	0.35
33	Hungary	0.33
34	Romania	0.29
35	Slovak Republic	0.15
36	Slovenia	0.11
37	Luxembourg	0.07
38	Iceland	0.02

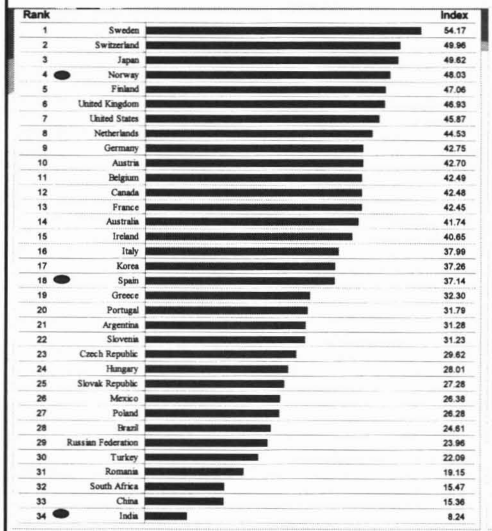
Strength Index of National Innovation in 2000

Rank		Index
1	United States	74.79
2	Japan	34.18
3	China	24.17
4	Germany	15.44
5	United Kingdom	12.44
6	Korea	12.20
7	France	10.69
8	Russian Federation	7.65
9	Italy	6.42
10	Canada	6.20
11	India	5.62
12	Spain	4.63
13	Brazil	4.19
14	Netherlands	4.13
15	Australia	3.32
16	Sweden	3.19
17	Mexico	2.39
18	Turkey	1.91
19	Belgium	1.83
20	Poland	1.75
21	Finland	1.51
22	Austria	1.45
23	Israel	1.32
24	south Africa	1.19
25	Norway	1.15
26	Argentina	1.00
27	Singapore	0.89
28	Ireland	0.81
29	Greece	0.80
30	Czech Republic	0.72
31	Portugal	0.71
32	Hungary	0.70
33	Romania	0.65
34	New Zealand	0.58
35	Slovak Republic	0.28
36	Slovenia	0.19
37	Luxembourg	0.16
38	Iceland	0.04

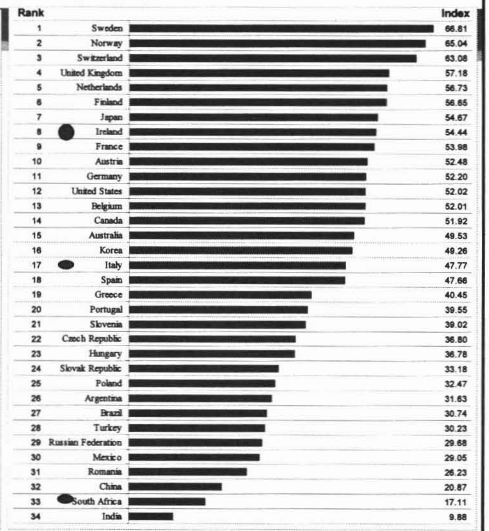
Strength Index of National Innovation in 2006

12

3. Key Factors of S&T and Innovation



Innovative Development Index in 2000

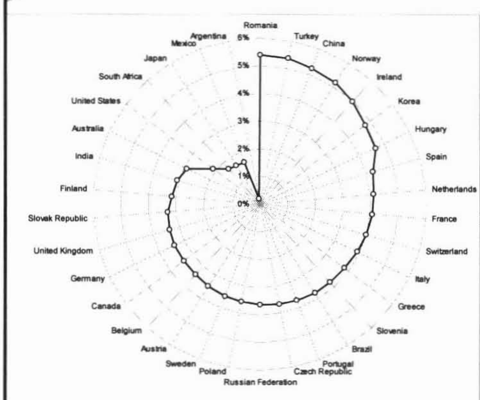


Innovative Development Index in 2006

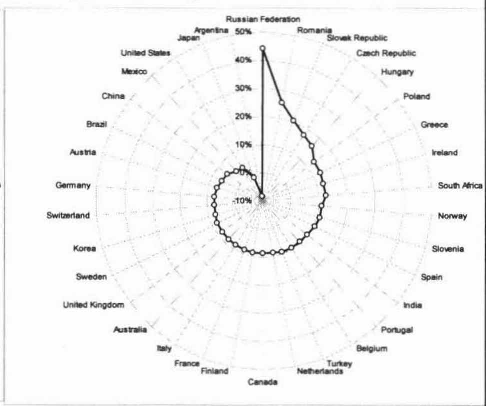
Industrialization, Informatization, Urbanization, Education & Health, S&T development 15

3. Key Factors of S&T and Innovation

GDP/Capital, CO2 Emission/GDP, Energy Consumption/GDP



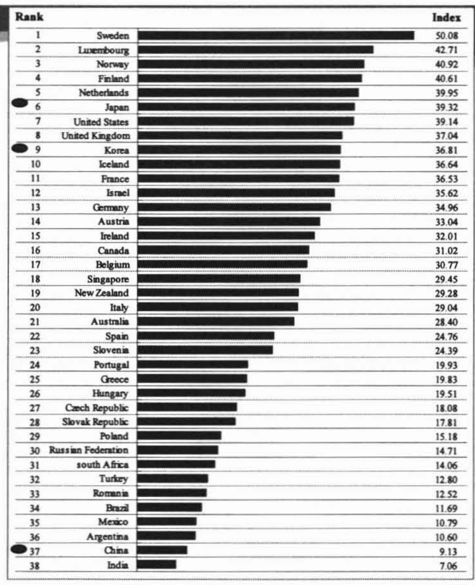
Annual Growth Rate of Innovative Development Index (2000-2006)



Annual Growth Rate of Industrialization Development Index (2000-2006)

16

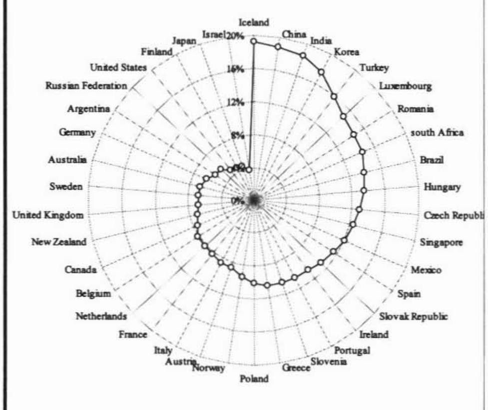
3. Key Factors of S&T and Innovation

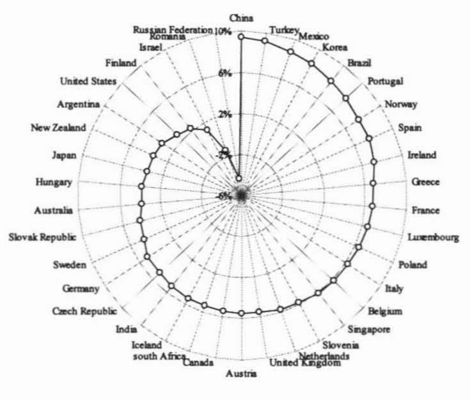


Effectiveness Index of National Innovation in 2006

13

3. Key Factors of S&T and Innovation

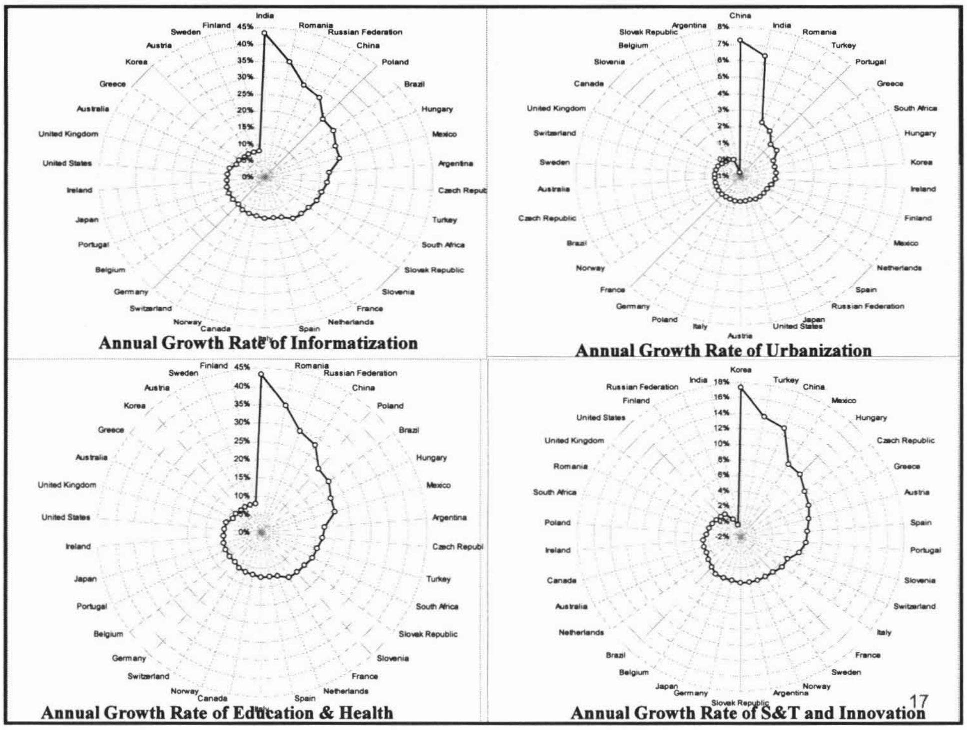




Annual Growth Rate of Strength Index for National Innovation (2000-2006)

Annual Growth Rate of Effectiveness Index for National Innovation (2000-2006)

14



Annual Growth Rate of Informatization

Annual Growth Rate of Urbanization

Annual Growth Rate of Education & Health

Annual Growth Rate of S&T and Innovation

17

4. Innovation Policy for Sustainable Development

- China is experiencing an objective historical process featuring the intensification of resources and energy consumption and pollutants discharge, marked by rapid development of heavy industry and chemicals. By 2004, CO_2 emissions in China accounted for 17.8% of the global total, and 87% of the world average per capita.

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4. Innovation Policy for Sustainable Development

- The issues of resources security, especially the dependency on import of oil/gas and other resources and the serious problems of sustainable utilization of resources show strong demands for technology and innovation. The high-speed urbanization and the resource & environmental problems resulted from urbanization also show the demands for technology and innovation.

19

4. Innovation Policy for Sustainable Development

- The development of new industrialization remains laggard with a slow growth rate, and is facing serious challenges such as industrial restructuring and upgrading, which are to a great extent determined by the capacity for innovation in enterprises themselves, and the innovation-friendly environment concerning the mechanism for sharing innovation risks and IPR protection.

20

4. Innovation Policy for Sustainable Development

- Expansion of innovation activities in scale has become major contributor to the improvement in innovation capacity building, while improvement in innovation effectiveness and efficiency has less positive impact on innovation capacity building, which implies that there is still a large gap in innovation quality.

21

4. Innovation Policy for Sustainable Development

- The speed of progress in innovative development is much slower than that in innovation capacity, especially in training, attracting and utilizing talents as well as in increasing the effectiveness, efficiency and influence of innovation activities. The quality of HR in S&T and innovation determines to a great extent the effectiveness of resources allocation, the efficiency of innovation organization, and the impact of innovation activities.

22

4. Innovation Policy for Sustainable Development

The innovation policies for sustainable development not only include of policies for promoting S&T and innovation, but also include policies for improving management of sustainable development issues concerning natural resources, environment, and pollutions.

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4. Innovation Policy for Sustainable Development

① China has formulated 30 laws about population, resources, energy and environment, incl.: "Environmental Protection Law", "Water Law", "Energy Conservation Law. The State Council has issued more than 100 administrative rules and regulations on sustainable development. There are several hundred regulations and standards worked out by government ministries and commissions. However, it is still necessary to improve the legal system for sustainable development, and to raise the uniformity of sustainable development policies so as to display the role of policy portfolio for sustainable development.

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2. China's Strategy for Sustainable Development

② China has made a series of institutional arrangements for implementing ***the Sustainable Development Strategy***. The Standing Committee of the NPC has set up an ***Sub-Committee on Environmental and Resources Protection***, which has played a major role in drafting laws and inspecting their enforcement and implementation. So far, China has signed more than 50 multilateral international treaties and conventions on environment. Besides, China has encouraged increasingly more public participation so as to increase the effectiveness of policies.

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4. Innovation Policy for Sustainable Development

③ China has implemented the "11th Five-Year Development Plan for S&T Development" and the Medium and Long Term Plan for National Science & Technology Development with the goals of sustainable development in all areas. M&L Term Plan includes 10 key research fields, four of which are directly related to sustainable development, such as energy, water and natural resources, environment, urbanization/city development. China has initiated 16 special mega-projects, three of which concern energy, resources and environment, other two of which are related to health and

26

4. Innovation Policy for Sustainable Development

④ China has issued the supportive policies for implementing M&L term plan of national S&T development, and 76 detailed rules by the end of 2008. These policies have effectively promoted the innovation capacity building in enterprises, and the upgrading of industries as well the improvement of industrial structure, which has profound impact on economic and social sustainable development.

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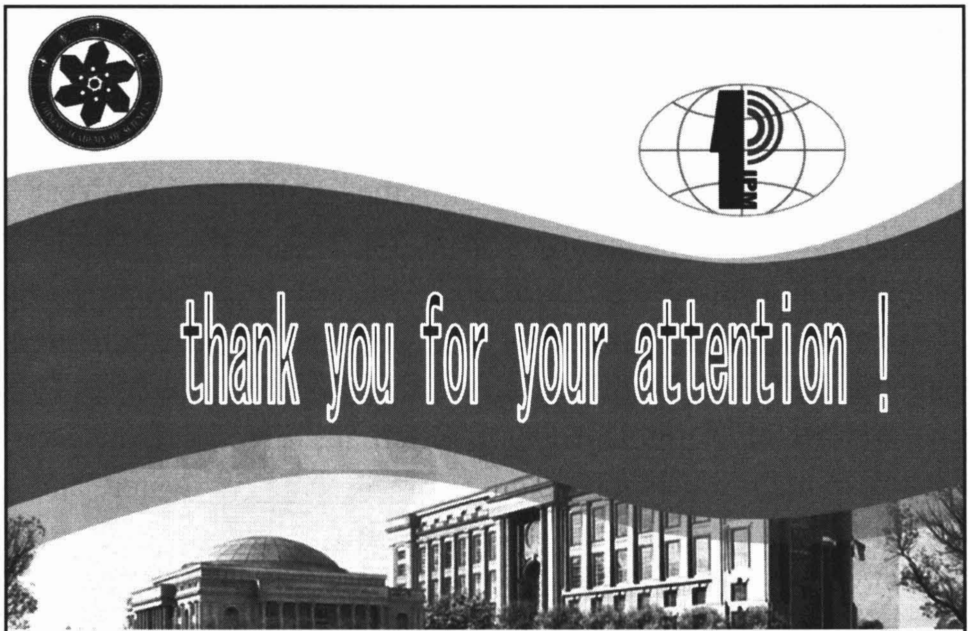

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Speaker: Dr. SukJoon Kim,
President, STEPI
"Strategy for Low-carbon Green Growth in Korea"

【Hill】 The last, but not least, speaker on the panel today is Dr. SukJoon Kim, who is president of the Science and Technology Policy Institute, STEPI, of Korea. He has been in this position since August of 2008. His job is to contribute to developing the future strategic vision for science and technology policy in Korea.

Unusual among speakers at AAAS Meetings, Dr. Kim actually served as a member of the National Assembly of the Republic of Korea from 2004 until 2008. For those not familiar with the political system of Korea, it's essentially the same as being a congressman of the United States or a member of the Diet in Japan. So, he has served as a political leader and now he's responsible for carrying out the kinds of policies perhaps he helped to determine. And he's going to talk today about the strategy for low-carbon green growth in Korea. Dr. Kim.

【Kim】 Thank you, Chairman. Even though he just left, Mr. Christopher Hill, maybe he's just going on to Six Party Talks to coordinate that, because he has the same name.

(Slide 2)

Good afternoon, ladies and gentlemen. Thank you for your patience and for your concentration. You have already spent two hours without moving. Today, I am very much honored to make a presentation on the strategy for low-carbon green growth in Korea. These are the key contents of today's presentation: Paradigm of a low-carbon society; Korea's low-carbon green growth vision and goals; Korea's "Green New Deal Policy;" Functions of the green innovation system.

(Slide 4)

The existing industry paradigm has aggravated global environmental issues including climate change. Human society is now at a critical juncture of migrating into a low-carbon green revolution based on energy/environmental technologies after the agricultural, industrial and information revolution in the history of mankind.

(Slide 5)

Though it was a late-comer in industrialization, Korea has made significant achievements in industrialization as well as in the information revolution based on IT. However, Korea is now faced with challenges of improving environmental quality, achieving energy independence and restructuring industrial and socioeconomic structures of a high-carbon society. Korea needs to transform into a creative post catch-up economic model from its current simple catch-up and imitation-based economic mode.

(Slide 6)

Now, let's look at the paradigm of a low-carbon society and its characteristics and dynamics.

(Slide 7)

This slide displays the dynamic relations of the paradigm shift, from a high-carbon to a low-carbon society. The paradigm of a low-carbon society should root in amidst the competition against the existing dominant paradigm of a high-carbon society. During the early stage, the conflict between the two paradigms is especially intense.

(Slide 8)

During the inception phase of a low-carbon society paradigm, it is disadvantaged as this new paradigm needs to take root, based on infrastructure and value chain of a high-carbon society. Therefore, the following wedge roles of science and technology, policy and civil society are needed to overcome the disadvantage of a low-carbon society paradigm. As a technological push, we need green technology. Also, we need the socioeconomic pull of a new paradigm through policy. We need support from civil society through education and a change in mindset to bring about change in consumption patterns.

(Slide 9)

Reaching time to "Tipping Point" from the inception phase is determined by two factors: the gap in the socioeconomic dominance between the old and the new paradigms and the intensity of the wedge in the new paradigm. Once the tipping point is reached, the new low-carbon paradigm rapidly expands during the take-off phase. During the take-off phase, market competitiveness is strengthened; more jobs are created; socio-cultural superstructure shift including changes in consumption patterns; and policy support for low-carbon technologies that have already gained competitiveness reduce, while policy support for less competitive low-carbon technologies increase.

(Slide 10-12)

Here is the comparison between high-carbon and low-carbon society paradigms. Because of the time constraint, I cannot explain in detail.

(Slide 13)

Now, let me briefly introduce you to Korea's low-carbon green growth vision and goals.

(Slide 14)

President Lee Myung Bak emphasized Korea's efforts to reduce greenhouse gas at the G8 summit meeting held in Hokkaido, Japan, in July 2008. President Lee

(Slide 15)

Myung Bak announced a low-carbon green growth vision on August 15th, 2008, commemorating the 60th anniversary of the country's foundation. With this vision, Korea aspires to achieve sustainable growth while reducing greenhouse gas and environmental pollution, and new development paradigms creating jobs and a new growth engine using green technology and clean energy.

(Slide 16)

Green growth is a growth model of a new paradigm, which pursues both growth and environmental conservation at the same time. In the existing economic theories, growth and environment exist in contradicting relationships. Thus, Korea pursues to realize the new paradigm by improving eco-efficiency, changing consumption patterns and strengthening knowledge-intensive services.

(Slide 17)

To achieve low-carbon green growth, it requires a new development strategy turning the current vicious cycle among energy, economy, climate and the eco-system into a virtuous cycle.

(Slide 18)

In fact, Korea is a birthplace of green growth strategy. Green growth was first adopted as a sustainable development strategy for the Asia-Pacific region at the 5th MCED Asia-Pacific Environmental Development Meeting of the UN ESCAP held in Seoul in March, 2005, and it was also the first occasion where the UN adopted a green growth strategy. Since 2006, the Seoul Initiative for Green Growth has been diffused throughout the Asia-Pacific region.

(Slide 19)

Here's the rationale of implementing low-carbon green growth in Korea. Faced with these energy and environmental issues and challenges of identifying new growth engines and creating jobs, Korea now has to pursue low-carbon green growth.

(Slide 20)

Then, what are the key elements of Korea's green growth vision? These are three avenues of the green growth vision of Korea. Green growth is a future national vision that can create triple effects: new development by securing new growth engines; improving Koreans' life quality as well as environment; and contribution to the efforts of the international society.

(Slide 21)

Here are the details of three key elements of green growth.

(Slide 22)

The Korean government has presented various policy measures to achieve the low-carbon green growth including strengthening support for financial and funding allocation policies as more than $23 billion is expected to be required over the next five years. Korea also plan to invest total US$3.7 billion by 2012 by increasing R&D investment by more than two times in core technologies like thin film solar cells and large wind generators.

(Slide 23)

Through low-carbon green growth, Korea is pursuing multiple goals. First, Korea wishes to secure energy independence and reduce greenhouse gas. Korea will move away from the past input-oriented growth model and pursue decoupling of economic growth from environmental pollution through low-carbon environmentally friendly policies. This will help maximize the efficiency of resource utilization while minimizing environmental pollution.

(Slide 24)

The second goal is to develop green technologies and turn them into new growth engines. Here, green technology is defined as a wide range of technologies including those responding to climate change and energy/resources/environmental technologies. The market size of green technology is estimated at $2.3 trillion in 2020 and R&D

investment in green technology is expected to increase by more than two times. Korea will also develop and promote fusion green technology combining IT, BT and NT, to form an export industry. In fact, six major Korean conglomerates are planning to invest about $5.9 billion in green energy as of October, 2008. Korea needs to secure breakthrough technologies to compete with advanced countries who are dominating core green technologies. These are the examples of breakthrough technologies.

(Slide 25)

Here are the goals: Restructure transport, agriculture, cities and land to be suitable for green growth; pursue low-carbon life reform and pursue green education and cultural policy.

(Slide 26)

A draft of the Basic Act on Green Growth was developed to provide legal and institutional support for low-carbon green growth. Based on this Basic Act, the Green Growth Committee will be established and National Strategy for Green Growth will be developed and implemented through the deliberation of the Green Growth Committee and the Cabinet Meeting. This Act will help develop and support green economy and green industries. For this purpose, new green industries with high growth potential will be identified and gradual migration to green economy and industry will be facilitated.

(Slide 27)

The Basic Act on Green Growth will help operate an environmentally friendly tax system, develop an Energy Master Plan and Basic Plan Responding to Climate Change and set and manage mid- and long-term targets and targets by phase.

(Slide 28)

The Basic Act also pursues: to establish and operate a total information management system and reporting system on greenhouse gas emission; to introduce a Cap-and-Trade System; and to build a consensus when developing plans relevant to green growth.

(Slide 29)

The Green Growth Committee will be co-chaired by prime minister and an expert from the private sector with total 50 members, both from public and private sectors. Natural members from the public sector include ministers of relevant ministries.

Members from the private sector will be appointed by the president among leading figures in the fields of economy, industry, society and culture, with relevance to green growth topics.

(Slide 30)

The functions of the three existing committees being; the Committee on Climate Change, the Energy Committee and the Sustainable Development Committee were merged into the Green Growth Committee.

(Slide 31)

The National Strategy for Green Growth will be reviewed by the Green Growth Committee. The National Strategy for Green Growth is a higher-level strategic plan giving the national policy direction for pursuing low-carbon green growth.

(Slide 32)

Here, you can see the positioning of vision and strategy for green growth in the National Development Plan.

(Slide 33)

Now, let's see what Korea's Green New Deal Policy is like.

(Slide 34)

Korea's Green New Deal Policy is aiming at specific achievements like creating jobs and a potential growth engine by simultaneously pursuing both "Green" and "New Deal." Korea will develop its Green New Deal Project by combining job creation policies with green growth strategy, like low-carbon, environmentally friendly growth and energy saving. Korea will maximize policy impact by systematically integrating overlapping green projects without clear orientation, and lead the realization of green economy and conservation of the earth's environment.

(Slide 35)

If we look at the scope of Green New Deal Project, projects that can facilitate transformation into a green economy and create growth and jobs are all included within the scope. For example: a project to build resource-saving economy through energy-saving, recycling of resources and development of clean energy; a project to improve life quality and provide a convenient and comfortable living environment by establishing a green transportation network and supplying clean water; preventive projects for both future and safety of the next generation through carbon reduction and water security and projects essential for preparing for the future and improving energy efficiency including the establishment of industry/information infrastructure and technology development.

(Slide 36)

The Green New Deal Project is composed of projects with high impact on growth and job creation and high relevance with the green industry among Korean New Deal Projects, New Growth Engine projects and other green projects with high impact in job creation. Given that the New Deal Project is large-scale public investment project intended to create jobs, the main investment project in the public sector is selected.

(Slide 37)

Now, let's see the Green New Deal and Green Growth Project pursued by key ministries. The Ministry of Land, Transport and Maritime develops and refines the land space and expands green transportation infrastructure. The Ministry of Environment focuses on water recycling and wider use of green cars.

(Slide 38)

The Ministry of Knowledge and Economy is focused on developing and diffusing recyclable energy technologies through following activities.

(Slide 39)

The Korean Forest Service implements the Green Forestation Project. The Rural Development Administration implements such projects as "turning livestock excrement into resources" and "turning food waste into compost." And the Ministry of Education, Science and Technology focuses on R&D of low-carbon technologies and environmental education.

(Slide 40)

This table shows funding requirements and the projected size of job creation by the Green New Deal Project. Total number can be almost a billion. And funding could be almost $37 billion.

(Slide 41)

And now, let me explain the functions of green innovation.

(Slide 42)

Transformation to green innovation system requires three phases. Korea has just entered Phase 2 and needs to move to the green innovation system of Phase 3 for full-fledged carry-out of green growth. In Phase 3, environmentally friendly technologies are continuously created and socially accepted. Innovation in environmental technologies develops into a new growth engine and improves socioeconomic sustainability.

(Slide 43)

The green innovation system is an innovation system where characteristics of technologies to be developed, organizational activities of innovation agents and operational mechanism of markets and institutions are aligned in an environmentally friendly mode.

(Slide 44)

This diagram shows the structure and roles of the green innovation system.

(Slide 45)

System transformation approach is needed to build the green innovation system. Past innovation systems composed of highly resource-consuming technologies, organizations, markets and institutions prevented the formation of a new system. To overcome this issue and build a green innovation system, a co-evolution strategy is needed that can strengthen the environmentally friendliness of organizations and networking of innovation agents, markets and institutions.

(Slide 46)

System transformation is an ongoing activity pursued under a long-term vision. Therefore, conducting small-scale experiments first and then a roll-out will be an effective approach. Thank you very much for your attention.

【Hill】 Thank you very much, Dr. Kim, for describing for us a very ambitious transformation process. And I would like to ask if there are questions from the audience, please.

Well, while people are thinking, let me ask one question.

In your very last slide, you said small-scale experiments first and then a roll-out will be an effective approach. I guess partially that gets to an answer to my question, but you've described a beautiful systems approach to this overall challenge. How far along is Korea in achieving such a vision and approach? And what could we imagine might be the time evolution of the rolling out as we go forward?

【Kim】 Maybe you already have the answer to your question. Korea is in the initial phase of the innovation. So, some of them are already implemented in part, but most of the others are just planning in detail for implementation, to get an organization for green growth committee; under that, around 50 government officials are already organized to implement and to formulate to coordinate all the different ministries. So, we are in the process of policymaking and policy implementation altogether.

【Hill】 Thank you. Question from the lady in the red scarf.

【Question】 The Korean plan pursues economic growth through the enhancement of life and environmental quality. Does your plan contribute to the development of other nation's green growth strategies including that of the States?

【Kim】 Yes. That's why maybe, several days ago, President Barack Obama announced that Americans should learn from Korean experience. I admire that. Maybe you can remember that. Because Korea is closely linked to the natural system, Korean river water is almost clear, without pollution, so we can coordinate between New Deal and Green Growth. That's why we can select some of the green technologies, which were developed by the United States or Japan or some of the other countries. We also can develop our original green technologies. So then we can share together between the United States, Japan, China, and Korea. That's what we can do.

【Question】 It is very reasonable that the co-evolutionary process is adopted in the transformation process. Could you explain about how to coordinate the process? The Korean Ministry of S&T does not seem to play a major role in the plan. Could you also explain the role of the S&T ministry?

【Kim】 Because Korea is a small country with a rapidly changing relationship between government and business over time. That's why Korea can move faster although the United States, Japan and Korea always announce simultaneously for the green growth. But in the United States, it is very difficult to coordinate between the government and the market. In Japan, it is also a little bit different, because business has already grown up into a global market. That's why they are not under government control. But in Korea, it is easier. If the government shows the vision to business, then they can calculate their own method to survive in global market. Because Korean business is in the process of the global crisis, they are trying to restructure their items for production or items for sale. So, in the Korean case, because of the small country size and closer relationship between government and business, it is relatively easier to implement than Japan or the United States.

The Korean Ministry of Education, S&T plays a key role in the plan by development green technologies, green manpower and innovation. Mainly Korea is in the process of the science and technology development, from catch-up to post catch-up. That means we need a kind of original research. So, some of the basic research institutes already start. For the last ten years, Korean government, especially Ministry of Science and Technology, they sponsored a kind of frontier project; it included 25 projects. Among them, they developed CDMA and WIBRO and LCD like that. It is applied to Samsung Electronic Company, KT, LG etc. So we already have that kind of experience. At this moment, Korean government initiated applied science research institute and some of the others business research institute to work closely; they work already to create their own new technologies. So I think it is already started in relation with government, business altogether.

【Question】 What is the role of STEPI to pursue the green growth strategies in Korea especially related with the Presidential office?

【Kim】 Great! Top secret. Actually, STEPI belongs to the prime minister's office, but we have a kind of monthly report, weekly report, sent to the presidential office. Some of them include this kind of report from last year. I think it might have contributed to formulate this kind of policies. But in detail, maybe we can talk at dinner time.

【Hill】 Thank you very much.

Now, on the schedule, we have approximately one half hour of time, and I invite all the speakers to come back to the table here next to me and we can have some additional dialog among the speakers or additional questions from the audience. So, if you can join me here, I'd appreciate it.

Strategy for Low-carbon Green Growth in Korea

February, 2009

SukJoon Kim

STEPI 과학기술정책연구원

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II. Paradigm of low-carbon society; characteristics and dynamics

III. Korea's low-carbon green growth; vision and goals

IV. Korea's "Green New Deal Policy"

V. Functions of green innovation system

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I. Introduction

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I. Introduction (1)

STEPI

- ❑ **Existing industry/economy paradigm has aggravated global environmental issues including climate change**
  - ❖ If the current condition continues, the earth's temperature will rise by 1.1~6.4℃ by 2100 (IPCC, 2007)
  - ❖ Environmental burden on the Earth to be intensified by the rapid economic development and population growth in the developing countries
  - ❖ Human society is now at a critical juncture of migrating into low-carbon green revolution based on energy/environmental technologies after the agricultural, industrial, and information revolutions in the history of mankind

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I. Introduction (2)

- ❑ **Though it was a late-comer in industrialization, Korea has made significant achievements in industrialization as well as in information revolution based on IT**
  - ❖ However, Korea is now faced with challenges of improving environmental quality, achieving energy independence, restructuring industrial and socioeconomic structures of high-carbon society.
  - ❖ Korea needs to transform into a creative post catch-up economic model from simple catch-up and imitation-based economic mode

- ❑ **This presentation will address strategy for low-carbon green growth in Korea in the following order**
  - ❖ Paradigm of low-carbon society; characteristics and dynamics
  - ❖ Korea's low-carbon green growth; vision and goals
  - ❖ Korea's "Green New Deal Policy"
  - ❖ Functions of green innovation system

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II. Paradigm of low-carbon society; characteristics and dynamics

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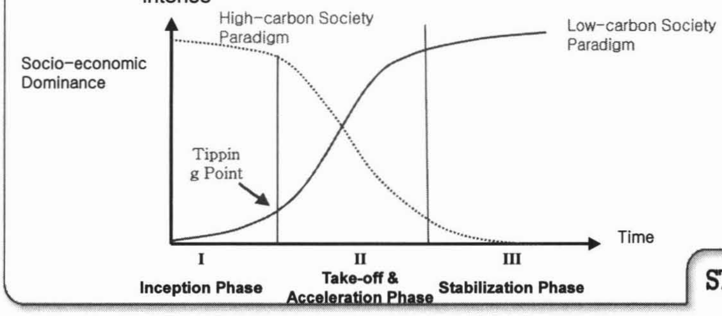
II. Paradigm of low-carbon society; characteristics and dynamics (1)

❑ **Dynamic relations in the paradigm shift from high-carbon to low-carbon society**

❖ Paradigm of low-carbon society has been created as the existing paradigm of high-carbon society has many problems

❖ Paradigm of low-carbon society should root in amidst the competition against the existing dominant paradigm of high-carbon society

⇨ During the early stage, the conflict between the two paradigms is especially intense



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II. Paradigm of low-carbon society; characteristics and dynamics (2)

❑ **During the inception phase of low-carbon society paradigm, it is disadvantaged as this new paradigm needs to root in on infrastructure and value chain of high-carbon society**

❖ Wedge roles of science and technology, policy, and civil society are needed to overcome the disadvantage of low-carbon society paradigm

⇨ Technological push: green technology
- ✓ Green technology minimizes consumption of materials and energy while utilizing recyclable and renewable materials and energy
- ✓ Green technology reduces environmental load and weakens the increase of entropy

⇨ Socio-economic pull of a new paradigm through policy

⇨ Support from civil society through education and change in mindset: bringing about change in consumption pattern

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II. Paradigm of low-carbon society; characteristics and dynamics (3)

STEPI

❖ Reaching time to "Tipping Point" from the inception phase is determined by the following two factors;
  ⇨ Gap in the socio-economic dominance between the old and the new paradigms
  ⇨ Intensity of the wedge in the new paradigm

❑ **Once the tipping point is reached, the new low-carbon paradigm rapidly expands during the take-off phase**
- ❖ Gain in market competitiveness
- ❖ Increase in job creation
- ❖ Shift in the socio-cultural superstructure including changes in consumption pattern
- ❖ Reducing policy support for low-carbon technologies that have already gained competitiveness and, instead, increasing policy support for less competitive low-carbon technologies (wedge support gradually reduced)

❑ **During the stabilization phase, both economic substructure and socio-cultural superstructure are operated under the new low-carbon paradigm**
- ❖ Paradigm reproduction structure is solidified

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II. Paradigm of low-carbon society; characteristics and dynamics (4)

STEPI

❑ **Comparison of high-carbon vs. low-carbon society paradigm**

Classification	High-carbon society	Low-carbon society
Relations between economy and environment	- Coupling: economic growth is coupled with increased load on environment - Trade-off of economy and environment	- Decoupling: economic growth is not coupled with increase in environmental load - Economy is operated within the limit of environmental capacity
Use of resources vs. knowledge	- Resource-intensive	- Knowledge-intensive
Goals of environmental management	- Environmental performance - Satisfying environmental standards	- Environmental sustainability - Consideration of future generation - Social sustainability is also relevant
Focus of management	- Supply-side	- Demand-side
Innovation system	- Innovation system focused on resource consumption - Innovation system based on catch-up mode	- Green innovation system focused on human and value - Creative innovation system

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II. Paradigm of low-carbon society; characteristics and dynamics (5)

STEPI

❑ Comparison of high-carbon vs. low-carbon society paradigm(continued)

Classification	High-carbon society	Low-carbon society
Framework of game	- Competition - Zero-Sum	- Mutual benefit - Win-Win
Ownership relations	- Ownership emphasized	- Sharing emphasized (e.g.: "Velib", a bike pool in Paris)
Development index	- GDP	- Green GDP - Social/ecological/economic indices
Technology/ process/product competitiveness	- Price and quality	- Price and quality - Degree of Greening*
Energy source	- Fossil fuel energy	- Renewable energy
Material source	- Petrochemical-based material	- Bio-based material

* Low energy + low material + low pollution exhaustion + long life span + dematerialization

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II. Paradigm of low-carbon society; characteristics and dynamics (6)

STEPI

❑ Comparison of high-carbon vs. low-carbon society paradigm(continued)

Classification	High-carbon society	Low-carbon society
Main technology level	- High-Tech	- High-Tech - Low-Tech
Key industry	- Petrochemical-based industry - Manufacturing - IT - Finance	- Energy/environment - Energy/environment + IT - Knowledge-based service
Booming market	- Manufacturing market - IT and other new technology market - Financial market	- Carbon market - Energy/environment market (including water) - Markets where emerging technologies are related with energy/environmental industries (e,g.: IT)
Socio-economic structure	- Centralization - Focus on central government	- Decentralization - Focus on local autonomy
International relations	- Standing issues between South and North - International relations dominated by advanced countries	- Cooperation between developed and developing countries on global issues - Multilateral cooperation

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III. Korea's low-carbon green growth; vision and goals

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III. Korea's low-carbon green growth; vision and goals(1)*

❑ **President Lee Myung-bak emphasized Korea's efforts to reduce greenhouse gas at the G8 summit meeting held in Hokaido, Japan (July 9th, 2008)**

- ❖ Korea actively joins with the global community in realizing the target of reducing greenhouse gas by half by 2050 and plans to announce the medium-term target for greenhouse gas reduction by 2020 next year based on the public consensus
- ❖ Technology development to reduce greenhouse gas will become a new growth engine that will lead the economic growth by creating new markets and jobs
- ❖ Korea will become an early-mover in the field of climate change and energy
- ❖ Key challenges in establishing "Post-2012 Earth Climate Change Framework" include presenting clear mid-term reduction targets for developed countries and introducing incentive system for developing countries, which will help achieve "green growth" and migrate to the "low-carbon society" where economic growth is coupled with greenhouse gas reduction
- ❖ Propose the establishment of the "Climate Partnership in East Asia" mainly participated by East Asian countries

* Developed based on Prime Minister's Office (2008)

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III. Korea's low-carbon green growth; vision and goals (2)

- **President Lee Myung-bak announced "Low-Carbon Green Growth" vision on August 15th, 2008, commemorating the 60th anniversary of the country's foundation**
  - ❖ Sustainable growth reducing greenhouse gas and environmental pollution
  - ❖ New development paradigm creating jobs and new growth engines with using green technology and clean energy

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III. Korea's low-carbon green growth; vision and goals (3)

- **Green growth is a growth model of a new paradigm which pursues both "growth" and "environmental conservation" at the same time**
  - ❖ **In the existing economic theories, growth and environment are in contradicting relations**
  - ❖ **Pursue to realize the new paradigm by improving eco-efficiency, changing consumption patterns, and strengthening knowledge-intensive service**

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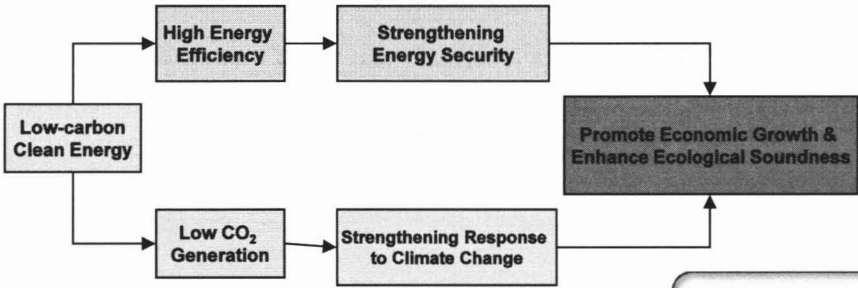
III. Korea's low-carbon green growth; vision and goals (4)

❖ **Low-carbon green growth: new development strategy turning the current "vicious cycle" among energy, economy, climate, and eco-system into the "virtuous cycle"**

< Low-carbon green growth paradigm>



Source: Prime Minister's Office (2008)

III. Korea's low-carbon green growth; vision and goals (5)

❑ Korea is a birthplace of green growth strategy

❖ **Green growth was first adopted as a sustainable development strategy for the Asia-Pacific region at the 5th MCED Asia-Pacific Environmental Development Meeting of the UN ESCAP held in Seoul in March, 2005 and it was also the first occasion where the UN adopted green growth strategy**

❖ **Since 2006, the "Seoul Initiative for Green Growth" has been diffused throughout the Asia-Pacific region**

III. Korea's low-carbon green growth; vision and goals (6)

❑ **Rationale of implementing low-carbon green growth in Korea**

❖ **Energy issues**

⇨ Dependency on overseas energy sources: 97%

⇨ Petroleum import: ranked 4th in the world

⇨ CO_2 emission: 6th among OECD countries and 1st in terms of growth rate

❖ **Environmental issues**

⇨ ESI (Environmental Sustainability Index): ranked 122th in the world (2005)

❖ **Identifying new growth engines and creating jobs**

⇨ Continuous decline of potential growth rate

⇨ Decrease in jobs for youth

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III. Korea's low-carbon green growth; vision and goals (7)

❑ **Three axes of green growth vision**

❖ **Green growth as a future national vision creating "triple effects"**

⇨ New development by securing new growth engines

⇨ Improving Koreans' life quality as well as environment

⇨ Contribution to the efforts of the international society

Source: Prime Minister's Office(2008)

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III. Korea's low-carbon green growth; vision and goals (8)

❑ Three elements of green growth

3 elements	Description
Minimize energy consumption while pursuing solid growth	• Pursue industrial restructuring focused on low energy consuming industries (focus shifted from manufacturing to knowledge-based service) • Save energy consumption and improve energy efficiency • Improve the eco-efficiency
Minimize environmental load such as CO_2 emission while using energy resources	• Develop/diffuse clean energy including new renewable energy • Strategically utilize low-carbon energies • Establish a mechanism to reduce CO_2 emission • Build low-carbon/environment-friendly infrastructure • Promote consumers' purchasing of green products
Develop new growth engines	• R&D investment in green technologies • Develop green industries like new renewable energies and promote them as export industry • Support the increase in global market share

Source: Prime Minister's Office (2008)

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III. Korea's low-carbon green growth; vision and goals (9)

❑ Various policy measures presented by the Korean government to achieve the "low-carbon green growth"

- ❖ Strengthen support for financial and funding allocation policy as more than 23 billion dollars* is expected to be required over the next 5 years
- ❖ Plan to invest total 3.7 billion dollars by 2012 by increasing R&D investment by more than two times in core technologies like thin film solar cell and large wind generator

* US$ 1 = KR¥ 1350

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III. Korea's low-carbon green growth; vision and goals (10)

- **Goal: Secure energy independence and reduce greenhouse gas**
  - Move away from the past input-oriented growth model and pursue decoupling of economic growth from environmental pollution through low-carbon environment-friendly policies
    - ⇨ Maximize efficiency of resource utilization and minimize environmental pollution

<Five visions for green growth in the National Energy Master Plan> (2006-2030)

5 visions	Index	2006	2030
Realize energy-independent society	Independent development rate	3.2%	40%
	Penetration rate of new renewable energy	2.2%	11%*
Transform into low energy consuming society	Energy intensity	0.347	0.185
Transform into post-petroleum society	Petroleum dependency	43.6%	33%
Realize co-prospering energy society	Energy-poor population rate	7.8%	0%
Creating jobs and new growth engines	Energy technology level	Compared with advanced countries 60%	World top class

* Require investment of 74 billion dollar

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III. Korea's low-carbon green growth; vision and goals (11)

- **Goal: Develop green technologies and turn them into new growth engines**
  - **Green Technology (GT): a wide range of technologies including those responding to climate change and energy/resources/environmental technologies**
    - ⇨ Market size of green technology estimated at 2.3 trillion dollar in 2020
    - ⇨ R&D investment in green technology to be increased by more than 2 times
  - **Develop/promote fusion green technology combining IT, BT, and NT to form export industry**
    - ⇨ 6 major Korean conglomerates are planning to invest about 5.9 billion dollar in green energy as of October, 2008
  - **Need to secure breakthrough technologies to compete with advanced countries who are dominating core green technologies**
    - ⇨ Green home technology using natural energy (ET+NT+IT+BT) → GT: Solar cell/super-adiabetic windows/integrated maintenance network/ self-cleaning electronics
    - ⇨ Technology to develop and apply hydrogen energy (ET+NT+IT) → GT: Produce/store hydrogen using biomass and solar energy and develop green car applying fuel cell

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III. Korea's low-carbon green growth; vision and goals (12)

- Goal: Restructure transportation, architecture, cities, and land to be suitable for green growth

- Goal: Pursue low-carbon life revolution
  - Emphasize role of consumers as a driving force for green growth
  - Pursue total life improvement in food, clothing, and housing
  - Actively collaborate with NGOs
  - Implement carbon-neutral at government events

- Goal: Pursue green education and cultural policy
  - Diffuse green culture campaign using media and education
  - Focus on "green" concept as a core element of culture/tourism industry

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III. Korea's low-carbon green growth; vision and goals (13)

- A draft of the "Basic Act on Green Growth" was developed to provide legal and institutional support for low-carbon green growth
  - **Establish "Green Growth Committee"**
  - **Develop and implement the national green growth strategy**
    - ⇨ The 'National Strategy for Green Growth" to be developed and implemented through the deliberation of the Green Growth Committee and the Cabinet Meeting, which includes policy goals, implementation strategies, and key initiatives to realize low-carbon green growth
  - **Develop and support green economy and green industries**
    - ⇨ Identify and develop new green industries with high growth potential and facilitate a gradual migration to green economy and industry

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III. Korea's low-carbon green growth; vision and goals (14)

❖ **Operate environment-friendly tax system**

⇨ Increase tax on goods and services that cause environmental pollution, and create greenhouse gas with low energy efficiency
⇨ Operate tax policy in the direction to reduce the inefficiency of resource allocation

❖ **Develop "Energy Master Plan" and "Basic Plan Responding to Climate Change"**

⇨ The "Basic Plan responding to Climate Change" and the "Energy Master Plan" to be developed and implemented through the deliberation of the Green Growth Committee and the Cabinet Meeting, which includes mid/long-term greenhouse gas reduction targets, reduction measure by area and by phase, effective energy demand management, and stable energy supply

❖ **Set and manage mid/long-term targets and targets by phase**

⇨ Set mid/long-term targets as well as targets by phase and develop supportive measures including management support and technical advice to achieve greenhouse gas reduction, energy saving, energy independence, improved energy efficiency, and increased penetration of new renewable energy

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III. Korea's low-carbon green growth; vision and goals (15)

❖ **Establish and operate total information management system and reporting system on greenhouse gas emission**
⇨ For companies with high greenhouse gas emission and high energy consumption, their greenhouse gas emission and energy consumption volume are reported to the government
⇨ Total information management system on greenhouse gas to be established and operated by the government

❖ **Introduce "Cap-and-Trade System"**

⇨ Allocation methods, registration and management methods, opening and operation of trade centers, and timing of the opening to be specified in a separate law

❖ **Build a consensus when developing plans relevant to green growth**

⇨ When developing green growth related plans including the S&T Mater Plan and the National Land Plan, seek for feedback from the Green Growth Committee

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III. Korea's low-carbon green growth; vision and goals (16)

- The Green Growth Committee to be co-chaired by Prime Minister and an expert from the private sector with total 50 members both from public and private sectors

  - ❖ Natural members from the public sector include ministers of relevant ministries and those designated by the presidential order

    ⇨ Minister of Strategy and Finance, Minister of Knowledge and Economy, Minister of Environment, Minister of Land, Transport and Maritime Affairs

  - ❖ Member from the private sector to be appointed by President among leading figures in the fields of economy, industry, society and culture, who have relevance to green growth topics such as climate change, energy, and sustainable development

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III. Korea's low-carbon green growth; vision and goals (17)

❖ The functions of the three existing committees, the Committee on Climate Change, the Energy Committee, and the Sustainable Development Committee, were merged into the Green Growth Committee

⇨ The Green Growth Committee is a higher-level committee coordinating all the green growth-related policy functions while the existing committees were mainly playing the role of an execution body

⇨ Develop the national strategy for green growth and other key national basic plans, decide key policies (national reduction target, negotiation strategy, energy supply/demand policy), and check and manage implementation progress

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III. Korea's low-carbon green growth; vision and goals (18)

- **The National Strategy for Green Growth to be reviewed by the Green Growth Committee**
- **The National Strategy for Green Growth is a higher-level strategic plan giving the national policy direction for pursuing low-carbon green growth**
  - ⇨ Give direction for plans by area such as green economy and industry, climate change, energy, and sustainable development

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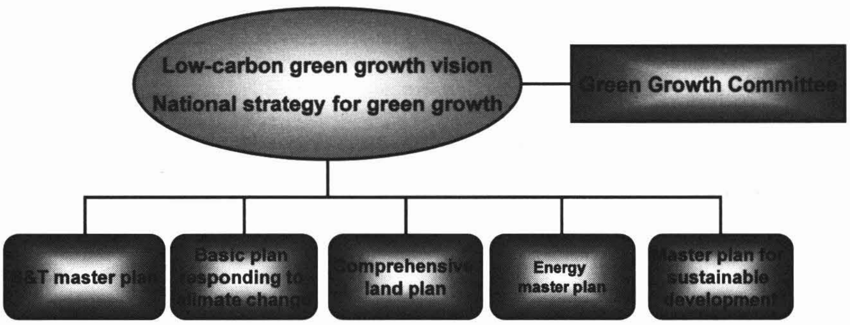
III. Korea's low-carbon green growth; vision and goals (19)

❑ **Positioning of vision and strategy for green growth in the national development plan**



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IV. Korea's "Green New Deal Policy"

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IV. Korea's Green New Deal Policy* (1)

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- ❑ Korea's Green New Deal Policy is aiming at specific achievements like creating jobs and potential growth engines by simultaneously pursuing both "Green" and "New Deal"
  - ❖ Develop "Green New Deal Project" by combining job creating policies with green growth strategy like low-carbon, environment-friendly growth and energy saving
  - ❖ Maximize policy impact by systematically integrating overlapping green projects without clear orientations, and lead the realization of green economy and the conservation of earth's environment

* Developed from The Ministry of Education, Science and Technology et al. (2008)

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IV. Korea's Green New Deal Policy (2)

STEPI

- Scope of "Green New Deal": projects that can facilitate transformation into a green economy and create growth and jobs
  - ❖ Projects to build resource-saving economy through energy saving, recycling of resources, and development of clean energy
  - ❖ Projects to improve life quality and provide convenient and comfortable living environment by establishing green transportation network and supplying clean water
  - ❖ Preventive projects for earth's future and safety of the next-generation through carbon reduction and water security
  - ❖ Projects essential for preparing for the future and improving energy efficiency including the establishment of industry/information infrastructure and the technology development

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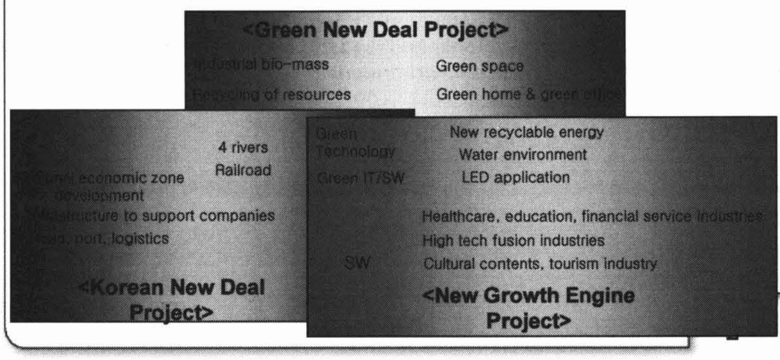
IV. Korea's Green New Deal Policy (3)

STEPI

- Relations with other policies/strategies
  - ❖ Green New Deal Project is composed of ① projects with high impact in growth and job creation and high relevancy with green industry among "Korean New Deal" projects and "New Growth Engine" projects and ② other green projects with high impact in job creation
  - ❖ Given that "New Deal Project" is large-scale public investment project intended to create jobs, mainly select investment project in the public sector



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IV. Korea's Green New Deal Policy (4)

STEPI

❑ **Green New Deal and Green Growth Projects by key ministries**

❖ **The Ministry of Land, Transport, and Maritime Affairs develops and refines the land space and expands green transportation infrastructure**

⇨ Revamp areas exposed to disasters, turn the area along the rivers into green, recover rivers
⇨ Construct and supply "Green Home"
⇨ Build a nationwide network of bicycle lanes and expand public transportation and railroad networks
⇨ Form "Eco-Road"

❖ **The Ministry of Environment focuses on water recycling and the expanded use of green car**

⇨ Recycle sewage treatment water
⇨ Increase the penetration of green car

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IV. Korea's Green New Deal Policy (5)

STEPI

❖ **The Ministry of Knowledge and Economy is focused on developing and diffusing recyclable energy technologies**

⇨ Increase the penetration of bio-ethanol vehicles

⇨ Turn bio-mass into energy: sea algae, wood fiber

⇨ Develop and apply energy saving technologies with medium to large size

⇨ Separation and recovery of carbon dioxide

⇨ Develop and diffuse renewable energy technology like photovoltaics

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IV. Korea's Green New Deal Policy (6)

- **The Korea Forest Service implements the "Green Forestation Project"**
  - ⇨ Forestation, recovery of damaged forests, and prevent forest disasters
- **The Rural Development Administration implements such projects as "turning livestock excrement into resources" and "turning food wastes into compost"**
- **The Ministry of Education, Science and Technology focuses on R&D of low-carbon technologies and environmental education**
  - ⇨ Develop high-efficiency hydrogen energy technology
  - ⇨ Develop next-generation super-conductor application technology
  - ⇨ Develop technologies to reduce and treat carbon dioxide

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IV. Korea's Green New Deal Policy (7)

❑ Green New Deal Project; funding requirements and expected size of job creation

	Project	Funding requirements ($100 mil.)			Jobs to be created		
		Already reflected (2009)	Additional requirement (~2012)	Total	Already reflected (2009)	Additional requirement (2012)	Total
Total		32.32	338.42	370.73	93,360	863,060	956,420
Nine key projects	Revive 4 rivers	3.62	103.63	107.24	7,000	192,960	199,960
	Build green transport network	13.59	57.92	71.51	25,042	113,025	138,067
	Build integrated national land information system	0.19	2.57	2.75	816	2,304	3,120
	Rain discharge facilities and small/medium-sized dams	1.37	5.61	6.98	3,063	13,069	16,132
	Supply green car and clean energy	2.38	12.83	15.21	1,643	12,705	14,348
	Recycle wastes	0.37	6.51	6.89	2,377	13,819	16,196
	Green forestation	2.32	15.59	17.91	22,498	148,204	170,702
	Green home and green school	-	59.63	59.63	-	133,630	133,630
	Eco-river	0.04	3.55	3.58	393	10,396	10,789

Source: The Ministry of Education, Science and Technology and et. al. (2008)

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V. Functions of green innovation system

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V. Functions of green innovation system

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❑ **Three phases in the transformation to a green innovation system**

Phase 1		Phase 2		Phase 3
End-product management		Preventive approach		Systematic approach
-Present regulations and economic incentives to manage "end of pipe" for the purpose of reducing emission of pollutants	→	-Develop technologies that can prevent environmental problems in advance through process/product innovation	→	-Establish green innovation system where environment-friendly innovation is continuously created and socially accepted

❑ **Korea has just entered Phase 2 and needs to move to the green innovation system of Phase 3 for a full-fledged carry-out of green growth**

- ❖ **In Phase 3, environment-friendly technologies are continuously created and socially accepted**
  - ⇨ Innovation in environmental technologies develops into a new growth engine and improves socio-economic sustainability

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V. Functions of green innovation system (2)

STEPI

❑ Green innovation system is an innovation system where characteristics of technologies to be developed, organizational activities of innovation agents, and operational mechanism of market and institution are aligned in an environment-friendly mode

- ❖ **Characteristics of technologies**
  - ⇨ Technology innovation driven by environment-friendly technology paradigm
  - ⇨ Efforts to promote environment-friendly R&D
  - ⇨ Environment-friendliness considered as an important criteria in selecting and evaluating government R&D projects
- ❖ **Organizational activities of innovation agents**
  - ⇨ Environment issue is not recognized as a regulatory factor but as a business opportunity as environment-oriented organizational structure is established at universities, research institutes, and companies
  - ⇨ Environmental values are placed as important criteria for decision-making at organizations
- ❖ **Market and institution**
  - ⇨ Market structure and incentive system that can facilitate environment-friendly innovation

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V. Functions of green innovation system (3)

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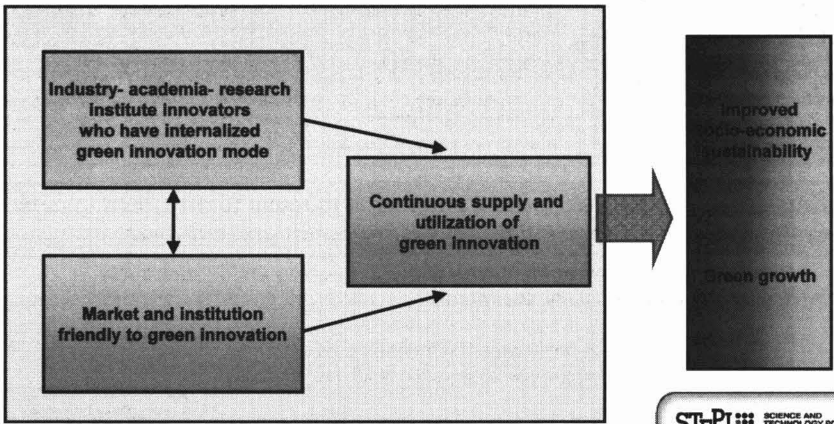
❑ Structure and roles of green innovation system

< Green Innovation System >



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V. Functions of green innovation system (4)

STEPI

- "System transformation" approach is needed to build green innovation system

  - ❖ Past innovation system composed of highly resource-consuming technologies, organizations, market and institution tends to prevent the formation of a new system

  - ❖ To overcome this and build a green innovation system, co-evolution strategy is needed that can strengthen environment-friendliness of organizations and networking of innovation agents, market and institution

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V. Functions of green innovation system (5)

STEPI

- ❖ System transformation is on-going activities pursued under a long-term vision. Therefore, conducting small-scale experiments first and then a roll-out will be an effective approach

  - ⇨ Strategic niche management; develop niches (regions, fields) that form new technology, organization, and institution, and roll-out them effectively
  - ⇨ Co-evolution process; involving not only technology development but also innovation agents, institution and market that are relevant to the issue of social acceptance
  - ⇨ Successfully implement pilot projects in some regions or fields through cooperation between innovation agents (industry, academia, and research institutes) and regional society
  - ⇨ Use national R&D project or regional development project like Eco-City Project as the subject of experiment
  - ⇨ Building a green platform is an effective means by which various innovation agents can discuss the development vision and concrete directions of innovation system and identify options, thus ensuring the sustainability of the project

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Discussion

Discussion

【Hill】 I think we could perhaps start this panel discussion by asking the members of the panel if any panel member would like to ask any other panel member a question, or explain to them the correct answer to their own question from before, as the case might be. So, do you have any question from the panel or discussion you would like to ask each other?

【Okuwada】 Thank you. At first, in Japan, we would like to make some strategy for the green issues, of course. I would like to ask Dr. Kim. In your Green New Deal, do you expect some startups or enterprises from your New Deal policy? For example, please compare with the policy or strategy in the existing industry.

【Kim】 Well, until the end of 2008, six conglomerates of Korea tried to invest around US$5.6 billion, including Samsung Electronics, LG, SK, like this. Even the chairman of the SK announced that he would invest US$1 billion within five years.

【Hill】 Other questions from the panel? Maybe, while you're thinking about a question to ask, I will ask the audience if you have additional comments or questions. Sir?

【Question】 (re-stated by Prof. Hill) Various countries talked about enhancing collaboration. How will that happen, or is this a change from the prior situation?

【Kim】 As the microphone is in my hand, I will respond first for the Korean case.

【Hill】 So he's a politician. (laughter)

【Kim】 I was. Not now.

Between the government, universities and business, their collaboration is always working well in Korea, but their relationship is different. I mean, during the early '60s, '70s and '80s, the government almost dominated their collaborations. But in and after the beginning of 2000 the role of university and the business increased rapidly. Even the Lee Myung Bak government merged Ministry of Science and Technology and Ministry of Education in MEST. That means for science and technology the role of a university and the role of business became much more increased than that of the role of the government. This is the short response to your question.

【Wada】 As I mentioned in my presentation in relation about industry-academia cooperation, there has been considerable progress in development of improvement of the intellectual property rights protection at universities. Consequently, there has been a steady increase in the number of industry-academia joint research projects and industry-funded, industry-contract research projects, resulting in a growing number of patents applied for and licensed by universities. Some of these patents have resulted in remarkable successes, but the cumulative total of patent applications filed between 2003 and 2006 indicate that relatively little progress has been made in the application of the patents. The challenge of the future is to file patent applications for quality inventions and strategically obtained intellectual property rights.

【Okuwada】 Can I add some words? As he said, the increasing of such collaboration is dramatic, but still the growth is not enough in Japan. So we are now still at low level of the collaboration. So we would like to promote more and more such collaboration. Still now we are at low level.

【Mu】 In China, there is a trend for cooperation between industries, universities, and research institutions to move from the stage of commercialization of research results obtained by the scientific communities to the stages of technology development and even further. This is a new phenomenon, and , I think this is different in China than in other countries. Research institutions in China are relatively powerful. For example, in the Chinese Academy, we have 100 research institutions. Therefore, nowadays, in China, an issue of ongoing debate is whether to follow the United States' model, that is, many researchers in universities, or to follow the model of the former Soviet Union's research academies. However, I have just heard that Korea aspires to expand university-based research. Am I to understand that this means there will be increasingly less research undertaken in institutions and more in universities?

【Kim】 Yes, Korean expenditures currently go more into universities than to the governmental research institutes. Also they are competing with each other for funding. Also, President Lee is preparing for a huge basic research institute that remains unnamed at present, but proposed is ABSI, Asia Basic Science Institute. Investment will be around US$2 billion; also it will recruit around 2,000 Ph.D.'s., some will be from abroad and some will be from the universities. So, it is very active field.

【Okuwada】 Can I add some words? It's just my view, but this current recession will promote such collaboration. Because investment for R&D in industry will be decreasing, so the company also wants to have some collaboration between government or universities or someone. So, it's my view that this recession will change the collaboration situation. It's my hope.

【Hill】 Very interesting. Thank you. Do we have another question from the audience? Let me take the gentleman toward the back.

【Question】 (re-stated by Prof. Hill) In the case of each country, what kind of mechanism do you have in place for assessing and evaluating how well the plans turn out over time? Also, do you discuss among the three countries, in your dialog, techniques and methods for ex post evaluation? So, perhaps we could just start with Japan, because they've been doing this at least for more than 30 years.

【Okuwada】 In Japan case, as I said in my slides, assessment and foresight shoud be going simultaneously. Because, for example, we are now doing the assessment for the 3rd Basic Plan, it's the current Basic Plan. And this discussion will be continuing to the preparation for the next Basic Plan. On the follow-up process, we could make future strategies.

【Mu】 In China, I think we have technological foresight, but no official technology assessment activities, because of less government demand. Consequently, there are several scholars' studies concerning these issues, but no such activity like the OTA in the United States.

【Kim】 Yes, in Korea, we have both functions—technological foresight as well as assessing technologies. Actually, STEPI and KISTEP were in the same body. It was divided into two, 10 years ago to have more function to assess the technology. KISTEP is assessing the technologies. And also, the other ministries, like defense and agriculture and health and industry, they also have a kind of this assessment to evaluate their own technologies, while STEPI focuses on policy advice and technology foresight.

【Mu】 I wish to add another point here. My institute is responsible for evaluating the performance of the research institutions within the Chinese Academy. Thus, this is a form of evaluation of technology, but not an outright assessment of technology.

【Hill】 Thank you. Other questions?

【Question】 (re-stated by Prof. Hill) What is the keyword of each country?

【Kim】 Maybe I know your question. In Korea, the last government had a kind of IT policy like IT-839. You mean this kind of keyword?

In Korea, overall, as already presented, the 577 Initiative is Korean science and technology and investment plans. Also, in addition to this one, currently, we have a kind of Green New Deal. This is a kind of keyword, or title of that. Does this answer the question?

【Wada】 It's a good question. I think I explained in my presentation that we have made a Science and Technology Basic Plan. Of course, these goals and areas are very important point, but I focused on in my presentation that there are three points of my keyword. In my opinion, our direction in Japan should be: one is basic research; and second one is international competitive technology development; and third one is contribution to global problems.

【Mu】 China has maybe three keywords. The first one is human beings. There is a focus on human beings, and we must meet their demands. The second keyword is development, both economic and social. The third one is sustainability. These are China's keywords.

【Hill】 Let me answer for the United States also on this. I think our answer is: Yes, we can! (laughter)

Another question? Nagano-san.

【Question】 (re-stated by Prof. Hill) From China and Korea, how might the present worldwide financial crisis influence the goals and the implementation of the policies you've described here today.

【Kim】 Yes. For the Korean case, we have two imminent goals. One is creating jobs; the other one is improving national competitiveness. So, for that purpose, in my presentation, Slide 40 shows the entire list and how many jobs are created, and how much money is invested. Thank you.

【Mu】 Yes, it is difficult to answer. To my understanding, three measures issued by the government may be important. First, as our Korean colleague has mentioned, to create jobs by increasing the investment in infrastructure and so on. Second, I think, is to strengthen the investment in innovation and capacity building. The volume of investment in capacity building is not large, but is still very important. The third one, I think, is to increase the number of graduate students, perhaps, to train future talent of the future. I think the third one is the most important.

【Wada】 Sorry, Nagano-san knows the Japanese situation, but I would like to speak about the Japanese situation. You know major companies of Japan expect a loss in March, 2009, at the end of the fiscal year 2008. For example, Toyota is expecting to be minus 350 billion yen and Hitachi, minus 700 billion yen, and Sony is minus 150 billion yen. So, we are afraid that these companies will decrease their R&D expenditure next year compared to that of last year. Private companies will maybe decrease their investment to the basic research. We feel it is necessary for the basic research of private companies to be supported by the government section. As Okuwada-san mentioned, we need to strengthen industry-academia-government cooperation, and also I think an open innovation system might be useful in that case. So we are now studying in our institute.

【Hill】 Thank you. This is a major challenge for all of us to catch up and restore our vitality.

We have essentially run out of time for our session. And Ms. Mitsumori, do you want to say anything further in closing this session?

By the way, of course, Ms. Mitsumori was the organizer who did all of the work to make today possible. So I think we should first thank her for her personal contribution. (clapping of hands)

【Mitsumori】 Thank you very much for attending the trilateral symposium today. It took one year for us to prepare for the symposium. So I'd like to express my gratitude to five great speakers today and also today's moderator, Dr. Hill, and also some international staff from the five research institutes, including Mr. Thomas Youn at KISTEP, Ms. Eun Joo Kim at STEPI and the other staff at CASIPM and CASTED. Most importantly, I'd like to say thank you to today's participants. Thank you very much.

--- End of Session ---