Japan's New Science and Innovation Policy under the Changing World

January 12, 2011 in Washington D.C.

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Tokyo, Japan

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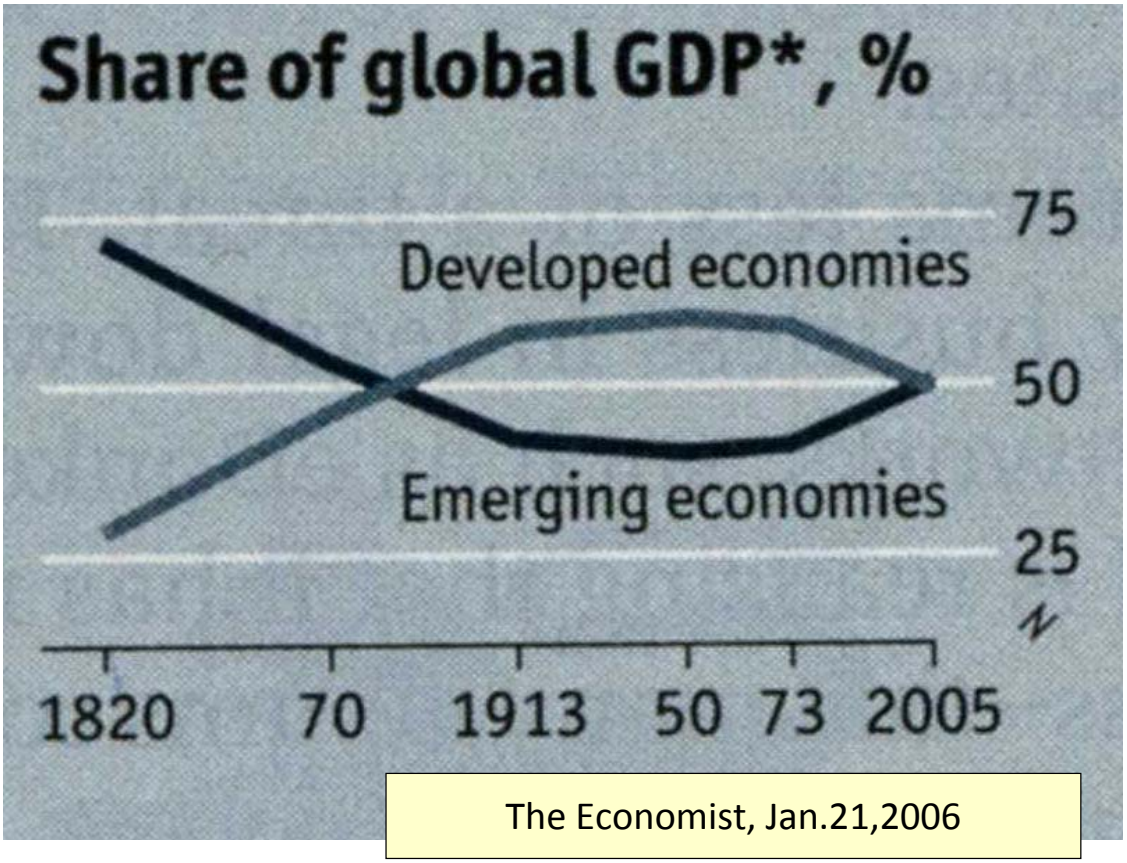


The Economist, Jan.21,2006

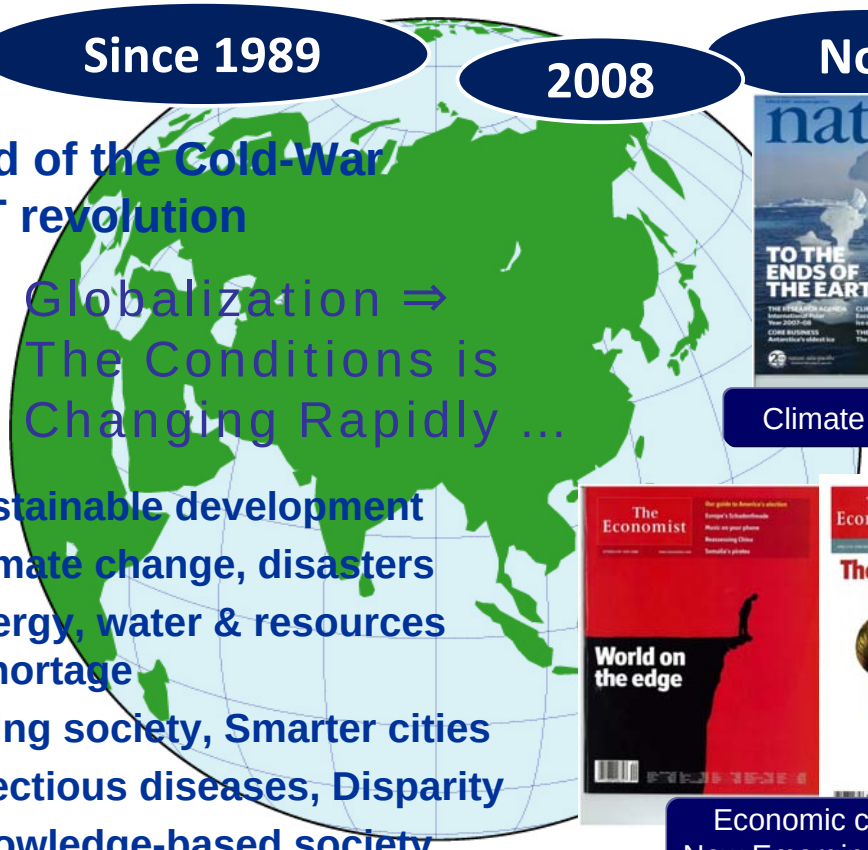
Since 1989

2008

Now

End of the Cold-War
ICT revolution

Globalization ⇒
The Conditions is
Changing Rapidly …



Climate change

Economic crisis &
New Emerging market

- Sustainable development
- Climate change, disasters
- Energy, water & resources shortage
- Aging society, Smarter cities
- Infectious diseases, Disparity
- Knowledge-based society

Since 1989

The Rules of games are Changing !!
Innovation & Entrepreneurship
Globalization and Localization
Shaping the Post-Crisis World
Shaping the Values and Leadership
Principles for a Post -Crisis World
Catalising the Next Wave of Growth
through Science & Innovation
Rethink, Redesign and Rebuild
Green New Deal & Smart Ageing Society
Global Management & Governance of
Enterprises and S& I

Economic crisis &
New Emerging market

Contents

Innovation is the key in the world - accelerating at a stretch（2004～）-

Trends of Innovation Policy in US

○Council on Competitiveness (December 2004)

"Innovate America" : Palmisano Report

・Target Countries：China, India

・"innovation as the intersection of invention and insight, leading to the creation of social and economic value »

*improve quality of life *new forms of conveniences

*gives rise to new industries and markets

*compete on traditional cost and quality terms

*ability to create new value

○National Academy of Sciences (October 2005）

"Rising above the gathering storm": Augustine Report

detailed design：Human resources development, R&D investment, Restructuring society's Infrastructure

Rapid growth of "BRICs" (Goldman Sachs, Oct. 2003)

→ Reference:

・" Sputnik shock"; Soviet Union, 1957-. PCAST, OST, NASA, DARPA, GI bill etc.

・US & Japan trade friction; 1980's , "Young Report", univ-industry collaboration, pro-patent policy, high-technology etc.

・State of the Union Address by President Bush (January 2006)
'American Competitiveness initiative' , 'Advanced Energy Initiative'
・The America Competes Act (August 2007)
・2008 two crises : Financial Crisis and Global Warming
・Inauguration of Obama Administration : respect S&T, Green Innovation etc.

○ Global competition of science & innovation policy

・Science and Technology Policy ⇒ Science, Technology and Innovation Policy
・R&D investment & reform of system
・Innovation : technological and social Innovation
national & local to regional & global
・Innovation for what? New age of innovation

○OECD:"New Innovation Strategy " May 2010

○Japan : New Science & Innovation Policy

・Democratic Party of Japan came into power in July 2009.
・Japan's new Gov. finalized its next 5 year (2011-2015) basic plan in December 2010.

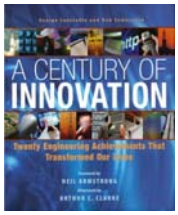
20 big innovations in the 20th century

National Academy of Engineering, 1999

("A Century of Innovation: Twenty engineering achievements that transformed our lives by G.Constable, B.Somerville, 2003)

1. **Electrification**
2. **Automobile**
3. **Airplane**
4. **Safe and Abundant Water**
5. **Electronics**
6. **Radio and Television**
7. **Agricultural Mechanization**
8. **Computers**
9. **Telephone**
10. **Air Conditioning and Refrigeration**

11. **Interstate Highways**
12. **Space Exploration**
13. **Internet**
14. **Imaging Technologies**
15. **Household Appliances**
16. **Health Technologies**
17. **Petroleum and Gas Technologies**
18. **Laser and Fiber Optics**
19. **Nuclear Technologies**
20. **High Performance Materials**



What kinds of innovations in the 21st century
⇒ sustainability & green ,
well-being & QOL, smart aging society

How to measure the values of states in 21st century

○Hard power:

military power, economic power

○Soft and smart power:

quality of life, environment, health, safety, peace, education, culture, science & technology, university, intellectual network, connectivity, science diplomacy

＊From industrial society to knowledge-based society:

intangible assets, brains, R&D, brand, design, network & connectivity

＊ Globalization;

both developed & emerging countries.

x. The Commission on the Measurement of Economic Performance and Social Progress (Sept.14,2009); STIGLITZ, Amartya SEN, FITOUSSI,
*Classical GDP + Quality of Life + Sustainable Development and Environment

Innovation for what in the 21st century ?

○Innovation for profit

○Innovation for competitiveness

○Innovation for growth

○Innovation for employment

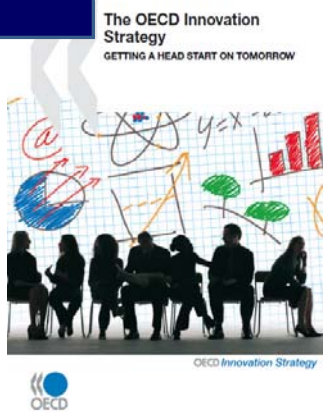
○Innovation for wellbeing & quality of life

○Innovation for safety, security & social cohesion

○Innovation for sustainable development

Innovation horizon is expanding,
both in the developed & emerging economies
Science and technology policy is changing.

" OECD New Innovation Strategy ", May 2010
- Getting a head start on tomorrow -



The broad concept of innovation embraced by the OECD Innovation Strategy emphasises the need for a better match between supply-side inputs and the demand side, including the role of markets. Moreover, policy actions need to reflect the changing nature of innovation.

* Broadening policies to foster innovation beyond science and technology in recognition of the fact that innovation involves a wide range of investments in intangible assets and of actors.

* Education and training policies adapted to the needs of society today to empower people throughout society to be creative, engage in innovation and benefit from its outcomes.

* Greater policy attention to the creation and growth of new firms and their role in creating breakthrough innovations and new jobs.

* Sufficient attention for the fundamental role of scientific research in enabling radical innovation and providing the foundation for future innovation.

* Improved mechanisms to foster the diffusion and application of knowledge through well-functioning networks and markets.

* Attention for the role of government in creating new platforms for innovation.

* New approaches and governance mechanisms for international cooperation in science and technology to help address global challenges and share costs and risks.

* Frameworks for measuring the broader, more networked concept of innovation and its impacts to guide policy making.

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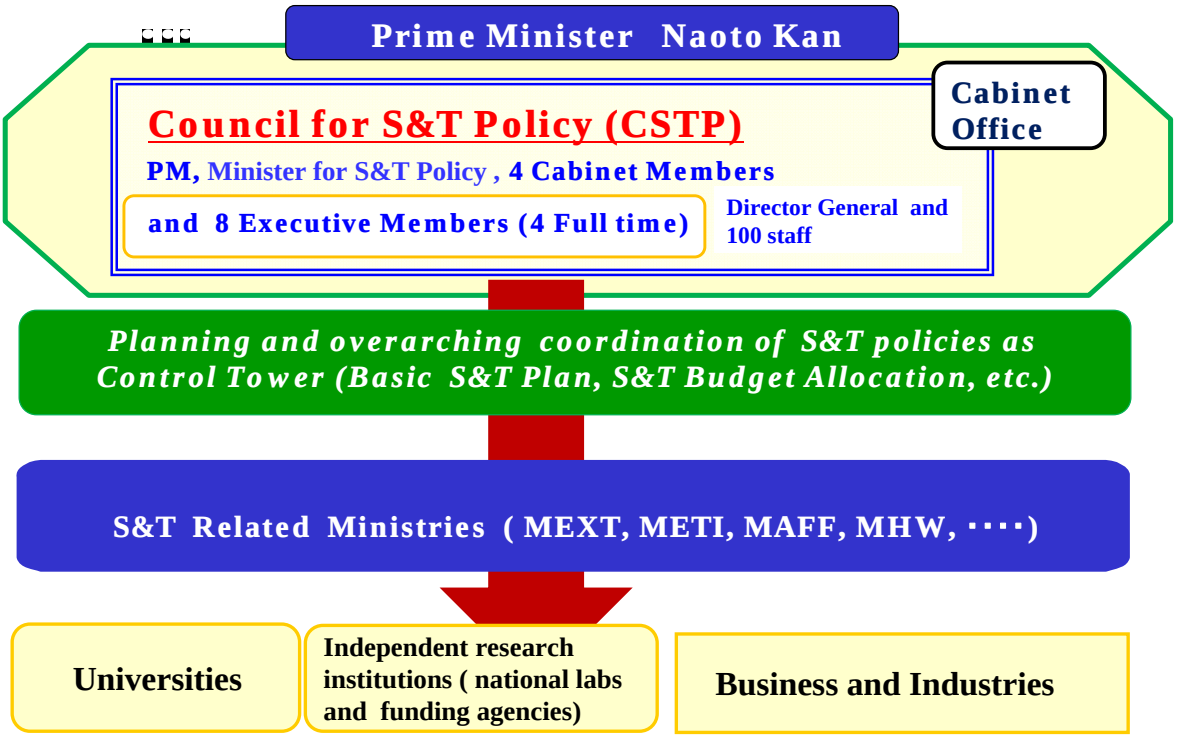
Structure of Japan's S&T Policy Decision Making



Legal framework : S&T Basic Law and Basic Plan

Science and Technology Basic Law（enacted unanimously in 1995）

1st Basic Plan (FY 1996-2000)

2nd Basic Plan (FY 2001-2005)

3rd Basic Plan (FY 2006-2010)

4th Basic Plan (FY 2011-2015)

●Increase in government R&D expenditure

The total budget for governmental R&D expenditure exceeded **170 B$.＜176 B$＞**

●Construction of new R&D system

- Increase in competitive research funds
- Support plan for 10,000 post-doctoral fellows
- Promotion of industry-academia-government collaboration
- Implementation of evaluation systems

●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**
- S&T system reforms
  - —Doubling of competitive research funds
  - —Enhancement of industry-academia-government collaboration
- Total budget :**240 B$ ＜211 B$＞**

●Three basic ideas

Create Human Wisdom, Maximi… and Protect Nation's Hea…

●Key Polici…

Promo…

- Quantum… based …
- Basic res… in diversified areas
- Strategic basic research

Prioritization of R&D

Prioritized 4 Areas	Promoted 4 Areas
*Life Science	・Energy
*ICT	・Manufacturing technology
*Environment	・Social Infrastructure
*Nanotech/Materias	・Frontier

Key Technologies of National Importance

S&T System Reform

- **Developing, securing and activating human resources**
- **Creating scientific development and persistent innovation**
- Total budget :**250 B$ < 215 B$ >**

1

THE DAILY YOMIURI

EDITION D

NATIONAL

Science budget cuts slammed

The Yomiuri Shimbun

The country's five leading scientists, including four Nobel Prize-winners, on Wednesday strongly criticized the Government Revitalization Unit's budget reductions for science and technology projects.

It is unusual for top scientists to attack central government's policies, and their remarks are being seen as an indication of the strength of their opposition to the government's plan.

The four Nobel Prize-winners, Leo Esaki, Makoto Kobayashi, Ryoji Noyori, Susumu Tonegawa, and Fields Medal recipient Shigefumi Mori held a joint press conference at Tokyo University.

Kobayashi said: "I just can't understand it at all. There's no consistency between the policies of [Prime Minister Yukio] Hatoyama's administration [aimed at] leading the world in the fields of science and technology and the [decision to cut funding for these fields]."

Tonegawa, who has long conducted his research activities in the United States, cited U.S. President Barack Obama's comment on developing human resources for the future by maintaining investment in science and technology—even during tough times. Tonegawa dubbed the government's axing of the science budgets as "the kind of thing that happens in a totally different world."

The five scientists released an statement saying: "If patient efforts to expand knowledge are halted, human resources will run dry and the results will be irreversible. This planned move runs contrary to the government's aim of making the country a scientific and technological powerhouse."

Prior to the press conference, Noyori had been invited by the Liberal Democratic Party to give a lecture at a joint conference of LDP committees—including a committee on education, science and technology—during which he said the government screening panel's decision to ax budgets for science and technology and effectively put a next-generation supercomputer project on ice should be reconsidered.

Noyori condemned the unit's decision, saying, "The panel's approach of judging science purely from the standpoint of cost is completely lacking in discretion."

Junior researchers attending the panel's review of budgetary requests for fiscal 2010 the same day also expressed strong concern over their future.

"The future of Japan is at risk if such decisions [on cutting science spending] continue," one of them said.

Noyori, 71, who won the Nobel Prize in 2001, is president of Riken physical and chemical research institute, which is playing a principal role in coordinating the supercomputer development project.

On Nov. 13, Democratic Party of Japan lawmakers and private experts tasked with reviewing budgetary requests concluded that the ¥26.76 billion requested by the Education, Science and Technology Ministry as a subsidy for the supercomputer project should be reduced to a level "extremely close to an unreserved cutting of the entire funding."

The panel members pointed out that the public can hardly see any benefits to the project and cited this as the reason for the budget reduction.

At the joint conference, Noyori said: "Like the Olympic games, advanced countries are fiercely competing to develop supercomputers—putting their national prestige on the line. The moment Japan freezes the budget for the supercomputer project, other nations will overtake us.

"I want to ask those people who claim the budget for the supercomputer project should be frozen: Are you ready to be judged by the court of history?"

"Science and technology are Japan's lifeline. We shouldn't consider these budgets using short-term cost-benefit analysis," Noyori said.

Asked by an LDP member whether waste was an integral part of science, Noyori said, "There are many failures in science, but without science and technology we wouldn't have seen the improvement in life expectancy enjoyed by advanced countries."

Wakata touts space development

Meanwhile, astronaut Koichi Wakata on Wednesday stressed the importance of promoting space development from a long-term point of view.

Wakata, who became the first Japanese to make an extended stay aboard the International Space Station, spoke to reporters after receiving the prime minister's award at the Prime Minister's Office.

After receiving a… from Hatoyama, Wa… "The importance of … been supported stro… nister before. We nee… velopment based on…

The Yomiuri Shimbun

Seated from left, Leo Esaki, Susumu Tonegawa, Shigefumi Mori, Ryoji Noyori and Makoto Kobayashi at a press conference at Tokyo University on Wednesday

44% nurs… gave… care…

About 40… charging nu… life palliativ… who died a… year, accord… bun survey.

The surv… has been gr… special nurse… dences for el… care amid ro… society. But… said they rec… cilities after… stipulated p… proaches ma…

The Your… naires to 2,4… the nation in… from 64 perc… Of those re… 44 percent sai… death at their… which the home … care, while 47 percent said they had had … any such deaths among their residents.

Mostly run by private firms, assisted-liv-…

July 2009
New Administration

↓

Nov. 2009
Review of budget items

" Why must Japan aim to develop the world's No. 1 (supercomputer)? What's wrong with being the world's No. 2 ? "

New Growth Strategy, June 2010

- Strong Economy, Robust Public Finances & Strong Social Security System -

- Achieve nominal & real growth in excess of 3% and 2% by 2020
- Return consumer prices to positive increase in FY2011
- Lower unemployment rate to 3% - 4% at an early time

【Growth areas】

Green Innovation

【Targets by 2020】

・Create over ¥50 trillion in new markets and 1.4 million new jo
・Reduce worldwide greenhous gas emissions by 1.3 billion to using Japanese technology

Life Innovation

【Targets by 2020】

Foster industries that meet demand and create jobs:
-Roughly ¥45 trillion in new markets and 2.8 million new jobs

Opening new frontiers

- Asia
- local Revitalization

Platforms to support growth

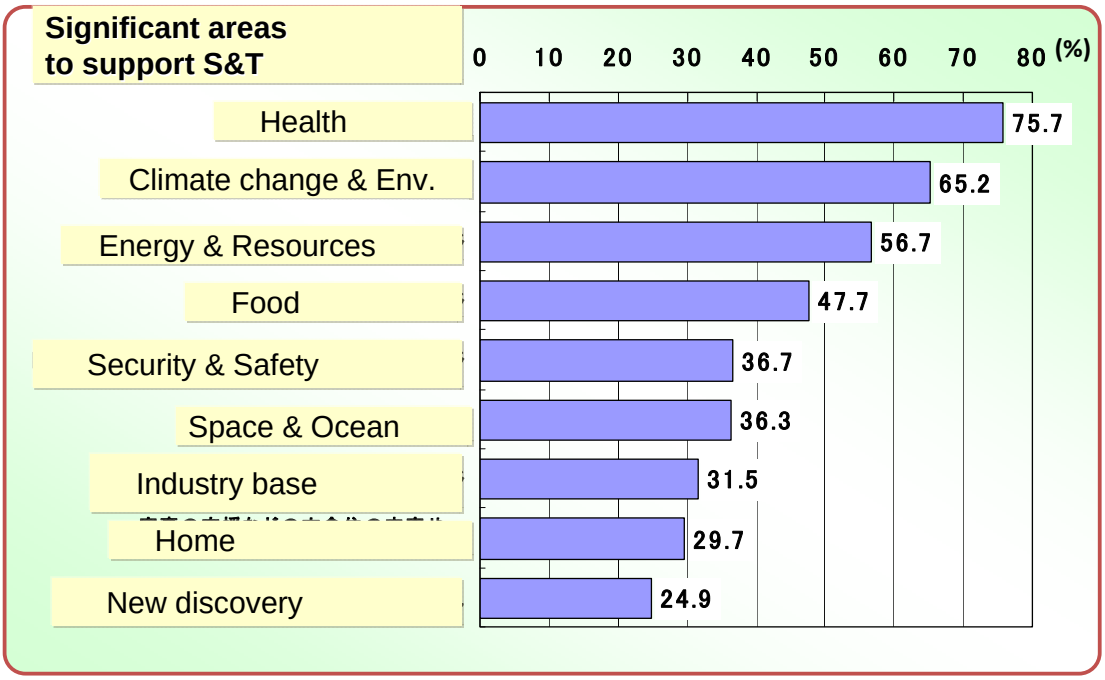
- Science & Technology
- Employment & human resources

S&T as an engine for New Growth Strategy

The 4th S&T Basic Plan（FY 2011-2015）

Comprehensive promotion of science, technology and innovation policy

How should S&T respond to the national expectations?



Public Opinion Poll on Science and Technology, Jan, 2010

4th Science and Technology Basic Plan（1）

Basic concept

Positioning of the Basic Plan in National Strategy

○A five-year-plan with the foresight of 10 years ahead, based on **"New Growth Strategy".**
Comprehensive promotion of science, technology and innovation policy

○Perspective for 2020

- Nation which realizes sustainable growth
- " takes the lead in solving global issues
- " create the world's highest knowledge
- Nation which takes pride in high quality of life
- Nation where the youths hold a dream

Two major innovation as the national strategic pillar

Green Innovation

To realize low carbon society with sustainability

- Renewable energy, Low carbon of energy supply and demand, Saving energy, Green infrastructure
- Accelerate innovation by affirmative legal framework
- Establish "National Lab" with proper regulation easing
- Develop strategies for the international standardization

Life Innovation

To realize high quality of life in an aging society

- Promotion of preventive medicine, Development of innovative diagnostic and treatment method, Development of life-supporting technology for elderly and disability people
- Promote translational research
- Promote regulatory science
- Accelerate innovation by affirmative legal framework

The new system which stimulates innovation

To construct the system which create issue-solving innovation

−Establish Innovation Strategy Platform
−Establish Open Innovation Centers
−Create a new market by the new affirmative legal framework

4th S&T Basic Plan（2）

Promotion of R&D which sustains the nation and produces new advantage

Bases for the high quality of life

−Maintain necessities: food/resources/energy
-Maintain safe society

Bases for the industries

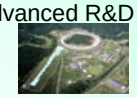
−Extend advantage of Japan
−Create new advantage for the future

Bases for the nation

-Maintain a technology bases for security
-Develop a new frontier

Common Base for R&D

-Maintain cross-sectional key technologies
-Establish hubs of advanced R&D



Drastic Reinforcement of S&T Potential

Drastic reinforcement of basic research

-Reinforce basic research based on originality/variety
-Reinforce the world top-level basic research
-Form the group of "Research Universities"
-R&D Hub for International research network

human capital for S&T

Drastic reinforcement of the graduate school education

Formation of research environment of international standard

-Domestic/international maintenance and utilization of large research facilities

International openness Integrated with world vitality

-"East-Asia Science and Innovation Area" Initiative

Implementing the new policy

Reforming S&T System : Construction of PDCA (Plan-Do-Check-Action) cycle

Bridging Science and Society : New development of S&T communication

Increasing R&D investment :Increase public and private R&D investment to **4%**(3.6), and government investment at **1%** (0.7) of GDP **<250 B$>**

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I. A historical Change of the World System
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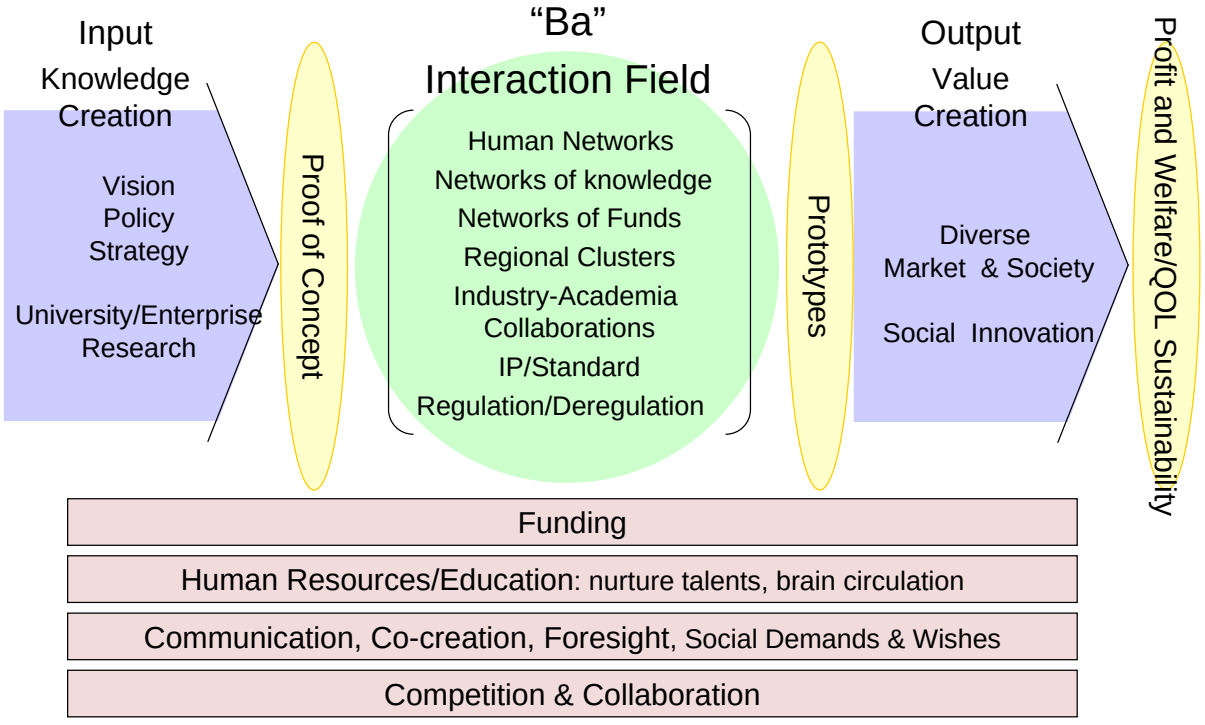
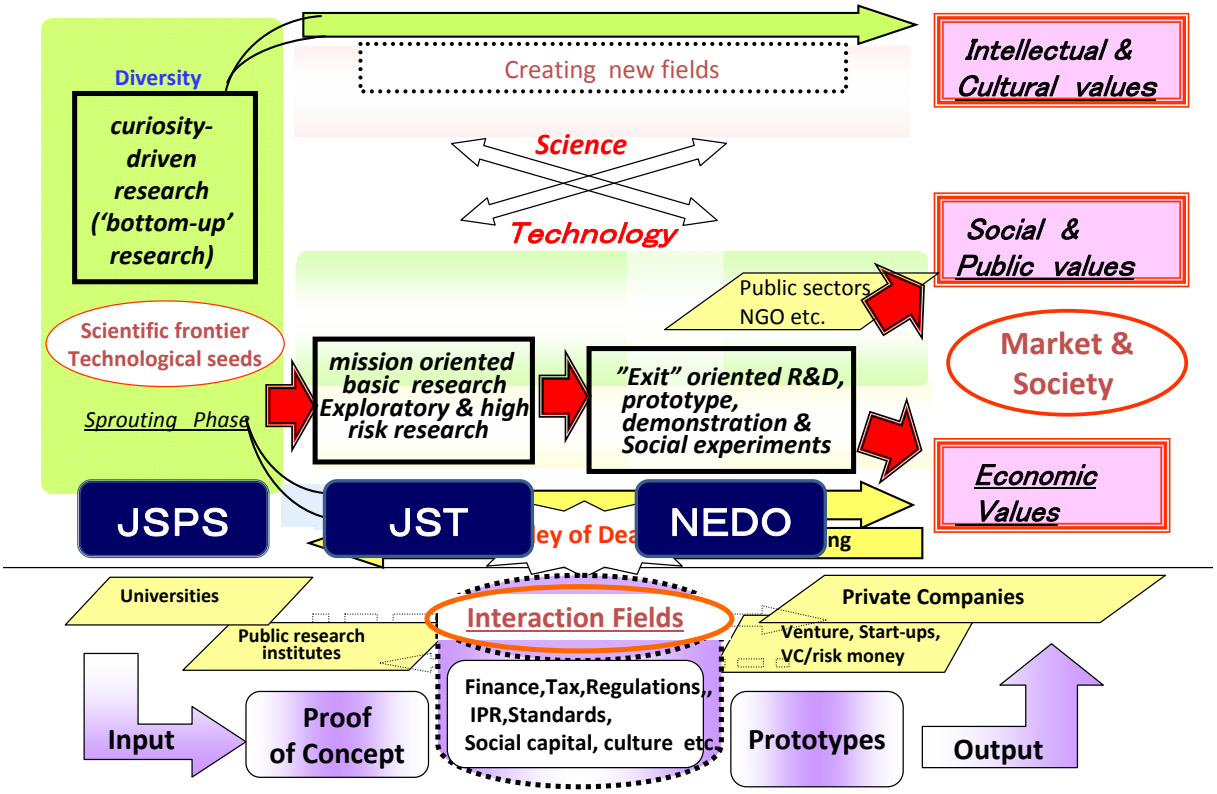
Funding, Issue-driven, Universities
V. Global Science & Innovation System
VI. Green Innovation in Japan
VII. Conclusion

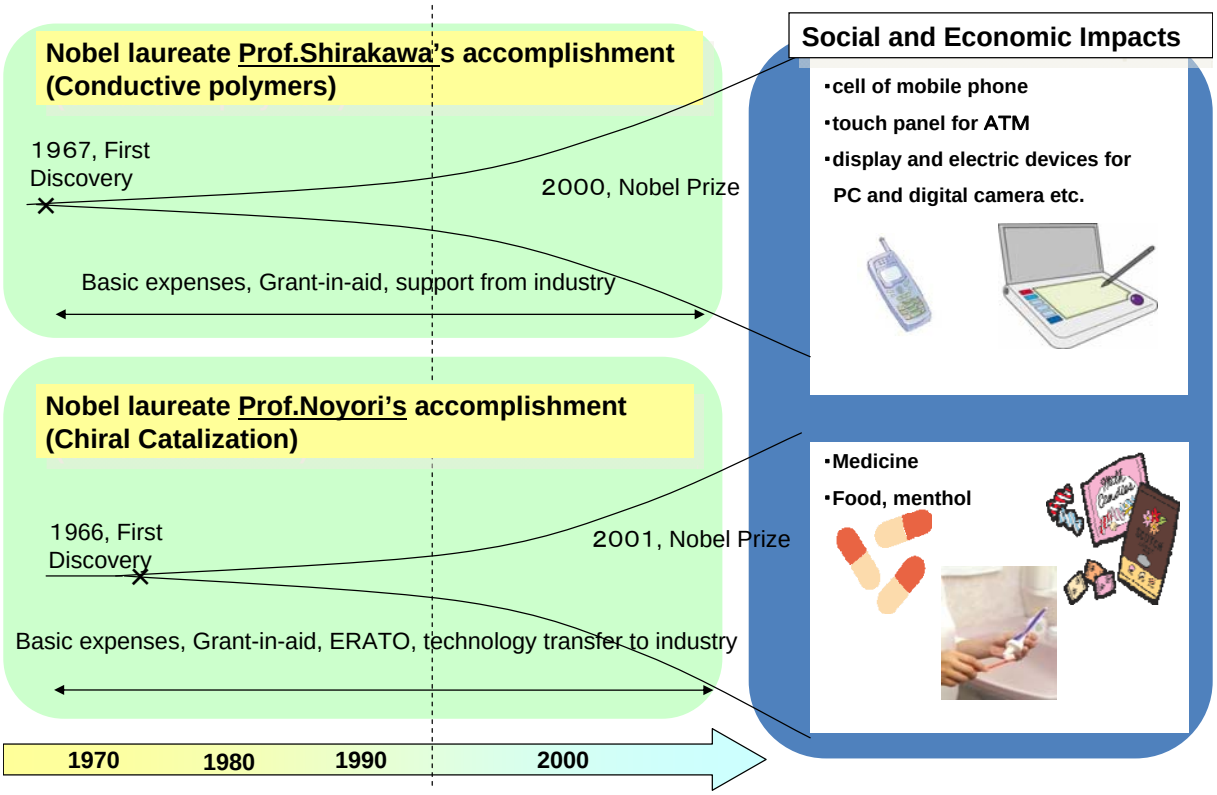
Innovation Ecosystem; [Global, Regional, National & Local]

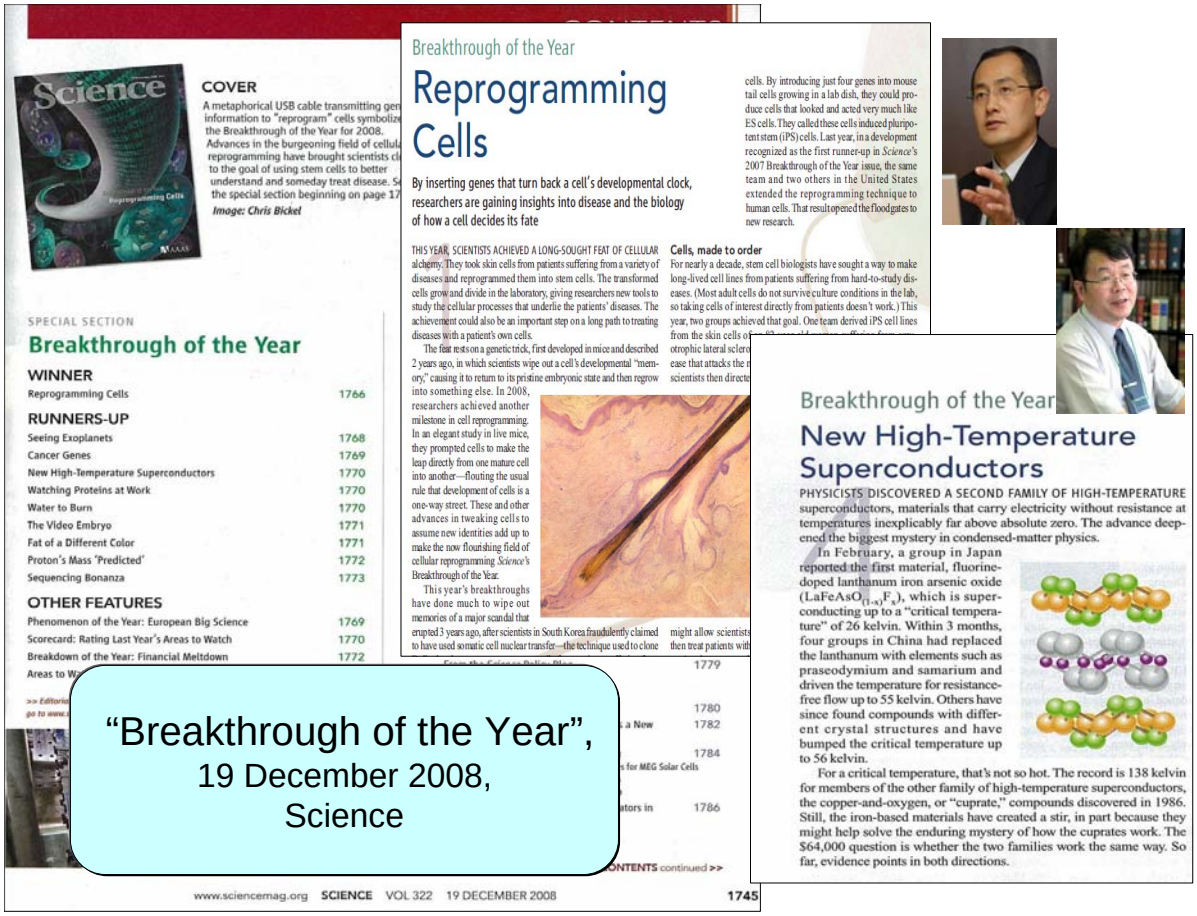


Funding system for science–based national innovation system : 3rd S&T Basic Plan



Original basic researches have great social and economic impacts through interactions of various elements.



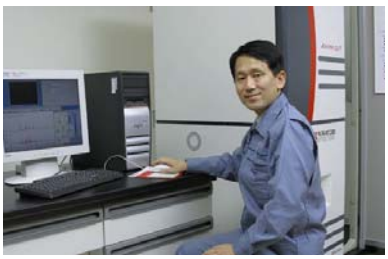
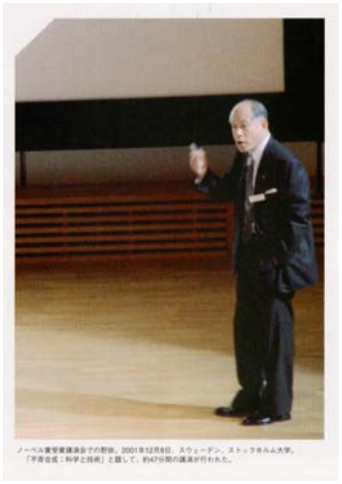


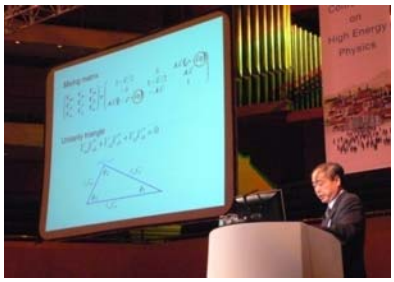
"Breakthrough of the Year",
19 December 2008,
Science

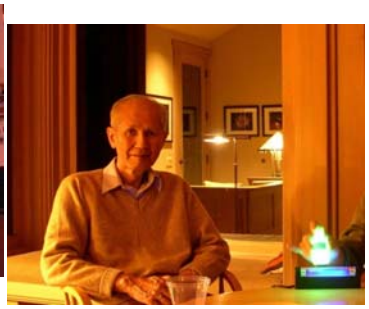









ノーベル賞受賞講演会での野依。2001年12月8日、スウェーデン、ストックホルム大学。
「不斉合成：科学と将来」と題して、約47分間の講演が行われた。



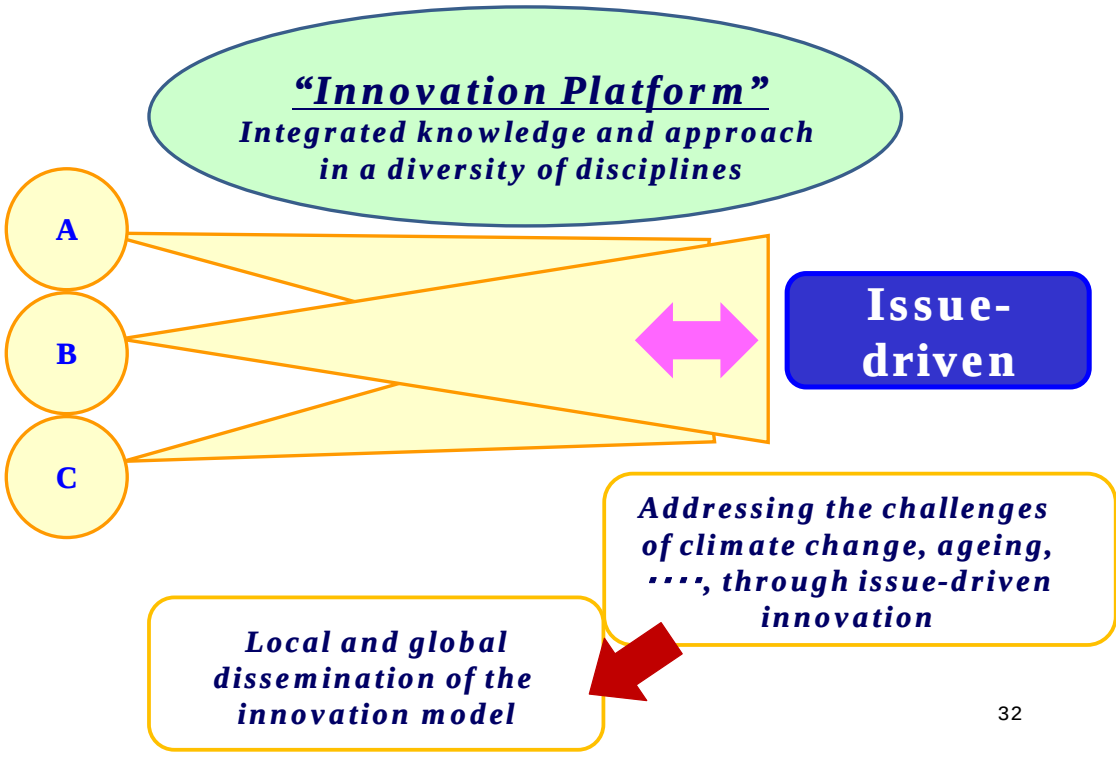





Grand challenges we should meet

- The world is confronted with the global challenges of climate change, food and energy security, and infectious deceases which threaten sustainability.
- The New Growth Strategy should be empowered by S&T and innovation to transform the grand challenges to opportunities for thriving in the fiercer global competition.
- Due to complexity of the challenges, it is getting more difficult to find a solution by single discipline of S&T.
- A diversity of knowledge derived in different disciplines of S&T along with social science and humanities should be integrated to address the challenges, which is characterized by Issue-driven Innovation beyond Discipline-oriented Innovation.

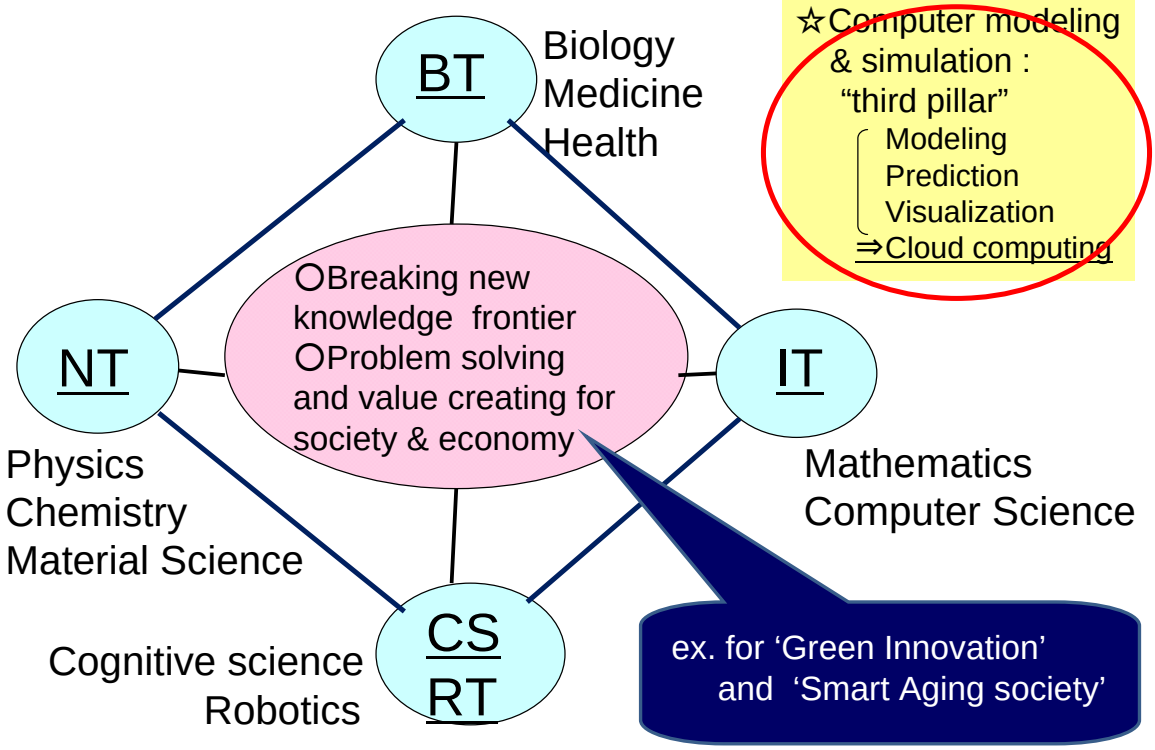
Issue driven innovation beyond discipline-oriented Innovation



Integrating Disciplines for Green Innovation & Smart Aging Society

☆Theory
☆Experiment
☆Computer modeling & simulation : "third pillar"
- Modeling
- Prediction
- Visualization

⇒Cloud computing



University in the 21st century

Transforming and reinventing universities
for the new world order and value systems

Universities in the 21st century

- ○global university, global career, global brand, . brains business.
- ○instruments of national competition as well as of peace. A powerful force for global integration, mutual understanding, geopolitical stability and foreign policy.
- ○brain circulation & network, university network, open innovation, collective intelligence
- ○COE(Center of Excellence) ⇔ NOE(Network of Excellences)

Exploring the future of modern university system

World Conference on Science
(ICSU / UNESCO)
Declaration on Science and the Use of Scientific Knowledge
- Science for the 21st Century
A New Commitment -

1999

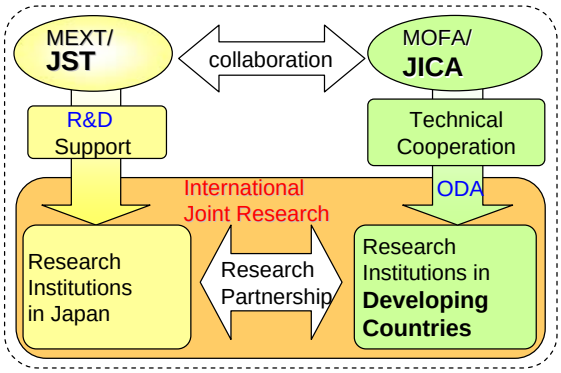
20th Century	21st Century
☆Science for knowledge; Knowledge for progress	☆Science for knowledge; knowledge for progress ☆Science for peace ☆Science for development ☆Science in society and Science for society

WSF 2009 in Budapest

Contents

JST / Science and Technology Research Partnership for Sustainable Development (SATREPS)

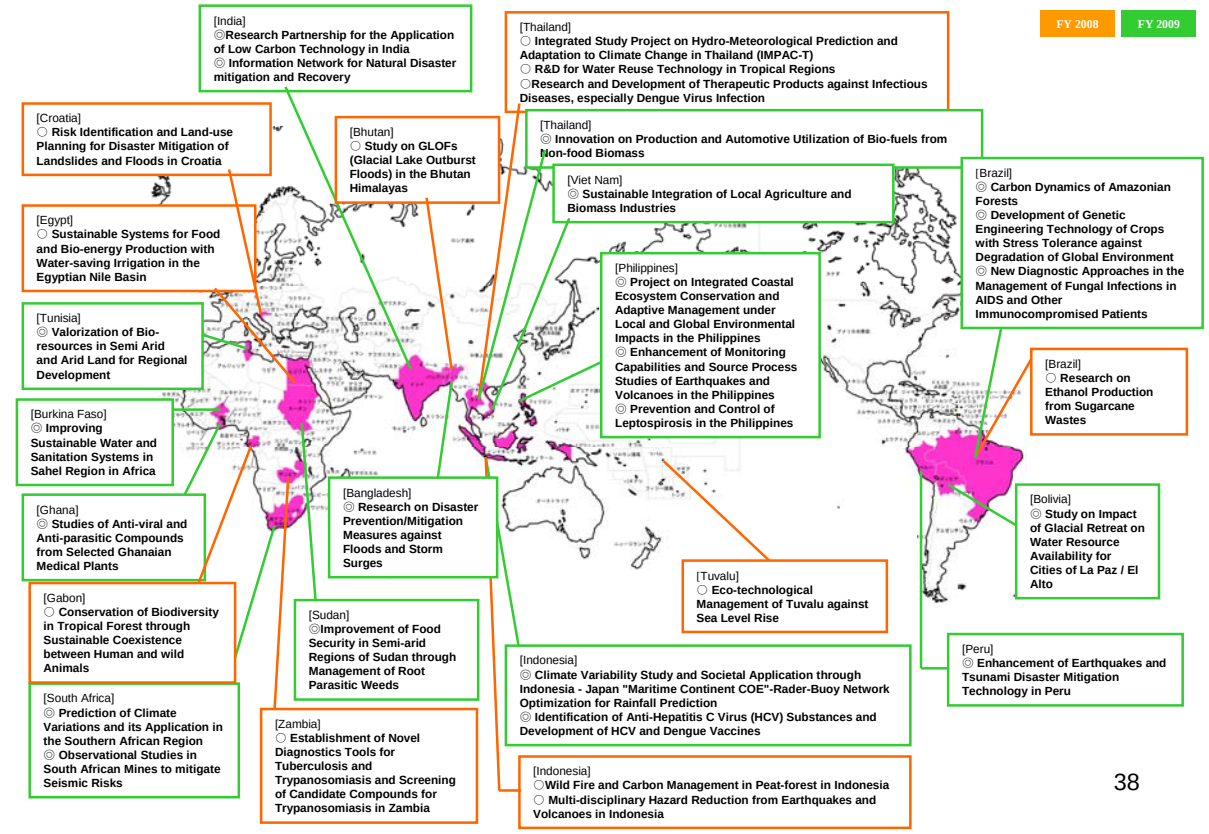
- JST supports international joint research cooperation between Japan and developing countries for resolving global issues such as: environment/energy, natural disaster prevention and infectious diseases control.
- Collaboration with JICA, an organization that implements ODA technical cooperation.
- Objectives of the program :
  to strengthen the international S&T cooperation between Japan and developing countries,
  to advance scientific knowledge and technology for resolving the global issues , and
  to build capacities of counterpart researchers and research institutes.



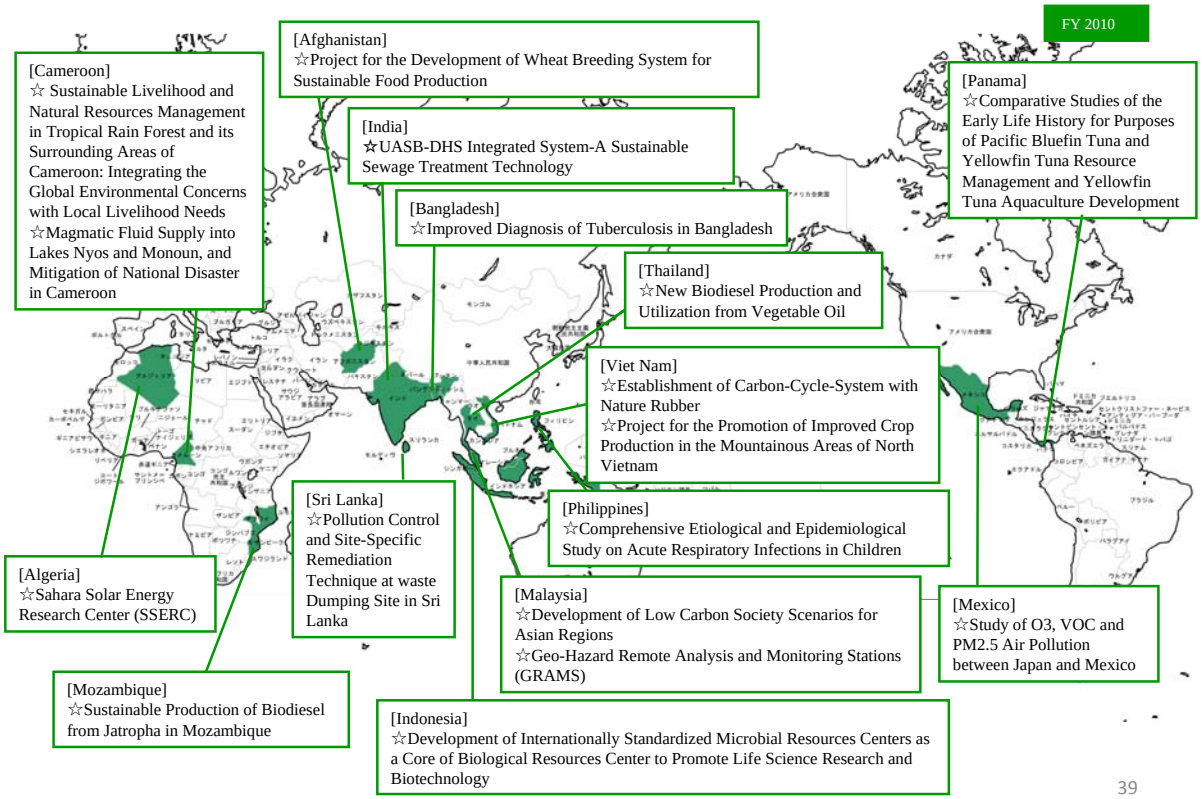
MEXT: Ministry of Education, Culture, Sports, Science and Technology
MOFA: Ministry of Foreign Affairs
JST: Japan Science and Technology Agency
JICA: Japan International Cooperation Agency

Research Areas	Region			FY		
	Asia	Africa	Others	2008	2009	2010
adptation to or mitigation of climate change	25	13	11	4	4	0
energy systems for low carbon society				—	—	4
the resolution of global-scale environmental issues				3	2	4
sustainable utilization of bio-resources				—	6	5
natural disaster prevention measures				3	4	2
measures to address infectious diseases control				2	4	2
Total				12	20	17
				49		

Selected SATREPS Projects for FY2008/FY2009



Selected Projects for FY2010



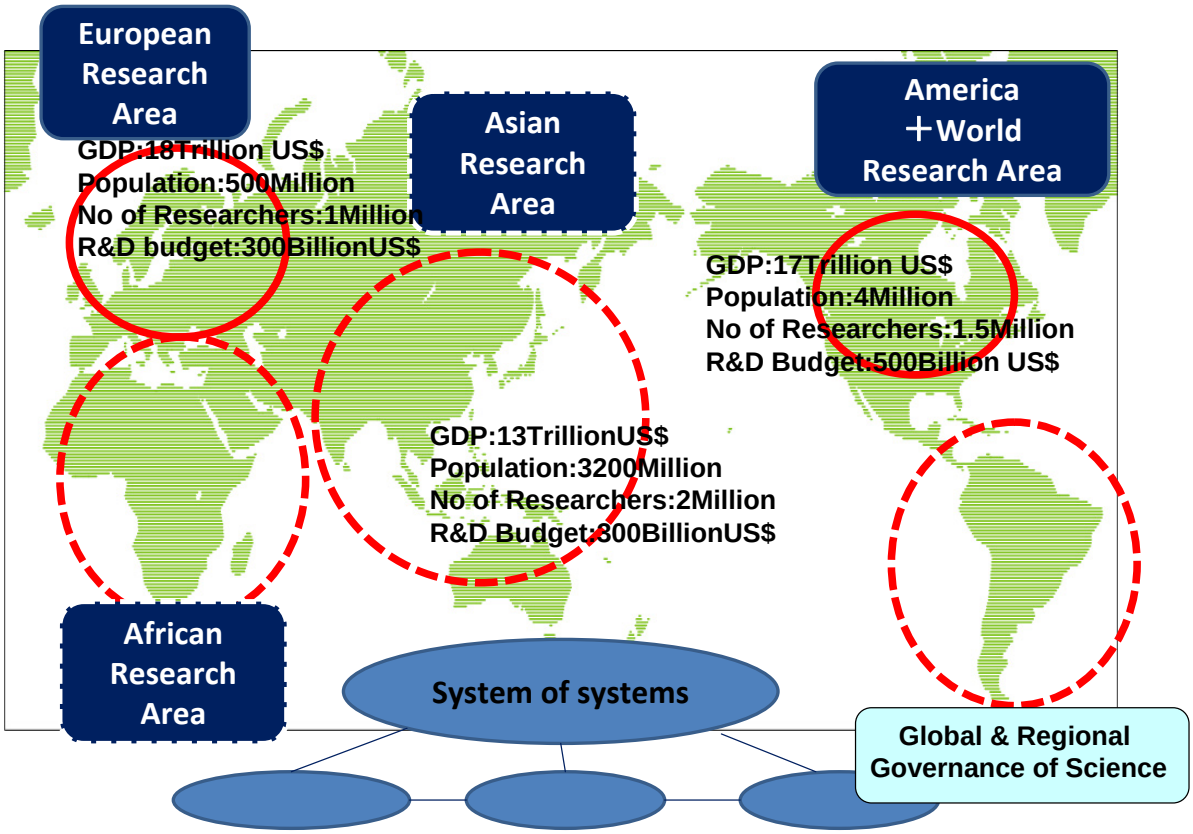
What should we do in Asia ?

- Necessary to solve many common regional problems for sustainable growth
- Problems spread over multi-countries . Being difficult to solve by an individual country
- Need to develop regional collaboration mechanisms
- Many exchange programs but few regional cooperation across borders

Proposing foundation of Asian Research Area

* Grasp common regional problems and needs
* A platform to discuss measures for regional problems and needs with versatile actors
* A platform for designing multi-country collaborative research, exchanging, and networking
* A platform to share research infrastructure
* An institution to maintain scientific research governance and quality
* A platform open to the rest of the world

Asian Research Fund, Asian Technology Assessment Center, Asian Technology Incubation Center etc.

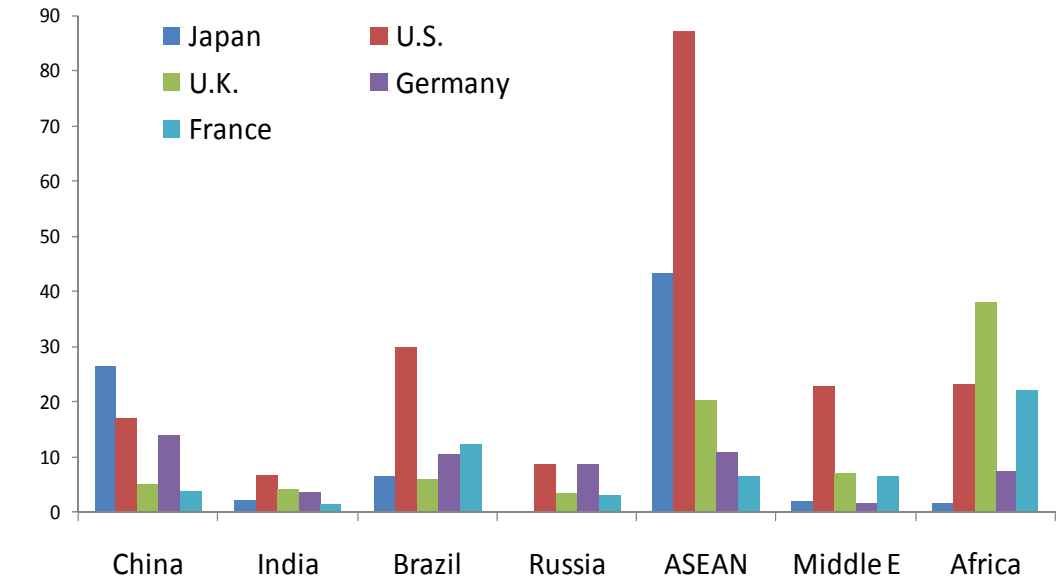


Enhancing presence in growing market (BRIICS and others)

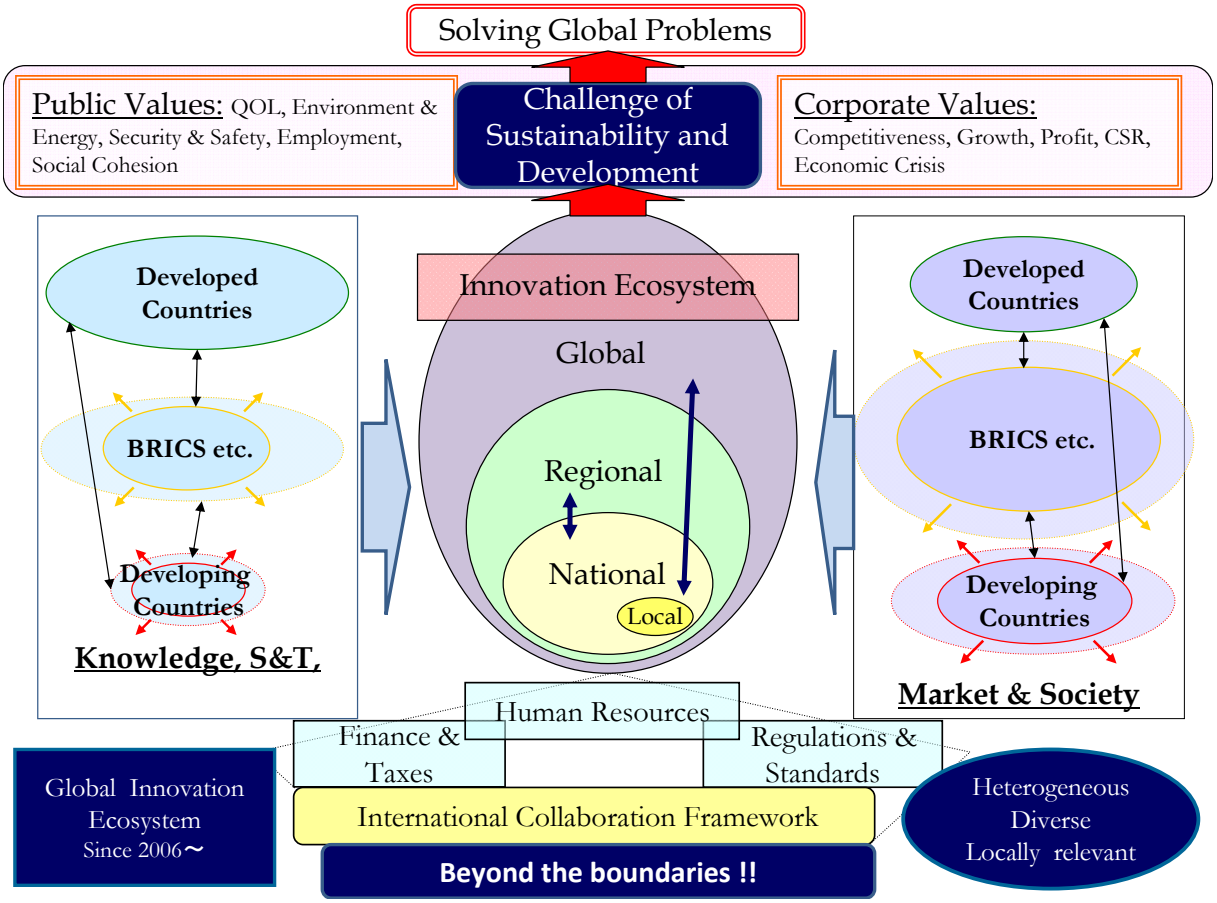
Balance of direct investment from five developed nations to the developing nations

*BRIICS：Brazil, Russia, India, Indonesia, China and South Africa

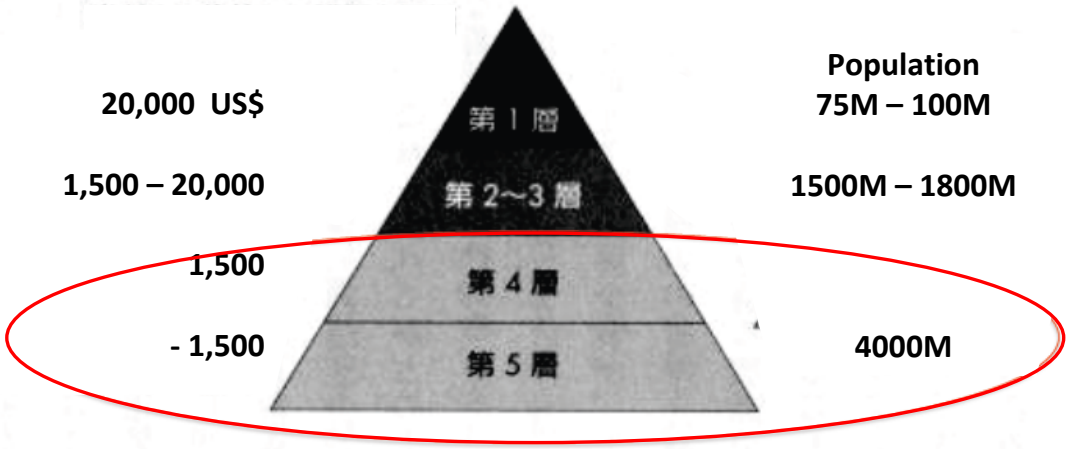
(Unit: billion dollars)

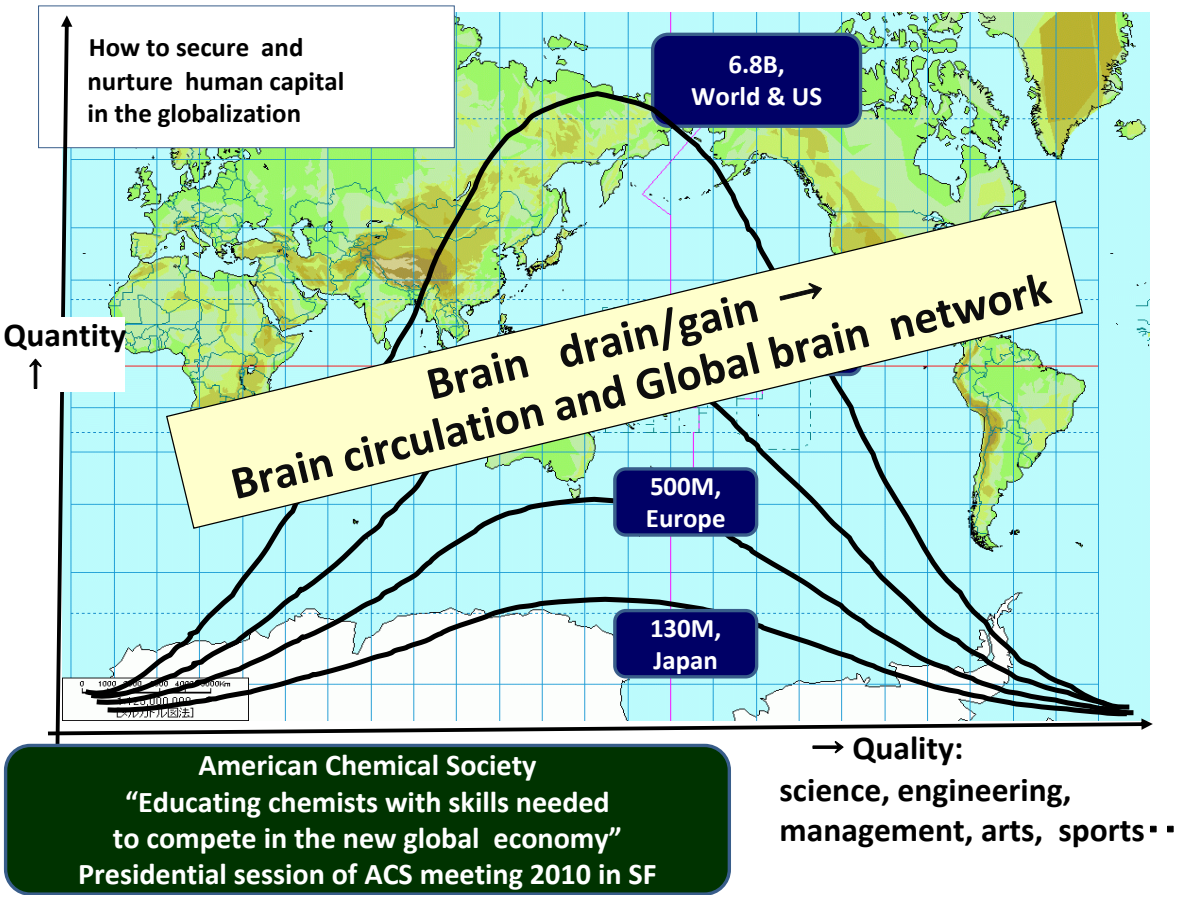


(Source: Trade White Paper 2009)



Bottom of Pyramid
"Bottom Billions"





"Capitalizing on Complexity
- Insights from the Global Chief Executive Officer Study- "
May 2010, IBM

It is this unprecedented level of interconnection and interdependency that underpins the most important findings contained in this report. Inside this revealing view into the agendas of global business and public sector leaders, three widely shared perspectives stand in relief.

1) The world's private and public sector leaders believe that a rapid escalation of "complexity" is the biggest challenge confronting them. They expect it to continue — indeed, to accelerate — in the coming years.

2) They are equally clear that their enterprises today are not equipped to cope effectively with this complexity in the global environment.

3) Finally, they identify "creativity" as the single most important leadership competency for enterprises seeking a path through this complexity.

(This study is based on face-to-face conversations with more than 1,500 chief executive officers worldwide, 60 countries and 33 industries, between September 2009 and January 2010.)

Contents

JST / Center for Low Carbon Society Strategy (LCS)

" Japan will aim to reduce its green house gas emissions by 25% by 2020 for its mid-term goal "

LCS : Social Scenario Research for Low Carbon Society

Founded in Dec 2009
in JST (Japan Science and Technology Agency)

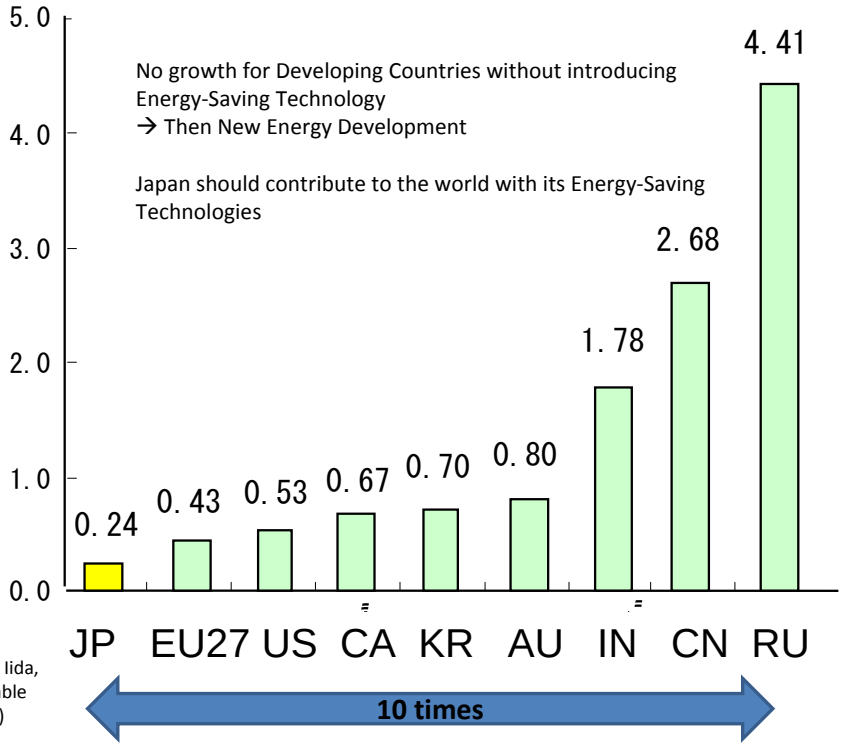
Director-General:
Hiroshi Komiyama,
Former President of the University of Tokyo

We are running out of time
We need a concurrent approach to accelerate the process.
Structuring of knowledge and actions is the key.

- **Improve energy efficiency by three times**
- **Double the use of renewable energy**
- **Establish recycling system of materials**

CO2 Emission per GDP (As of 2005)

[KgCO2/US$ (Central Currency Exchange Rate of 2000)]



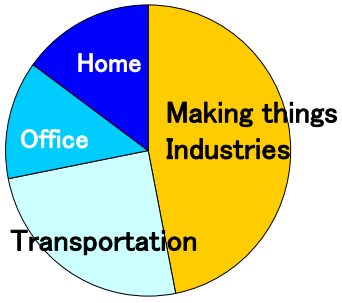
Data by Dr.Tetsunari Iida, Institute for Sustainable Energy Policies (ISEP)

CO2 Reduction for each sector (1990 basis) 1/2

by JST LCS Center

Reduction rate

Daily Life	Residence/ Office	6 %	Solar power(80% of new houses) High efficiency electrical appliances (100%) Insulation Smart Energy Management System (100%) Removal of old house by compact city (4%)
	Transportation	6%	Hybrid car (20%) Energy saving car (30%) Modal shift
	Agriculture	2%	・Treatment of plant disease ・Reduction of fertilization ・CO2 fixation



Energy consumption by final use (Japan)

CO2 Reduction for each sector (1990 basis) 2/2

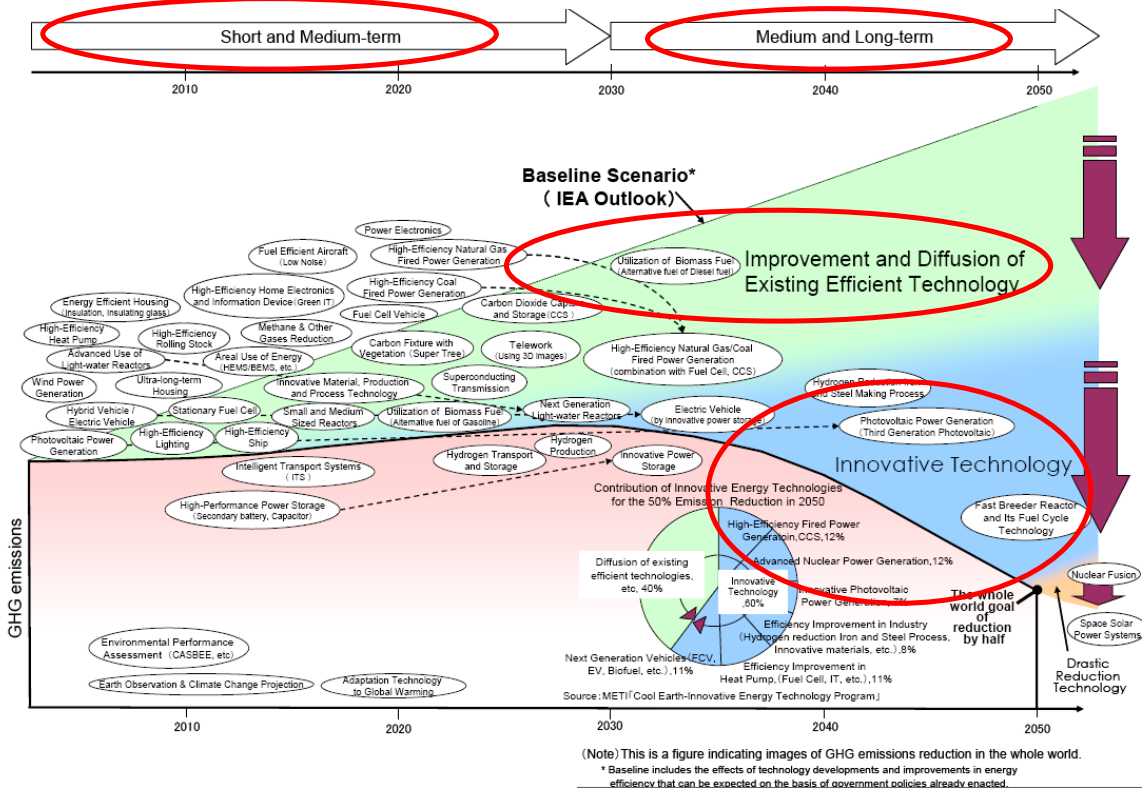
Electricity	5%	・Nuclear power (6%, operating rate → 90%) ・High eff. power plant ・Coal –biomass mixed fuel (50%) ・Solar power, Wind, Geothermal ・Higher voltage (1w → 2W/400V)
Industry	3%	Annual reduction rate of 1%/y
Forest	3%	Regeneration

New CDM α

Total 25%+α

Reduction : 410 Mt-CO2/y

Development and Diffusion of Environment & Energy Technology - Short/Medium/Long term - (CSTP, 2008)



(Note) This is a figure indicating images of GHG emissions reduction in the whole world.

* Baseline includes the effects of technology developments and improvements in energy efficiency that can be expected on the basis of government policies already enacted.

Promoting Global Green Innovation

Green Innovation Symposium:

JST held an international symposium "International Challenge for Promoting Green Innovation to Realize a Low Carbon Society Worldwide" on May 17, 2010, Tokyo.

"**Joint Statement**" says:

- Various support activities for international cooperation are crucial
- The experts of each funding agency would have a network meeting to specify problems to be solved by international cooperation between/among the funding agencies and to consider concrete measures to be taken

Participant Agencies (From 9 Countries)

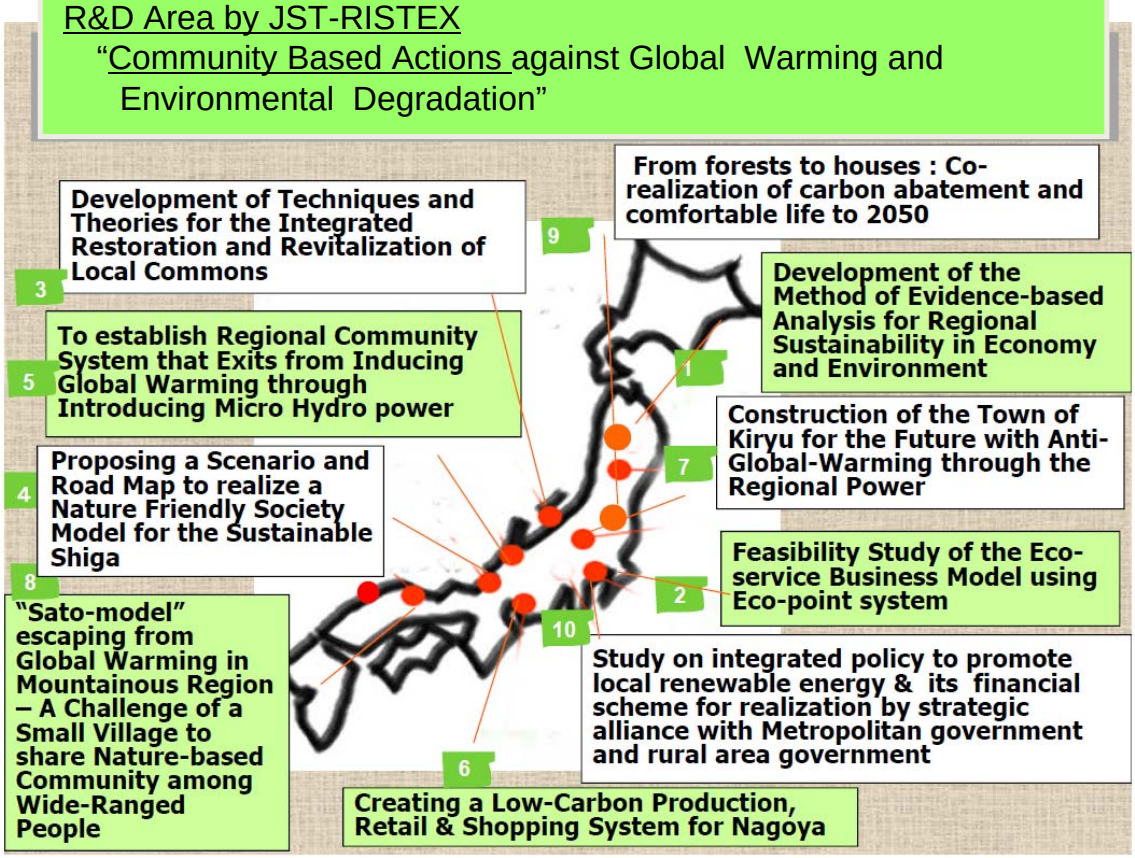
- National Natural Science Foundation of China (NSFC)
- German Research Foundation (DFG)
- French National Research Agency (ANR)
- National Research Foundation of Korea (NRF)
- National Council on Science and Technology of Mexico (CONACYT)
- Swedish Governmental Agency for Innovation Systems (VINNOVA)
- Engineering and Physical Sciences Research Council of UK (EPSRC)
- National Science Foundation of USA (NSF)
- Japan Science and Technology Agency (JST)

Green Innovation Working Group:

"The first Working Group Meeting"
April, 2011 in Germany
Organized by German Research Foundation (DFG)

R&D Area by JST-RISTEX

"Community Based Actions against Global Warming and Environmental Degradation"



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II. Innovation in the 21st century
III. Japan's New Science & Innovation Policy
IV. Innovation Ecosystem
Funding, Issue-driven, Universities
V. Global Science & Innovation System
VI. Green Innovation in Japan
VII. Conclusion

New Perspectives for Science and Innovation:No.1

○ Gravity of scientific activities moving to developing countries

"Silent Sputnik" (Rita Colwell);

(AAAS2010 Annual Conf. "Bridging Science and Society")

(AAAS2011 " "Science without Borders")

"Royal Society Global Science Report" ; "New entrants are reshaping the landscape for science and innovation in the world. But what do these changes mean? How should policymakers, scientists and business leaders respond? And how do we strike the right balance between competition and collaboration? "

○ Scientific integrity, Quality control of science

- Global governance of science
- Science diplomacy

○ Design & system thinking, and foresight under the complex and uncertain world

New Perspectives for Science and Innovation:No.2

- ○Bridging science and society
- ○Beyond the boundaries(disciplines, organizations, generations, nations)
- ○Network, Platform, Connectivity for Innovation
  COE(Center of Excellence)
  ⇔ NOE(Network of Excellences)
- ○Transformative research, Converging Tech.

.....

- ○New innovation model
  - *Disruptive Innovation（by Christensen)
  - *Reverse Innovation（by Immelt)
  - *Frugal Innovation (by the Economist)

New Perspectives for Science and Innovation:No.3

- ○ National, Regional and Global science and innovation ecosystem
  - Open innovation
  - Global governance of science
  - Globally integrated enterprise
  - System of systems (ex. ERA, ARA etc)

- ○ Brain circulation & network, collective intelligence
  S&E workforce: non-traditional skills and sense
  Global leaders under the uncertain and complex world

Challenges and Opportunities

- Implementing the target of R&D investment
  total:4% of GDP, Gov:1% (250 B$)
- Reform of innovation system
  - *more seamless funding mechanism
  - *development of issue driven system
    innovation platform, role of national labs
  - *balance of discipline oriented system and issue driven system
- Development of human resources with global perspective
  - *collaboration of universities and industries
    global leaders, diversity, design thinking

Thank you very much for your attention!!

Questions:

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