Redesigning Science & Innovation System and Nanotechnology

March 28, 2012
International Symposium on Assessing the Economic Impact of nanotechnology
OECD, USNNI and AAAS

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Contents

I. Historical Change of the World System
II. New Perspective of Science, Technology and Innovation
III. Evolution of Nanotechnology
    - Engine for Innovation -
IV. Science of Science and Innovation Policy
    - Japan’s perspective –
V. Conclusion
Since 1989

End of the Cold-War
ICT revolution

Globalization ⇒
The Conditions is
Changing Rapidly …

- Sustainable development
- Climate change, Energy &
  Natural resources
- Water, Health, Food, Biodiversity
- Natural/Artificial Disasters
- Knowledge & Aging society

Now 2012

Disasters

Climate change

Economic & Financial
Crisis
The great transformation
Rules of games are changing!!
Shaping the new values and leadership
Changing social norms
Technological and social innovation
Innovation & entrepreneurship
Green new deal & smart ageing society
Redesigning governance of ST and Innovation;
Global, regional, national & local
Breaking the conventional thought framework!!
Shaping new models
Since 1989
End of the Cold-War
ICT revolution
Globalization
Disasters
Climate change
Economic & Financial Crises
S & T and Innovation in the 21st century

- STI for Profit
- STI for Competitiveness
- STI for Growth
- STI for Employment
- STI for Wellbeing & quality of life
- STI for Safety, security & social cohesion
- STI for Sustainability & resilience

Innovation horizon is expanding.
Redesigning science & innovation system; locally, nationally, regionally and globally
Science and technology policy is changing.
“Science of STI policy”
People’s distrust of science is growing after 3.11.

I trust scientists; ①yes, ②rather than.  
I distrust scientists; ③rather than, ④yes. ⑤no response
Tough choices
Scientists must find ways to make more efficient use of funds—or politicians may do it for them.

Scientists in the United States can find plenty of good news as they peruse the 2012 budget proposal. Despite substantial cuts elsewhere—and fierce pressure from Republicans to cut more—Obama could get healthy overall increases in both fundamental research and science education (see page 263). But the good news is offset by reality. The Obama budget document is one long struggle to balance two contradictory goals: to stimulate the lagging US economy and to cut the annual budget deficit, which is more than $1 trillion. Science and science education are widely viewed as helping with the first, and will doubtless continue to be seen as such by the White House. But the administration is also resisting the growth of many programs.

The idea that science is the answer is one of the tenets on which the United States has traditionally defined itself as a political party. But other scientists argue that the Obama administration will have to rein in its expectations and set some priorities.

This week’s budget proposal, which contains many references to “tough choices,” shows that the process is already under way. The Department of Energy (DOE), for example, wants to downsize funding of several large projects that have not met their milestones, or that seem otherwise unproven. The National Science Foundation (NSF) is likewise cutting back on its 265 million dollars in priority education, outreach, and research programs. The National Institutes of Health (NIH) has already been ordered to “prune” new grants to 7%. And NASA is being asked to make drastic cuts to its Mars exploration programs so as to finish building its flagship James Webb Space Telescope.

Conceivably, this process could get even more drastic. Last month, Obama asked Congress to give the authority to consolidate and streamline agencies on its own initiative—and suggested that one early application would be to transfer the National Oceanic and Atmospheric Administration from the Department of Commerce to the Department of the Interior. If Congress goes along in the spirit of the administration, it is possible to imagine him—on Senate Republicans’ say-so—setting all of the NSF’s science-education programmes in the Department of Education, or merging the DOE’s particle and nuclear physics research into the NSF’s.
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Gravity of Scientific Activities Moving to Developing Countries

“Silent Sputnik” (Obama, Rita Colwell);
- AAAS2010: “Bridging Science and Society”
- AAAS2011: “Science without Borders”
- AAAS2012: ”Flattering the world: Building the 21st C. Global Knowledge Society”
- WSF2011: ”The Changing Landscape of Science: Challenges & Opportunities”

Globalization and Localization
Climate change, energy problems, economic & financial crises, disasters, unemployment, poverty, aging society etc.
Reshaping the values and leadership principles

Global and regional governance of science, Science diplomacy
Bridging science and society
Scientific integrity, ethics and resilience to risk

New Innovation Models;
“Disruptive” Innovation,
“Reverse” and “Frugal” Innovation
New Perspectives of STI (No.2)

◆ Policy
  ▪ Breaking the conventional thought framework of traditional science policy
  ▪ Issue-driven S&T policy,

◆ System
  ▪ Redesigning STI and evaluation system
  ▪ Network, platform & connectivity for innovation
    NOE (Network of Excellences), Open innovation,
    Beyond the boundaries; disciplines, organizations, nations
    Non-traditional players and partnership
  System of systems; global/regional/national/local

◆ Human capital
  Design and system thinking, non–traditional skills and sense,
  diversity and inclusiveness, collective intelligence,
  foresight under the complex and uncertain world

Redesigning governance of STI system
Science of science, technology & innovation policy
In the post-crisis world, and with a still fragile recovery, we are facing significant economic, environmental and social challenges. While no single policy instrument holds all the answers, innovation is the key ingredient of any effort to improve people’s quality of life. It is also essential for addressing some of society’s most pressing issues, such as climate change, health and poverty.

Innovation today is a pervasive phenomenon and involves a wide range of actors than ever before. Once largely carried out by research and university laboratories in the private and government sectors, it is now also the domain of civil society, philanthropic organizations and indeed individuals. Therefore, policies to promote it should be adapted to today’s environment and equip a wide variety of actors to undertake innovative actions and benefit from its results. Effective mechanisms for international co-operation in science, technology and innovation will also need to be put in place in order to make innovation an engine for development and growth.
The last few years have seen a burst of interest in steering research and innovation to address social challenges. This interest reflects the rise of “social innovation”, the use of innovation to address social problems. Many of today’s social challenges, such as those associated with ageing populations and environmental sustainability, as well as longstanding problems such as poverty, education and migration, have resisted conventional government or market solutions. 

They can in fact be complementary, but this will require changes to the way policy makers promote innovation, for example by involving stakeholders so as to link social demands with research agendas.

Given the multidisciplinary nature of many social problems, research to address them must bring together the natural and social sciences.
“Many of the issues which arise in the course of the interaction between science or technology and society---e.g., the deleterious side effects of technology, or the attempts to deal with social problems through the procedures of science---hang on the answers to questions which can be asked science and yet, which cannot be answered by science. I propose the term trans-scientific for these questions since, though they are, epistemologically speaking, questions of fact and can be stated in the language of science, they are unanswerable by science; they transcend science.”

Alvin M. Weinberg, “Science and Trans-Science” (1972)
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1. Evolution of Nanotechnology

**Progress Nano** (1st generation)
- Progress of Nano-world (1-100nm) in each independent discipline via top-down, bottom-up or combination process
- TEM, STM, ALE, lithography, CNT, computer science, omics

**Fusion Nano** (2nd generation)
- Interdisciplinary fusion of nano-worlds of different disciplines, producing new function of material, process or device
- low-k material via block-copolymer process, chemical biology

**Systems Nano**
- Integration of various nano-worlds into functional systems
- materials design, molecular electronics, ceranostic medicine, hierarchical self-assembly of systems (→innovative products)

**Engine for Innovation**
2. Evolution to System and Society

Safe, Sustainable and Eco-friendly Society

Policy / Social system

“Element” industry (Parts & Materials)  “Umbrella” industry (Solution business)

Nanoelectronics  Bionanotech  Green Nanotech

Functions Design

Interdisciplinary fusion & Integration of technologies

Electronics  Systems Engineering

Nanotechnology

Materials Design  Computational science

Materials science  Self-organization  Systems science

Physics  Chemistry  Biology  Mathematics

Seeds-pushing Evolution (Science and Technology)
The 4th Basic Plan for Science and Technology, Government of Japan, August 2011 after the March 11

I. Basic Concept
1. Unprecedented Crises of Japan and Change of the World
2. 1st-3rd Basic Plans’ achievements and problems
3. S&T policy to S&T and innovation policy; Issue-driven beyond discipline-based innovation

II. Realization of Sustainable Growth into the Future and Social Development
1. Realization of Recovery and Reconstruction from the Disasters
2. Promotion of green innovation
3. Promotion of life innovation
4. System reforms: Innovation platforms

III. Addressing key challenges facing Japan
1. Basic principle
2. Promotion of measures to attain key challenges
3. System reforms to attain key challenges (same as II.5)
4. Strategic development of globally integrated activities “East Asian Science and Innovation Area (e-ASIA)”

IV. Enhancement of basic research and human resources development
1. Basic principle
2. Deepening relations between society and science/technology innovation
3. Promoting effective STI policy
4. Expanding R&D investment

V. Science and society
- Development of policies together with society

* Bridging science & society
* Promoting Science of STI Policy
* Public participation
* Addressing ethical, legal and social issues (ELSI) & technology assessment (TA)
* Science communication
Funding system for science-based national innovation system in Japan

Science

Diversity

*curiosity-driven research* (‘bottom-up’ research)

Scientific frontier
Technological seeds

Sprouting Phase

Science

Creating new fields

Technology

RISTEX/JST

Public sectors
NGO etc.

Social & Public values

Economic Values

Intellectual & Cultural values

Market & Society

JSPS

JST

NEDO

 mission oriented basic research
Exploratory & high risk research

“Exit” oriented R&D,
prototype, demonstration & Social experiments

Valley of Death
backcasting

Redesigning funding systems for issue-driven innovation

International competition and collaboration of funding systems

“Cloning” DARPA (DOD, DOH, DOE, DOEd, NIH), NSF&USAID
FP#8(2014-2020), European Technology Platform (ETP),
VINNOVA, ANR : Bridging the gap, Transformative research
Innovation Ecosystem;

Input
- Knowledge Creation
- Vision
- Policy
- Strategy
- University/Enterprise Research

Proof of Concept

Interaction Sphere
- Human Networks
- Networks of knowledge
- Networks of Funds
- Regional Clusters
- Industry-Academia Collaborations
- IP/Standard
- Regulation/Deregulation

Output
- Value Creation
- Diverse Market & Society
- Social Innovation

Funding
- Human Resources/Education/Learning: brain circulation
- Communication, Co-creation, Foresight: Social Demands & Wishes
- Competition & Collaboration

Global, Regional, National & Local

Profit and Welfare/QOL Sustainability
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Growing expectations for Science, Technology and Innovation (STI) to cope with societal challenges, in responding appropriately to economic and social structural changes.

Evidence-based policy-formation through more rational process is required.

Deepening the understanding the processes among Science, Technology and Innovation, and visualizing the social and economic impact of STI policy. The results must be utilized in the actual policy-formation, ensuring transparency in decision-making in order to meet accountability to the public.

Making use of evidence as shared social resources, which serves as a foundation for public participation in policy-formation.

Developing “Science of STI Policy” to realize evidence-based policy-formation.
○ Demand for policy reappraisal for the realization of a safe and secure society, stable energy supplies and dissemination of renewable energy.

○ Renewed awareness of the limits of Science and Technology, which require for reappraisal of previous policies.

○ High expectations for the role of Science and Technology to contribute to address social issues facing Japan for the recovery from the disaster and promote the sustainable growth and development of social economy.

○ Need to conduct serious and objective reviews of previous policies to rethink the proper role of Science and Technology, and to find a vision and strategy of how science and technology can contribute to the society.

Now is the time to promote “Science of STI Policy” to advance evidence-based policy-formation.
The Science of STI policy should be designed based on the following philosophies:

1. Forming policy with scientific rationality and scientific integrity

2. Realizing rational policy-forming process

3. Increasing transparency of policy-forming process and assure accountability for the public

4. Making knowledge obtained from the Science of STI policy available to the public

5. Establishing collaborations among stakeholders, to engage appropriately in policy-formation, under the defined functional roles and responsibilities
"Principles of Scientific Advice to Government" (March 24, 2010),
UK Department of Business, Innovation, and Skills.

"Scientific advisers should respect the democratic mandate of the Government to take decisions based on a wide range of factors and recognize that science is only part of the evidence that Government must consider in developing policy."

- Independence
- Academic freedom
- Professional status & expertise
- Respect & value
- Transparency & Accountability
- Free from political interference
The guiding principles to realize the philosophy are as follows:

1. **Realize co-evolution of policy-formation mechanism and the Science of STI Policy**

2. **Facilitate public participation** in policy-formation process by presenting evidence-based alternative policy menu (*)

3. **Develop the Science of STI policy** through collaborations among various natural and social scientific fields. Use the knowledge which is collected, accumulated and structuralized from the Science of STI policy, as **common assets of the society**, to inform and guide policy-formation.

4. **Define functional roles and responsibilities of government, science community, industries and the public in policy-formation**, to collaborate appropriately. Then establish **code of conduct** for each party.

5. **Foster human resources** who take leading roles in innovative policy-formation process and the Science of STI policy. **Build communities and networks** for them. Improve environments that enable them to be active across organizations and internationally.

(* “policy menu” is defined as combination of alternative policy instruments with description of its estimated social and economic impacts.)
Japan’s “Science of Science, Technology and Innovation Policy” Program

Rationales

- Measuring and showing impacts and effects of public R&D investment scientifically is necessary for gaining public understanding for “advance investment in the future”.
- Development of systematic and international comparable STI data infrastructure is inevitable for evidence-based policy-making.
- Vigorous investment in human resource development and enhancing the diversity of career path among sectors are essential for securing and capacity-building of personnel for evidence-based policy-making, who can handle the wide-range of STI policy field.

The ultimate goal is to realize “policy formation based on objective evidence”, which tries to make Policy more effective to address policy challenges, based on observations and analysis of social and economic states from various aspects.

“Science of Science, Technology and Innovation Policy” Program

Comprehensive management system
- Set up a steering committee to design and supervise the entire program.
- Set up an office responsible for supporting the steering committee at MEXT.

Mission-oriented investigation and research
- Conduct investigations and researches in response to short- and mid-term policy issues. (Focusing on Measuring the impacts of R&D investment for the time being)

Competitive Research Grant Program
- Develop Methodologies, tools and Models for Science of STI Policy, expected to contribute in the medium and long terms. (The MEXT gives the basic policy for the grant program.)

Data-infrastructure
- Create data infrastructure systematically and continuously to develop “Science of STI Policy”
- Enhance environment s for utilizing data

Universities and networks for human resources development
- Foster policy-makers and researchers promoting “Science of STI policy”
- Build Networks among hubs and with other institutions

Active collaboration Building a community

Administration

Draft Budget for FY2012: 1,077 million yen
Budget for FY2011: 802 million yen

Academy

27
“Science of Science, Technology and Innovation Policy” : Expansion of frontier by participation from related fields

Natural Science for Research
- Physics
- Biology
- Linguistics
- Informatics

Use of Natural Science Tools
- Engineering
- Economics
- Business Administration
- Sociology
- Ethics
- Philosophy
- History
- Cultural Anthropology

Development of Informatics
- Psychology
- Education

Use of Social Science Tools
- Law
- Political Science
- Public Administration
- Public Policy

Traditional STI policy studies

Expansion of frontiers by enhancing participation from various fields

(Note) Academic fields in outer circles are for illustrative purpose.
The “Science of STI Policy” Needs to Answer Important Questions

Understanding the Dynamics of STI System

- What is the process involved in STI?
  - Who are the main actors?
  - What is needed? (Finance, HR, Infrastructure, Management)?
  - Diffusion and adoption process of ST
  - Barriers to STI
  - Interaction with other types of innovation (ex. Social innovation) etc.

- What is the government role in STI Process?
  - What is the objective of STI Policy?
  - How do we identify and select societal challenges to be addressed by STI Policy?
  - What is the process of STI Policy Formation? Who are involved?
  - How is it possible to build consensus in STI policy formation?
  - What is the relationship between STI Policy and other policy areas?
  - Any synergetic effects or impediments? etc.

Understanding the Social and Economic Impacts of STI Policy

- How can we evaluate the impacts of STI Policy?
  - What is the outcome? How to evaluate economic and social value?
  - What are the differences in outcomes among alternative policy instruments? How can we measure them? etc.

Understanding Policy Formation Process and its Interaction with Society

Cultivating community of practice on SciSIP across academia, industry and the public
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Co-evolutionary development of “Science of STI Policy” and “Policy Formation Mechanism”

Science

Science of STI policy

Co-evolution
Communicating & Trusting

Policy-Formation Mechanism

Policy

Society

Objective

Science-Policy Continuum

Normative
Basic Loop for Sustainable & Resilient Society

- Role of Scientists and Actors in Society -

**Policy & Strategy**

*Design*

**Advice & Providing knowledge**

*Actors in Society*
- citizens
- statesmen
- policymakers
- businesspersons
- layers
- administrators
- engineers
- educators
- writers
- artists
- journalists
- etc...

**Evaluation, Synthesis**

Policy & Strategy

Analysis & Knowledge production

Prof. H.Yoshikawa, DG,CRDS/JST
New Social Contract for Nanotechnology in next decades

- Nanotechnology for Knowledge
- Nanotechnology for Peace
- Nanotechnology for Sustainability
- Nanotechnology in Society and for Society

* Be Socially Trusted
* Be Socially Embedded
* Shaping New Values and Social Transformation
* Beyond the Boundaries
* Fuse Intellectual Disciplines
* Enabling young students success
World Science Conference (UNESCO/ICSU) 'Declaration on Science and the Use of Scientific Knowledge' - Science for the 21st Century A New Commitment -

20th Century

☆ Science for knowledge
Knowledge for progress

21st Century

☆ Science for knowledge
☆ Science for peace
☆ Science for Development
☆ Science in society & Science for society

“Budapest Declaration” World Science Forum 1999 - 2011
Thank you very much for your attention!!

Questions:
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Solving Global Problems

Public Values:
- Wellbeing, QOL, Energy & Envi.
- Security & Safety, Resilience

Corporate Values:
- Profit, Competitiveness, Growth,
  Employment, CSR

Challenges of Sustainability and Development

Developed Countries

Local

Regional

Global

Innovation Ecosystem

Developing Countries

Knowledge, S&T, BRICS etc.

Global Innovation Ecosystem Since 2006 ~

Developing Countries

BRICS etc.

Market & Society

Heterogeneous, Diverse, Reverse & Frugal Innovation

Human Resources

International Collaboration & Competition

Finance & Taxes

Regulations & Standards
The University of Tokyo
- Focused area: Public policy and engineering
- Establish an interdepartmental education program within existing postgraduate program

Hitotsubashi University
- Focused area: Interdisciplinary innovation research with a foundation in social sciences including management and economics
- Establish a doctoral-level certificate course

GRIPS National Graduate Institute for Policy Studies
- Establish a master's program and doctoral program in the “Science of STI policy”
- Guide inter-hub collaboration and promote the development of the academic discipline and community

Joint Program
- Provide opportunities for gatherings: Seminars, summer-camps, etc.
- Share characteristic curriculums of each institution etc.

Osaka University (Jointly with Kyoto University)
- Focused area: Ethical, legal and social issues (ELSI) in science and technology
- Establish a minor specialization as a part of existing master's programs

Kyushu University
- Focused area: East Asian and regional innovation
- Establish a specialized course consisting of interdisciplinary postgraduate subjects

“Hub Institutions for Fundamental Research and Human Resource Development Program”
- Japan’s “Science of STI Policy”
Mission-Oriented Investigation and Research

1. Impacts on Economy and Society of Government Research and Development Investments
   (1) Micro-Data Analysis of the impacts of Government R&D Investments
   (2) Macroeconomic Analysis of the impacts of Government R&D Investments
   (3) Development of Analytical Method of Social Impacts (Non-economic) of Government R&D Investments
   (4) Overall Research

2. Investigation related to the Great Earthquake

Data / Information Infrastructure Construction

1. Grand Design of Data / Information Infrastructure and Promotion of Data-Providing Services
   (1) Construction of a Core Data Base
   (2) Data Gathering and Arrangement directly Supporting Mission-oriented Investigation Research

2. Data Gathering and Arrangement corresponding to the Needs of Policy Research
NISTEP(1) Themes of the Mission-oriented Investigation Research

<table>
<thead>
<tr>
<th>1. Impacts on Economy and Society of Government Research and Development Investments</th>
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<tbody>
<tr>
<td><strong>(1) Micro-Data Analysis of the Impacts of Government R&amp;D Investments</strong></td>
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<tr>
<td>① Micro-data Analysis of Immaterial Assets, Innovation, and Productivity</td>
</tr>
<tr>
<td>② Investigation on Innovation: Following up the 2nd Investigation and Conducting the 3rd Investigation</td>
</tr>
<tr>
<td>③ Analysis of R&amp;D Investment and Economic Impacts in Specific Fields, Areas, or Policies [FS]*</td>
</tr>
<tr>
<td>④ Investigation Research of Knowledge Transfer between Universities or Institutes and Businesses</td>
</tr>
<tr>
<td>⑤ Analysis of the Impacts of Knowhow or Trade Secrets on Innovation Outcomes of Businesses</td>
</tr>
<tr>
<td><strong>(2) Macroeconomic Analysis of the Impacts of Government R&amp;D Investments</strong></td>
</tr>
<tr>
<td>① Improvement of the Macro-Economic Model developed in NISTEP</td>
</tr>
<tr>
<td>② Analysis and Prediction of the Effects of Government R&amp;D Investment using Dynamic General Equilibrium Macro Model</td>
</tr>
<tr>
<td><strong>(3) Development of Analytical Method of Social Impacts (Non-economic) of Government R&amp;D Investments</strong></td>
</tr>
<tr>
<td>① Extraction of Quantitative Indices of Social Impacts of Innovations given by Government R&amp;D Investments, and Case Studies [FS]*</td>
</tr>
<tr>
<td><strong>(4) Overall Research</strong></td>
</tr>
<tr>
<td>① Overall Analysis of Economic and Social Impacts of Government R&amp;D Investments</td>
</tr>
<tr>
<td>② Investigation and Analysis on Trends in Economic and Social Impacts of Government R&amp;D Investments in the World.</td>
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<th>2. Investigation related to the Great Earthquake</th>
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<tr>
<td>① Questionnaires to the Expert Community</td>
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<tr>
<td>② National Awareness Survey</td>
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<tr>
<td>③ Others</td>
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</tbody>
</table>

*In this FY, a few case studies and preliminary discussions are to be conducted as feasibility studies, and the full survey will be done in the next FY based on the outcomes of this FY.*
### NISTEP(2) Action Items in Data / Information Infrastructure Construction

<table>
<thead>
<tr>
<th>1. Grand Design of Data / Information Infrastructure and Promotion of Data Providing Services</th>
<th>① Grand Design of Data / Information Infrastructure and Promotion of Data Providing Services</th>
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<tbody>
<tr>
<td>2. Data Gathering and Arrangement corresponding to the Needs of Policy Research</td>
<td>① Data Gathering on Scientific Knowledge Production in Government Research Systems</td>
</tr>
<tr>
<td></td>
<td>② Data Gathering on Innovations in Industries</td>
</tr>
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<td></td>
<td>③ Time-series Observations of Scientific and Technology Systems and its Application</td>
</tr>
<tr>
<td></td>
<td>④ Construction of a Tracking-system and Data Base of Doctor Course Graduates</td>
</tr>
<tr>
<td>(1) Construction of a Core Data Base</td>
<td>① Construction of a Data Base on Immaterial Assets, Productivity and Policies, and Growth Accounting Analysis</td>
</tr>
<tr>
<td></td>
<td>② Construction of a Data Base on Government R&amp;D Budget by Fields and Objectives</td>
</tr>
</tbody>
</table>
1. **Objective**

- Promoting R&D projects on new analytic methodologies, models, data-systematization tools and aggregate indicators that can be used in actual policy.
- Increasing the number of researchers who work on this challenge in a wide range of disciplines and interdisciplinary fields, and expanding the community network through public relations and dialogue on the activities.

2. **Period**

   Total of seven years from FY 2011 to 2017 (New R&D projects will be accepted for the first four years)

3. **Targeted R&D Projects**

   - Designing and implementation of a strategic framework for forming overall STI policy
   - Determination of the social and the economic impact of public investment in R&D
   - Assessment of optimal system (organization, framework, etc) for promoting STI policy, and the impact of the system on the STI process
   - Development of designs for frameworks to promote the participation of members of society in STI policy formation, creation of related methodologies, and use of them in actual policy formation

   Outcomes will be sought that can be used in the actual formulation of the Fifth Science and Technology Basic Plan to be adopted for FY 2016-2020 and other medium- to long-term policy-forming process.

4. **Approaches needed**

   - Promotion of multidisciplinary R&D that harnesses expertise in the natural sciences as well as the humanities and social sciences
   - On-site activities or simulations of the use of R&D outputs
   - Collaboration by researchers, policy-makers and other parties at the appropriate stages of the R&D
   - Development of cooperation with other related programs, keeping in mind international trends
5. R&D projects

- **Length of Individual R&D Projects**: 1.5 to 3 years
- **R&D Expenses per Project**: Appox. 15 to 20 million yen annually
- **Number of Projects to be Accepted**: Several up to ten projects annually

### <Projects accepted in FY2011>

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Length</th>
<th>Project Director</th>
<th>Affiliation</th>
</tr>
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<tbody>
<tr>
<td>Development of Methods for Impact Assessment of Electric Power Innovation and R&amp;D Network Evaluation</td>
<td>3yrs.</td>
<td>Taro AKIYAMA</td>
<td>Director, Center for Economic Growth Strategy Professor, Faculty of Economics Yokohama National University</td>
</tr>
<tr>
<td>Scientometrics Conducive to Management of Funding Programs</td>
<td>3yrs.</td>
<td>Masashi SHIRABE</td>
<td>Associate Professor, Graduate School of Engineering, Tokyo Institute of Technology</td>
</tr>
<tr>
<td>Methodology Development for Visualization and Quantification of Social Expectation to Science Technology</td>
<td>3yrs.</td>
<td>Masatoshi TAMAMURA</td>
<td>Associate Professor, Faculty of Policy Management, Keio University</td>
</tr>
<tr>
<td>Research on Scientific Sources of Innovations and Economic Impacts of Science</td>
<td>3yrs.</td>
<td>Sadao NAGAOKA</td>
<td>Professor, Institute of Innovation Research, Hitotsubashi University</td>
</tr>
<tr>
<td>Integrating Joint Fact-Finding into Policy-Making Processes (IJFF)</td>
<td>3yrs.</td>
<td>Masahiro MATSUURA</td>
<td>The University of Tokyo, Graduate School of Public Policy</td>
</tr>
<tr>
<td>Study of Innovation Strategies Conducive to Creating Future Industries</td>
<td>3yrs.</td>
<td>Eiichi YAMAGUCHI</td>
<td>Professor, Graduate School of Policy and Management, Doshisha University</td>
</tr>
</tbody>
</table>
Original basic researches have great social and economic impacts through interactions of various elements.

Nobel laureate Prof. Shirakawa’s accomplishment (Conductive polymers)
- 1967, First Discovery
- Basic expenses, Grant-in-aid, support from industry
- 2000, Nobel Prize

Nobel laureate Prof. Noyori’s accomplishment (Chiral Catalization)
- 1966, First Discovery
- Basic expenses, Grant-in-aid, ERATO, technology transfer to industry
- 2001, Nobel Prize

Social and Economic Impacts
- cell of mobile phone
- touch panel for ATM
- display and electric devices for PC and digital camera etc.
- Medicine
- Food, menthol

Integration of disciplines for innovation

- Biology
- Medicine
- Health

- Physics
- Chemistry
- Material Science

- Cognitive science
- Robotics

- Mathematics
- Computer Science

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

Obreaking new knowledge frontier
OProblem solving and value creating for society & economy

ex. for ‘Green new deal’ and ‘Aging society’