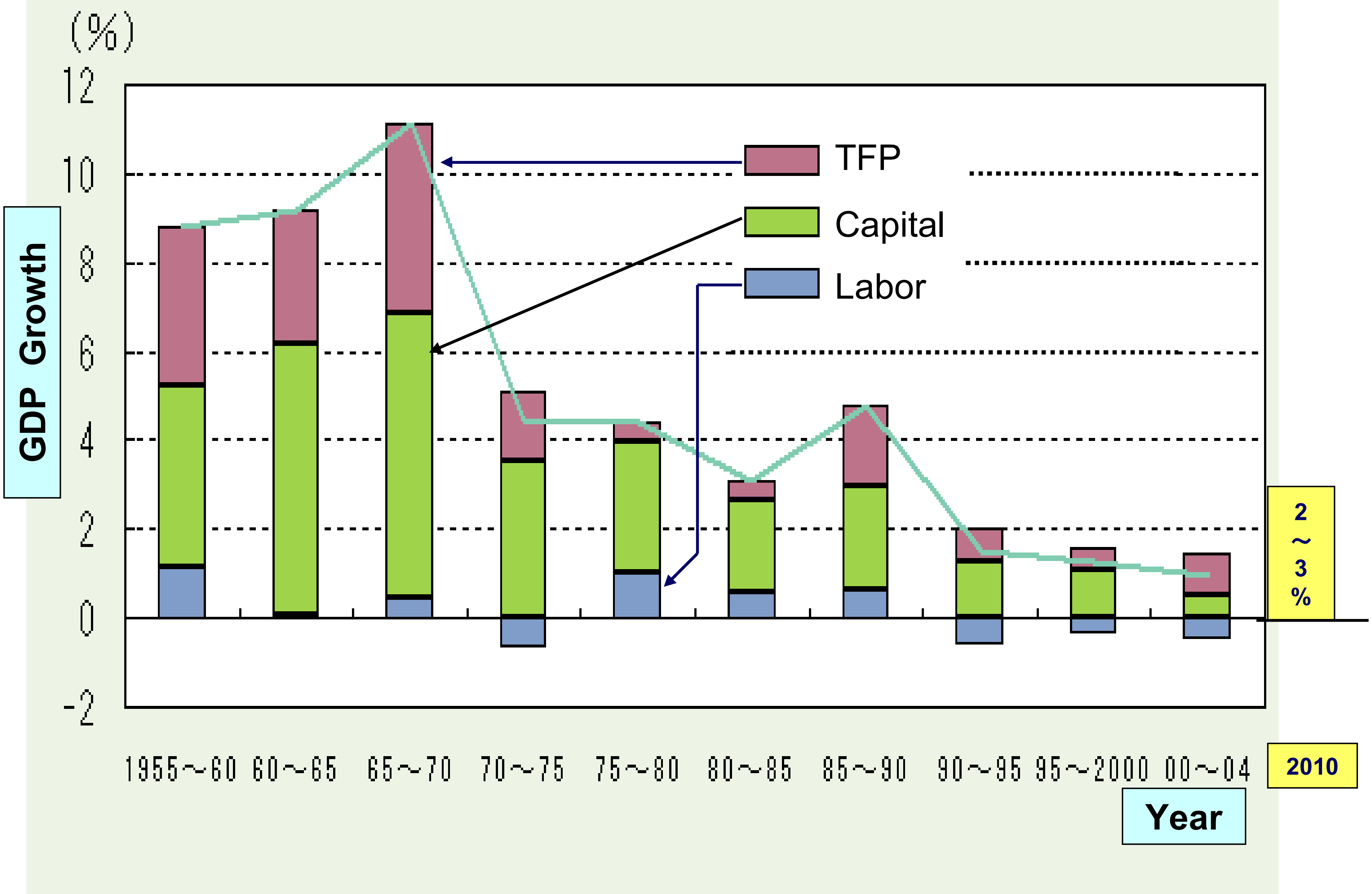
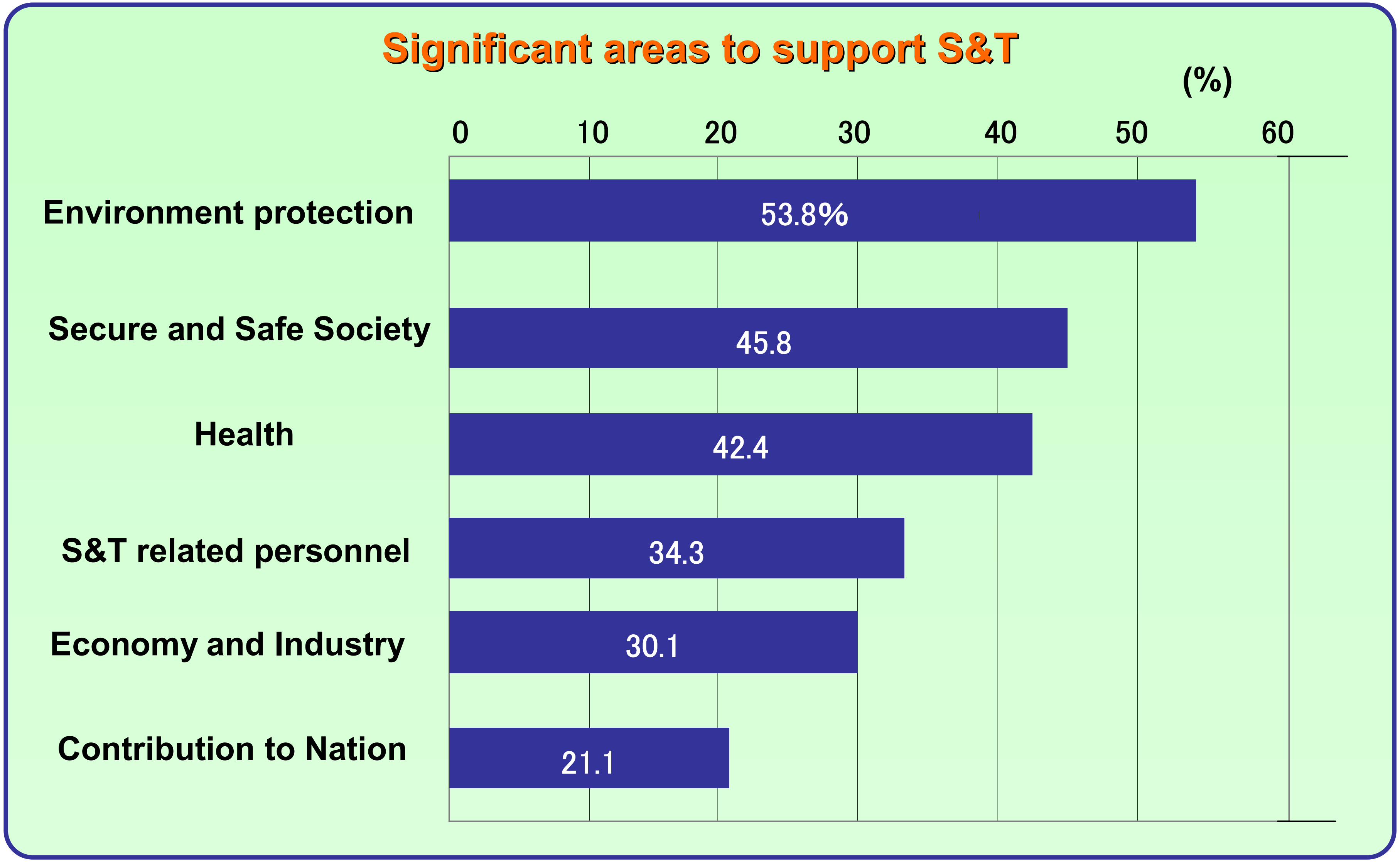

☆GIES Setting the Tone ☆
Innovation Ecosystem
In a New Era
Sept.8.2006
Tateo Arimoto
Cabinet Office

Contribution of Technological Innovation to Economic Growth of Japan(1955～2004）

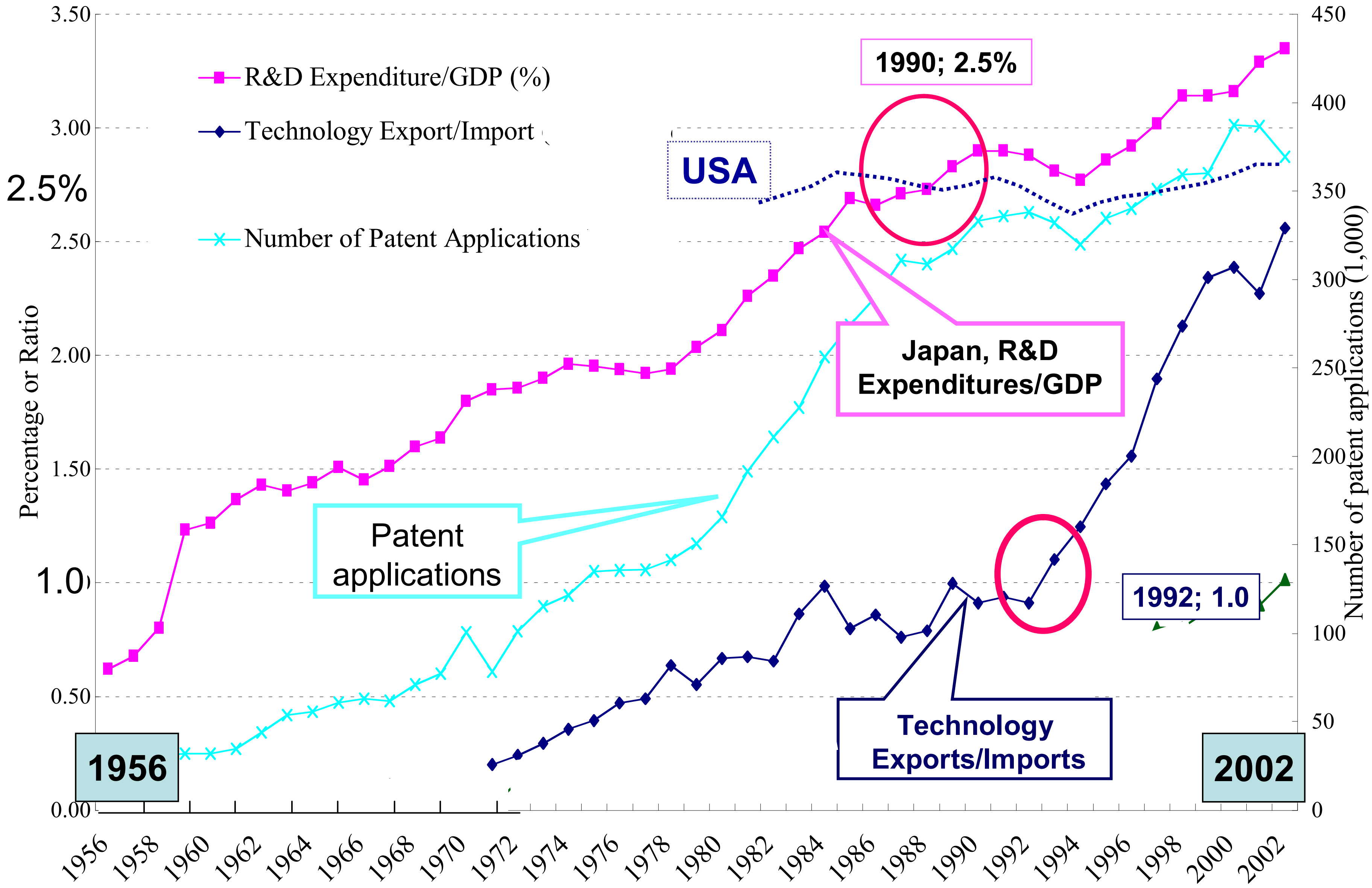


How should S&T respond to the national expectations?

Public Opinion Poll on Science and Technology, May, 2005



Trend in R&D/GDP, Technology Exports/Imports in Japan (1956-2002)



End of the Cold-War
Globalization
ICT revolution

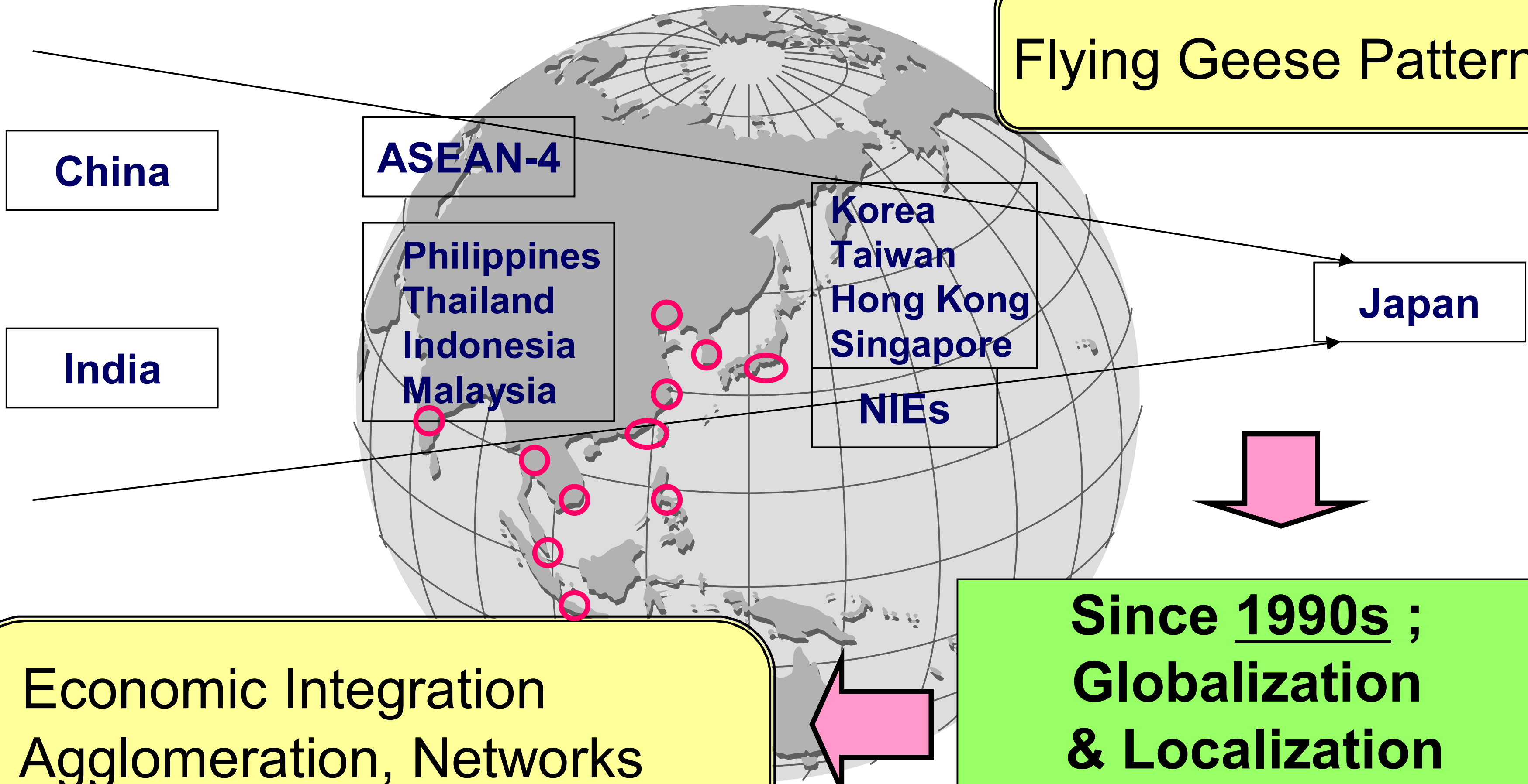
The Environment is Changing Rapidly …

- Economic environment
- Knowledge-based society
- Sustainability, Global issues
- Science and technology

Structural Transformation of Economic Development in Asia

Until <u>1980s</u>

Flying Geese Pattern



Since <u>1990s</u> ;
Globalization
& Localization

Economic Integration

Agglomeration, Networks

Multi-cored, Urban-Industrial Belt

Disparity

GDP share:EU15(25%), NAFTA(35%), East Asia(23%)

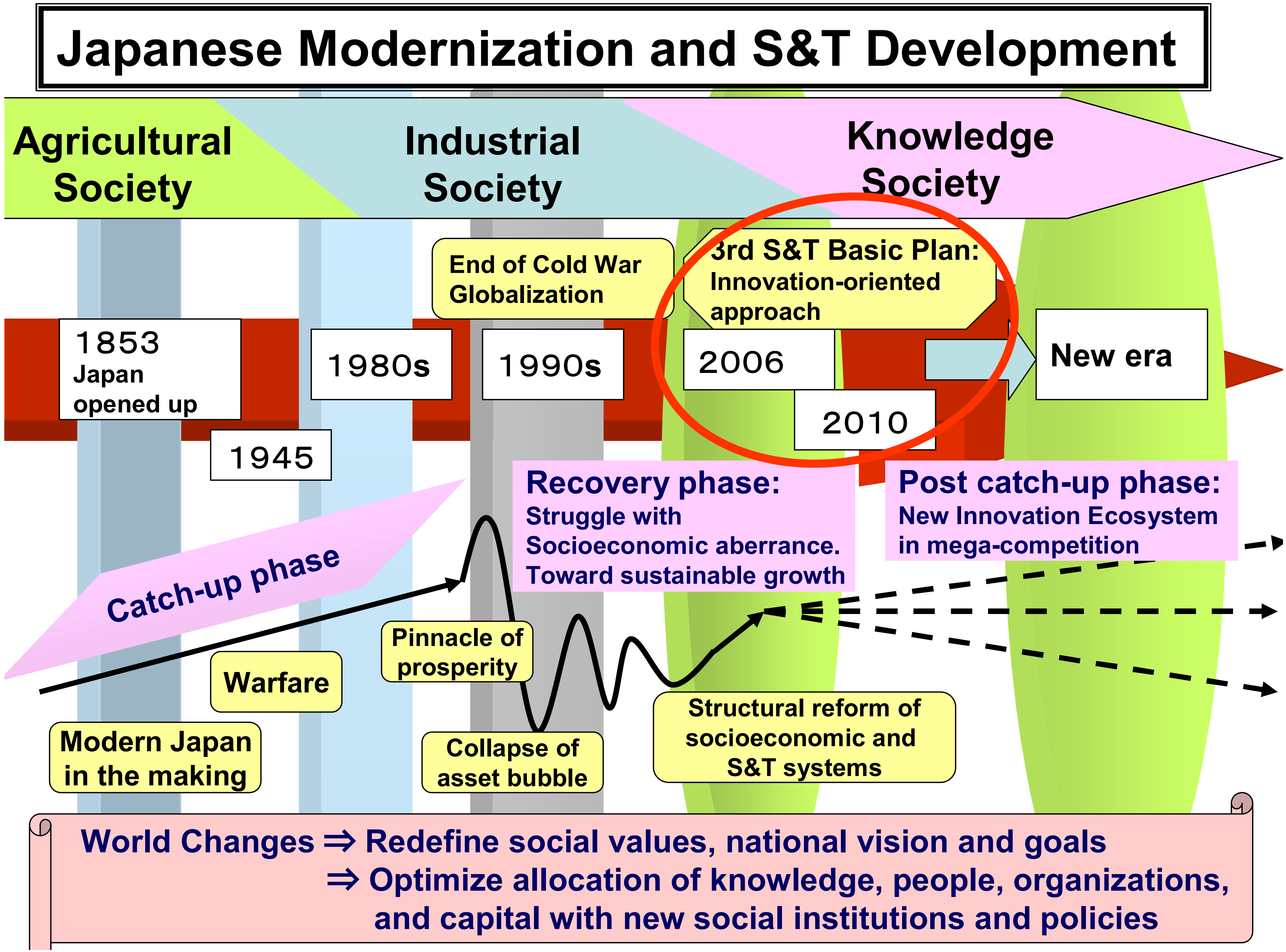
Causes of Prolonged Recession of the 1990s

○Macro-economic view

- ♢Collapse of asset bubble in the 1980s
  dysfunction of financial sector
- ♢Excess capacity build in the 1980s
- ♢Depressed market demand and financial and
  monetary stinginess since 1990

○Productivity slowdown

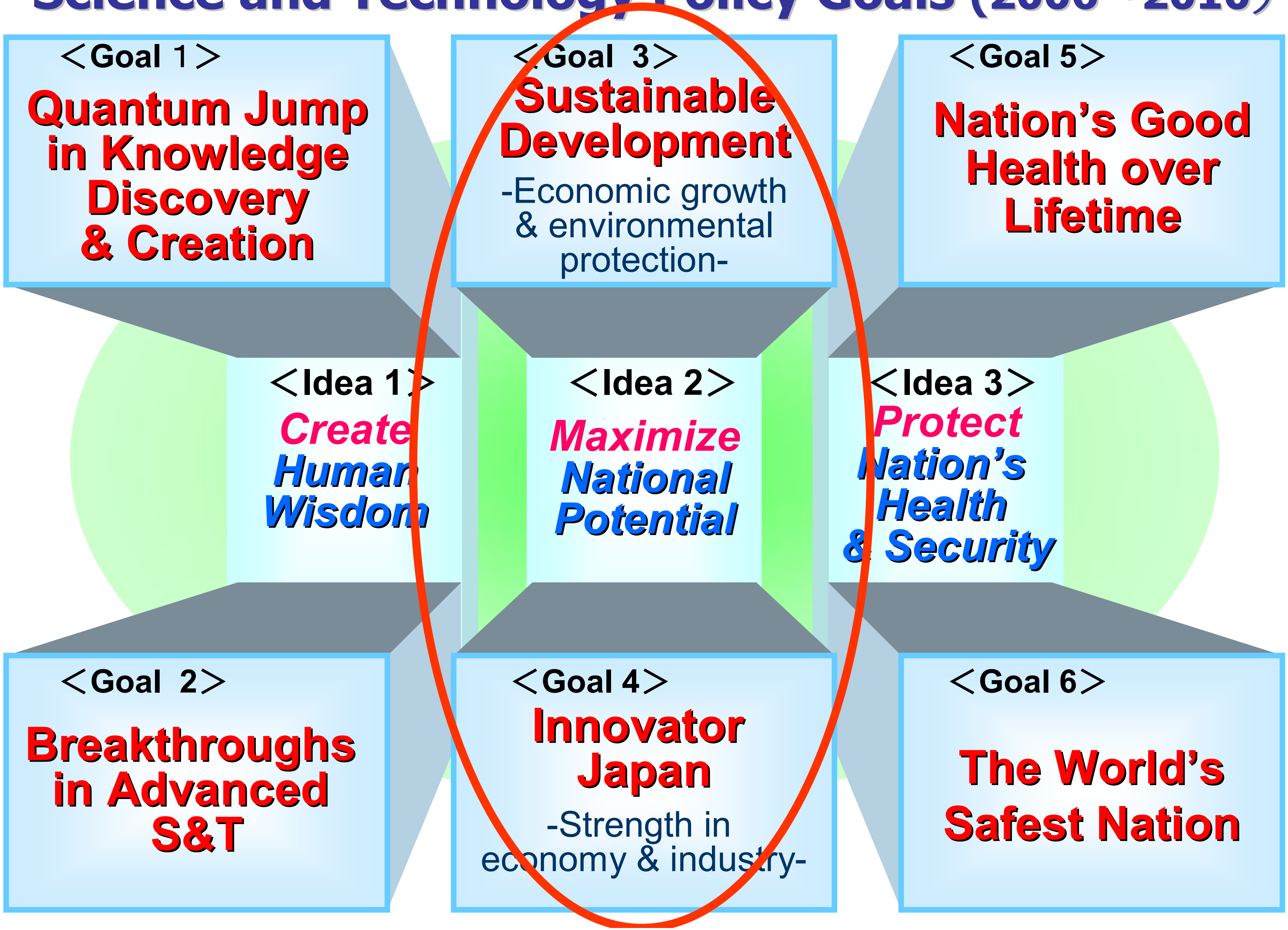
- ♢Less productive firms stayed, failure of resource allocation
- ♢Completion of catch-up, R&D became less efficient,
  exhaustion of easily imported technologies
- ♢Deterioration of innovation capability
  mismatch of innovation system to newly emerging
  science based industries such as IT and BT,
  and open-innovation & global integration age.

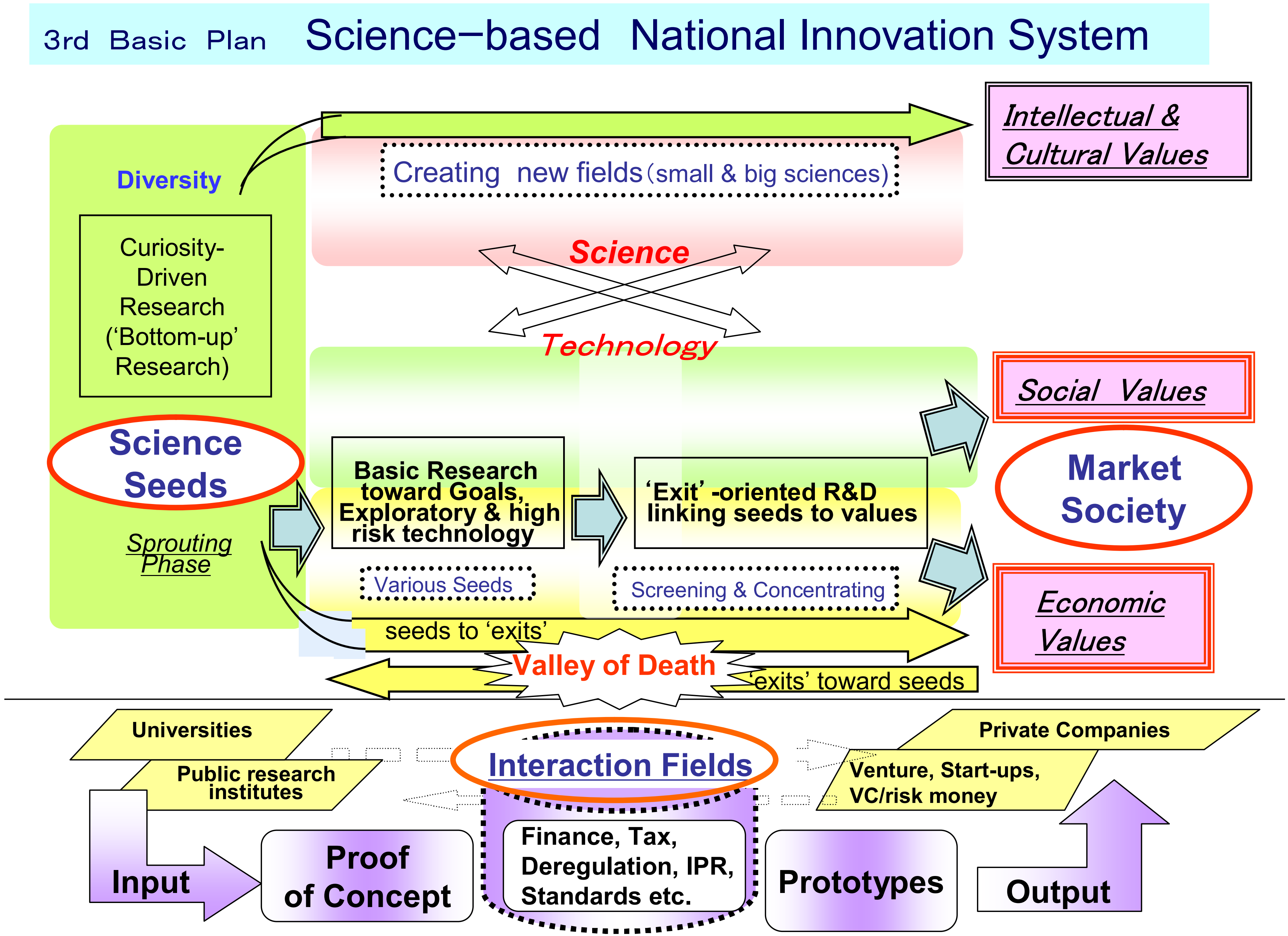

Japanese Modernization and S&T Development
Agricultural Society
Industrial Society
Knowledge Society
End of Cold War Globalization
3rd S&T Basic Plan: Innovation-oriented approach
1853 Japan opened up
1945
1980s
1990s
2006
2010
New era
Catch-up phase
Recovery phase: Struggle with Socioeconomic aberrance. Toward sustainable growth
Post catch-up phase: New Innovation Ecosystem in mega-competition
Warfare
Pinnacle of prosperity
Modern Japan in the making
Collapse of asset bubble
Structural reform of socioeconomic and S&T systems
World Changes ⇒ Redefine social values, national vision and goals
⇒ Optimize allocation of knowledge, people, organizations, and capital with new social institutions and policies

☆Innovate Japan

☆Sustainable Development

Science and Technology Policy Goals (2006～2010）

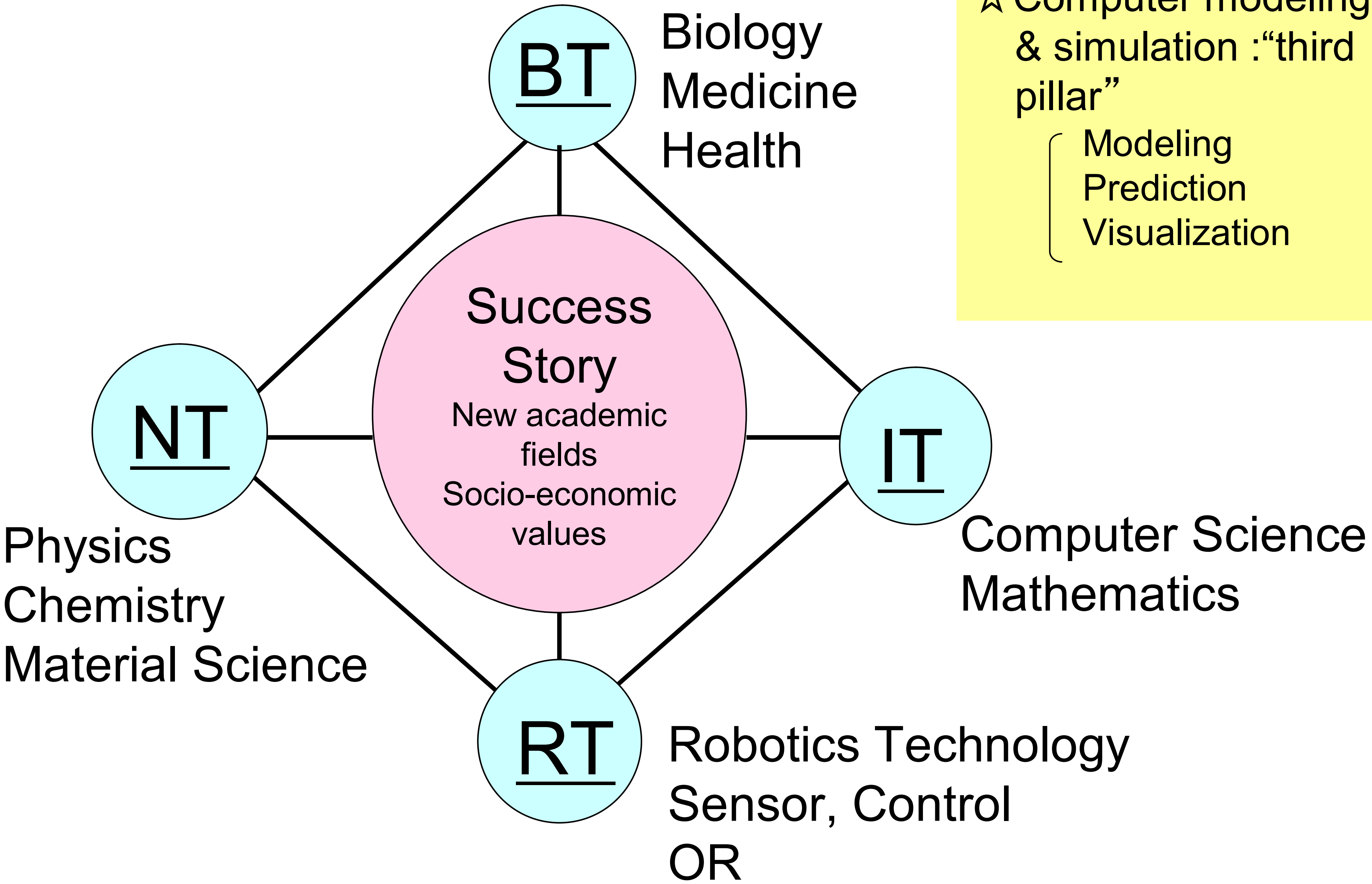




3rd Basic Plan Science−based National Innovation System
Intellectual & Cultural Values
Diversity
Creating new fields (small & big sciences)
Science
Technology
Curiosity-Driven Research ('Bottom-up' Research)
Science Seeds
Sprouting Phase
Basic Research toward Goals, Exploratory & high risk technology
'Exit' -oriented R&D linking seeds to values
Social Values
Market Society
Economic Values
Various Seeds
Screening & Concentrating
seeds to 'exits'
Valley of Death
'exits' toward seeds
Universities
Public research institutes
Interaction Fields
Private Companies
Venture, Start-ups, VC/risk money
Input
Proof of Concept
Finance, Tax, Deregulation, IPR, Standards etc.
Prototypes
Output

Integration of traditional disciplines
⇒ Creating new fields and new values

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



Original Basic Research Has Great Social and Industrial Impact Through Long-term Research Support.

Nobel laureate Prof.Shirakawa’s accomplishment (Conductive polymers)

1967, First Discovery

2000, Nobel Prize

Basic expenses, Grant-in-aid, support from industry

Nobel laureate Prof.Noyori’s accomplishment (Chiral Catalization)

1966, First Discovery

2001, Nobel Prize

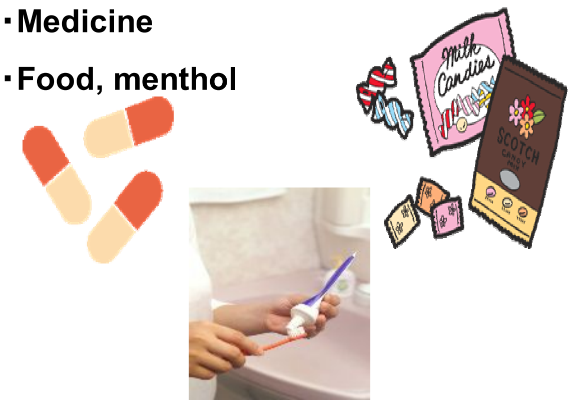
Basic expenses, Grant-in-aid, ERATO, technology transfer to industry

1970 1980 1990 2000

Social and Economic Impacts

- cell of mobile phone
- touch panel for ATM
- display and electric devices for PC and digital camera etc.

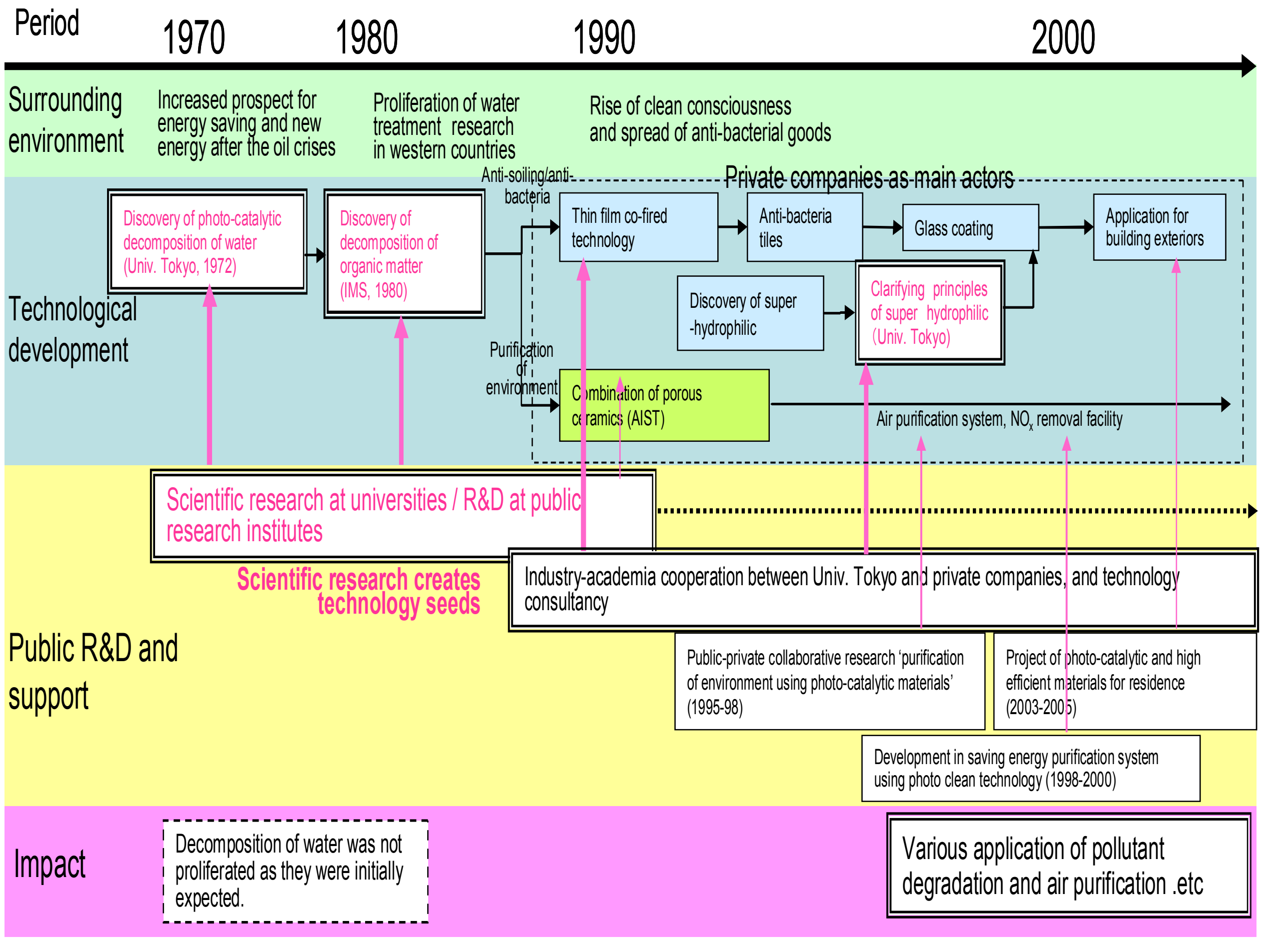
- Medicine
- Food, menthol



Impact Analysis : Case Study of Photo-Catalytic Materials

[Points of case analysis]

- In the initial stage of technology development, scientific research at the Univ. Tokyo and public research institutes played a significant role.
- Basic research at Univ. Tokyo also contributed to developing technology processes. In the meantime, technology development of industry-academia went beyond its framework to reach another progress in basic research.
- Later, taking advantages of the development of decomposition of organic matters and thin film technology, various applications of self-cleaning tiles and air purification yielded technology impacts.



●Economic impacts

- Due to the accumulated values and substitutes of existing product goods such as roof and siding materials, air purification equipment, and deodorant machines etc, large market（estimated about 40 billion yen）would take place.

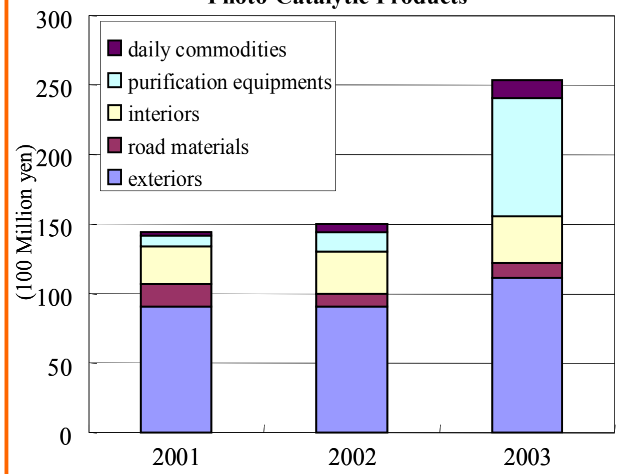
●Social impacts

- Reducing the budget of road and building cleaning costs
- Purification of waste water caused by greenhouse
- Prospect for NO_x absorption on the street
- Prospect for saving energy in air conditioning

●Impacts on the lives of people

- Saving time for cleaning the exterior and interior of residence
- Improving appearance in towns and streets

Trend of Market Scale in Applied Photo-Catalytic Products



* The reason for increase in the amount of purification equipments in 2003 is caused by a different calculation method (Calculated filter only before 2003 and thereafter calculated a whole equipment). Source: Materials issued by Japanese Association of Photo-catalyst Products

Survey on contributions from public research institutes in the development of important patents at big businesses (November 2005, NISTEP)

Respondents:

324 innovators of important technology at **41** large corporations

Questionnaire:

18 questions regarding patenting and contributions in various forms from public research organizations

Finds:

80% of the respondents admit public contributions in developing their important corporate patents. Top 3 forms of public contribution are:

1. **Basic research at public organizations revealed the feasibility of a given invention seed.**
2. **Small collaboration project.**
3. **Communication with researchers gave clues for problem-solving.**

Direct transfer of technology from the public institution is ranked lowest.

- Diversified, consolidated base of basic research at universities and public organizations is indispensable to support inventions at the private sector.
- Communication among public and private researchers is at least as important as transfer of intellectual properties: Industry finds it valuable to absorb lessons from unsuccessful cases as well as 'implicit' knowledge of public researchers.
- Various forms of public contribution are involved both before and after collaboration projects are created: This may include interactions with public researchers to solve problems and foster technology seeds, and increasing exploitation of accumulated knowledge.

A Special Symposium: "Socioeconomic Conditions for Innovation"
November 29, 2005, Tokyo

1.Improving socioeconomic conditions for the national innovation ecosystem

S&T innovation requires the reform of the existing R&D system as well as the reform of overall socioeconomic conditions. We thus strongly encourage stakeholders, including politicians, government officials, corporate management, and academic administration, to cooperate in the following arena:

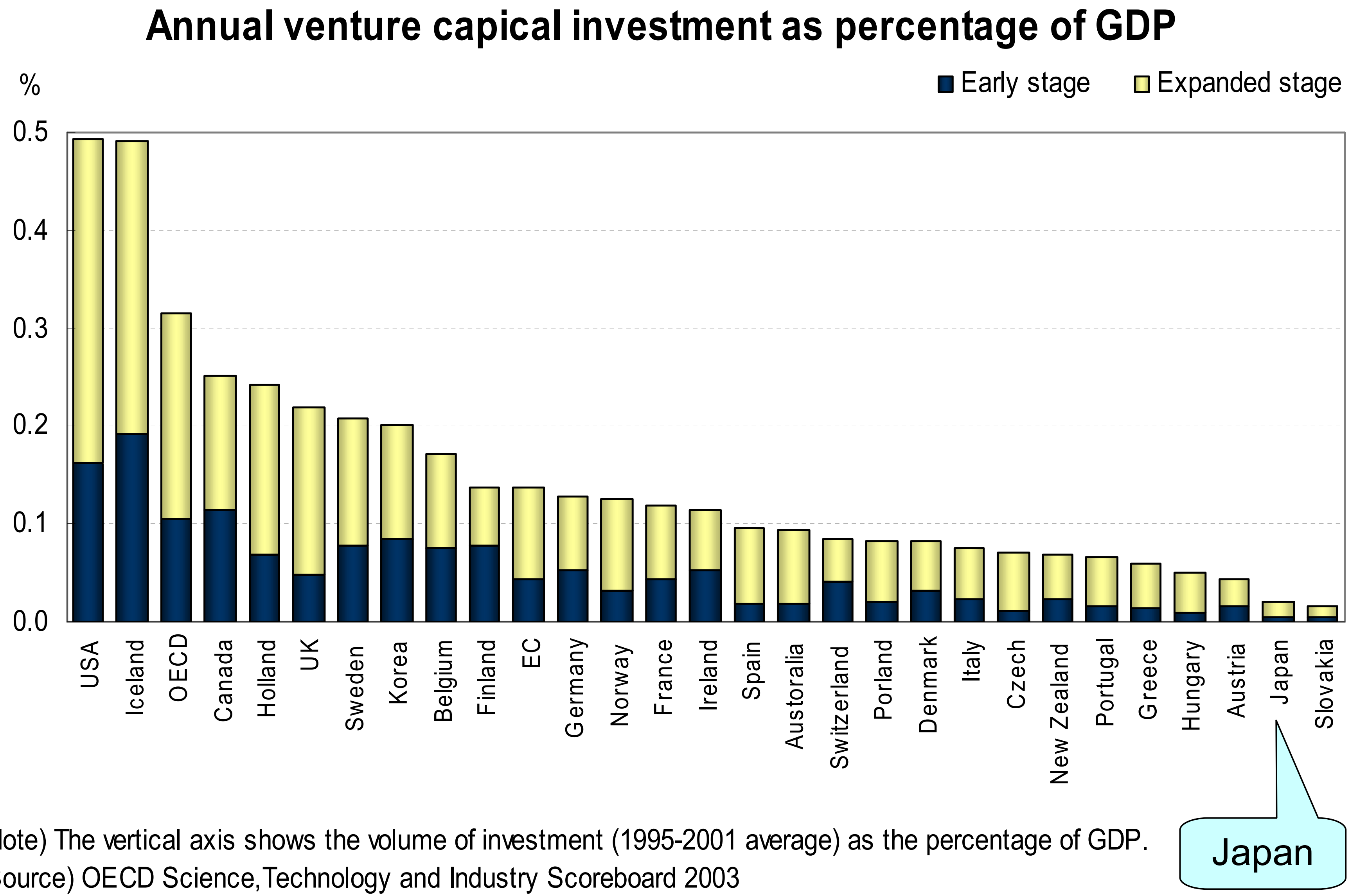
☆S&T policies ☆Human resource policies ☆Macro-economic policies
☆Industrial policies including focused regional revitalization
☆Improvements in regulations, taxation, finance, subsidiaries, procurements, and market formation
☆International standards, reform of IPR system and pro-innovation measures
☆A new safety net for innovation stakeholders
☆Enhancements in energy systems, distribution systems, communications networks, and other infrastructures.
☆Changes in social climate by setting out a clear national innovation policy, by creating a challenging atmosphere, by raising public awareness of innovation

2. Enhance opportunities for Government-Industry -Academia discussions

To share issues about the Japanese innovation ecosystem for its challenges.

3. Promote science of science policy

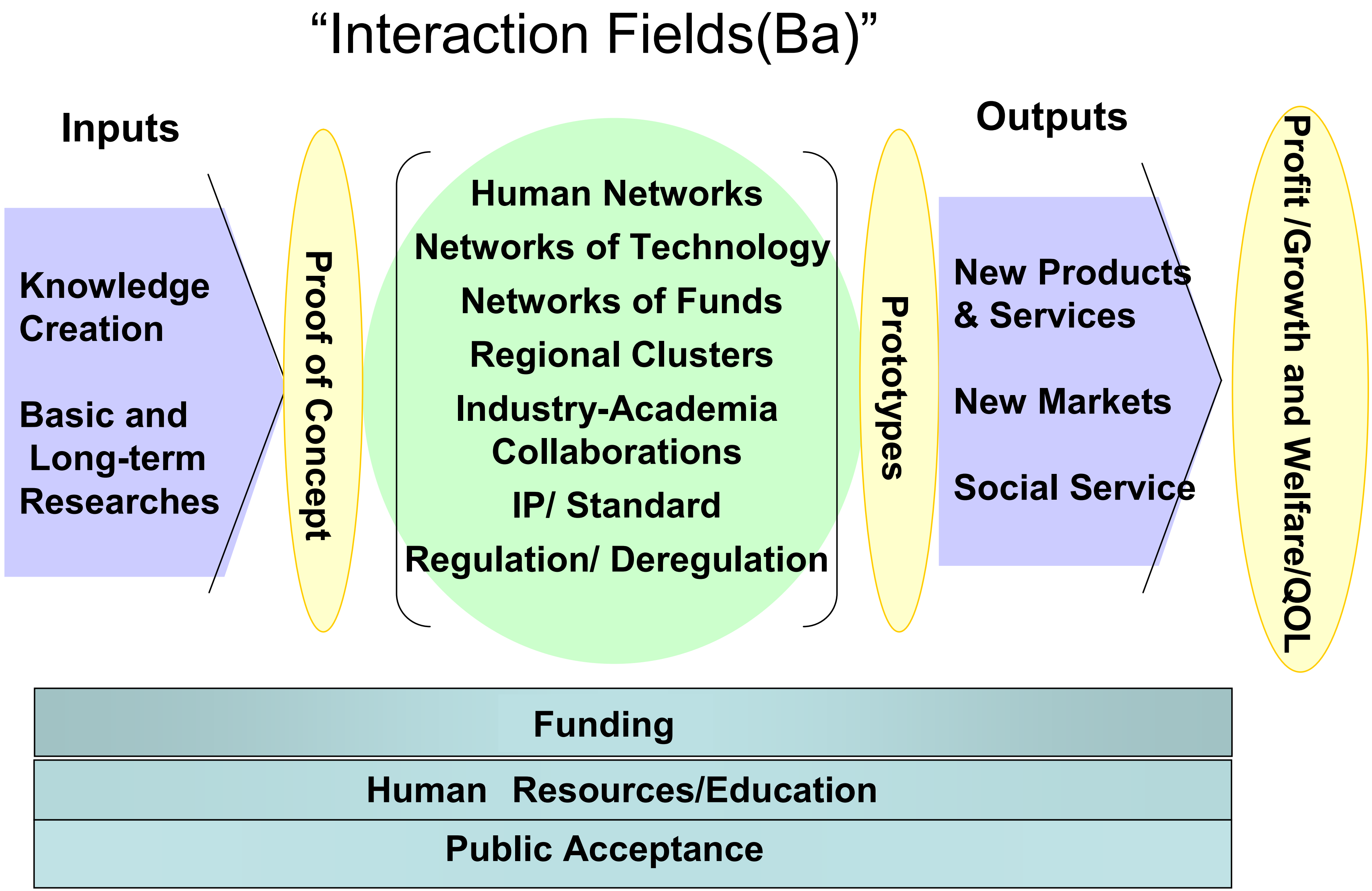
by creating interdiciplinary and international networks for science-based policymaking mechanism



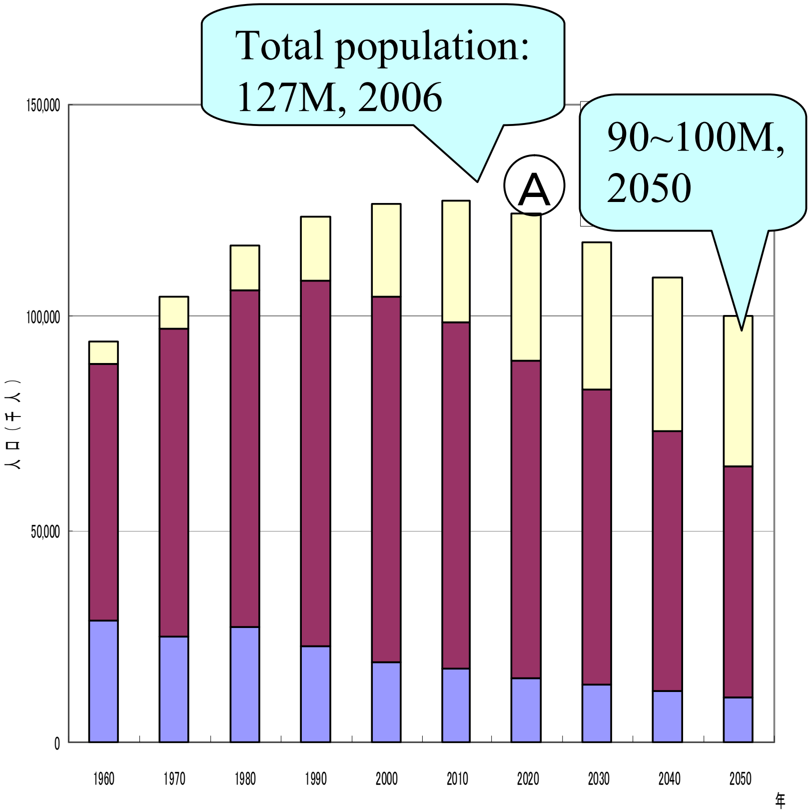
(Note) The vertical axis shows the volume of investment (1995-2001 average) as the percentage of GDP.
(Source) OECD Science,Technology and Industry Scoreboard 2003

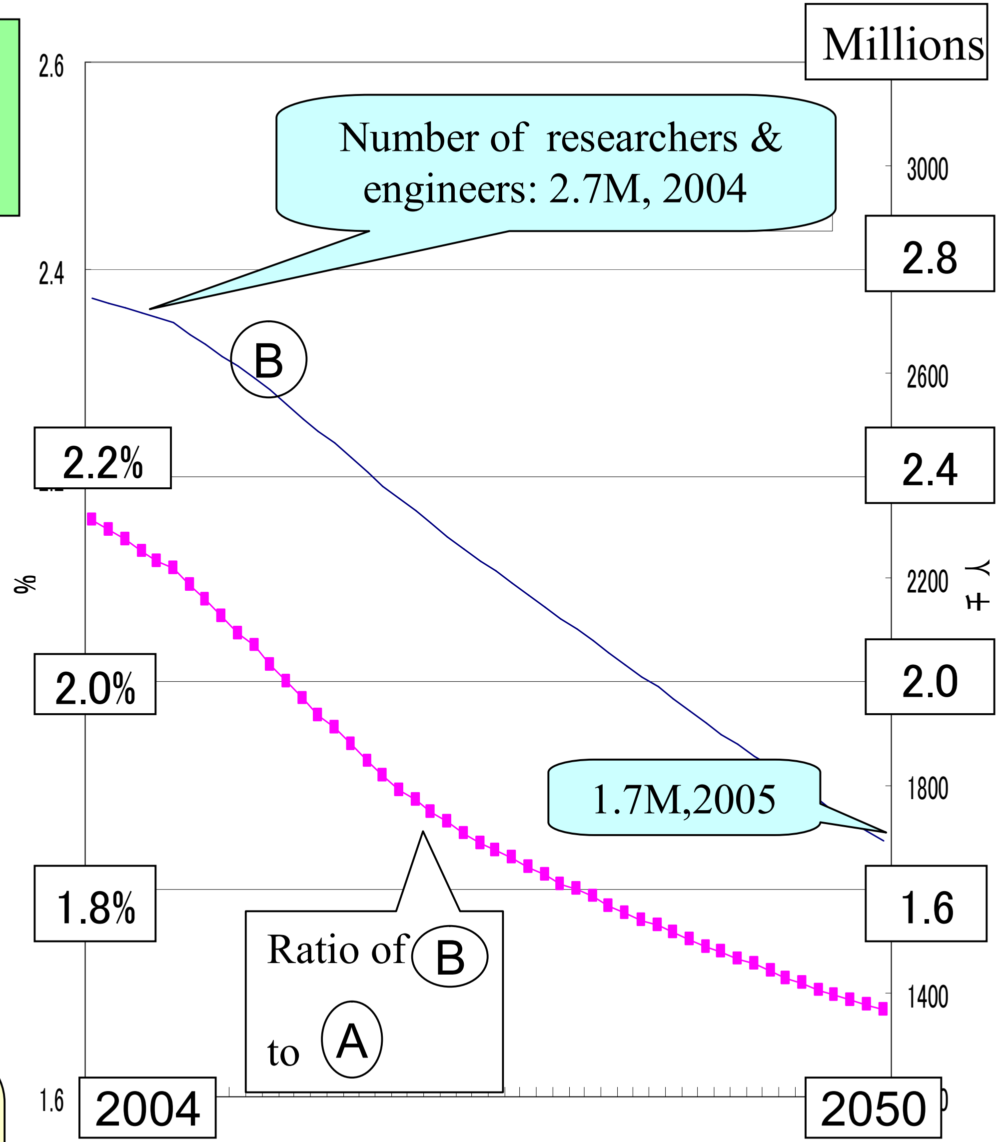
The supply of risk money is very small in Japan.

Innovation Ecosystem



Population decreasing Rapidly in Japan

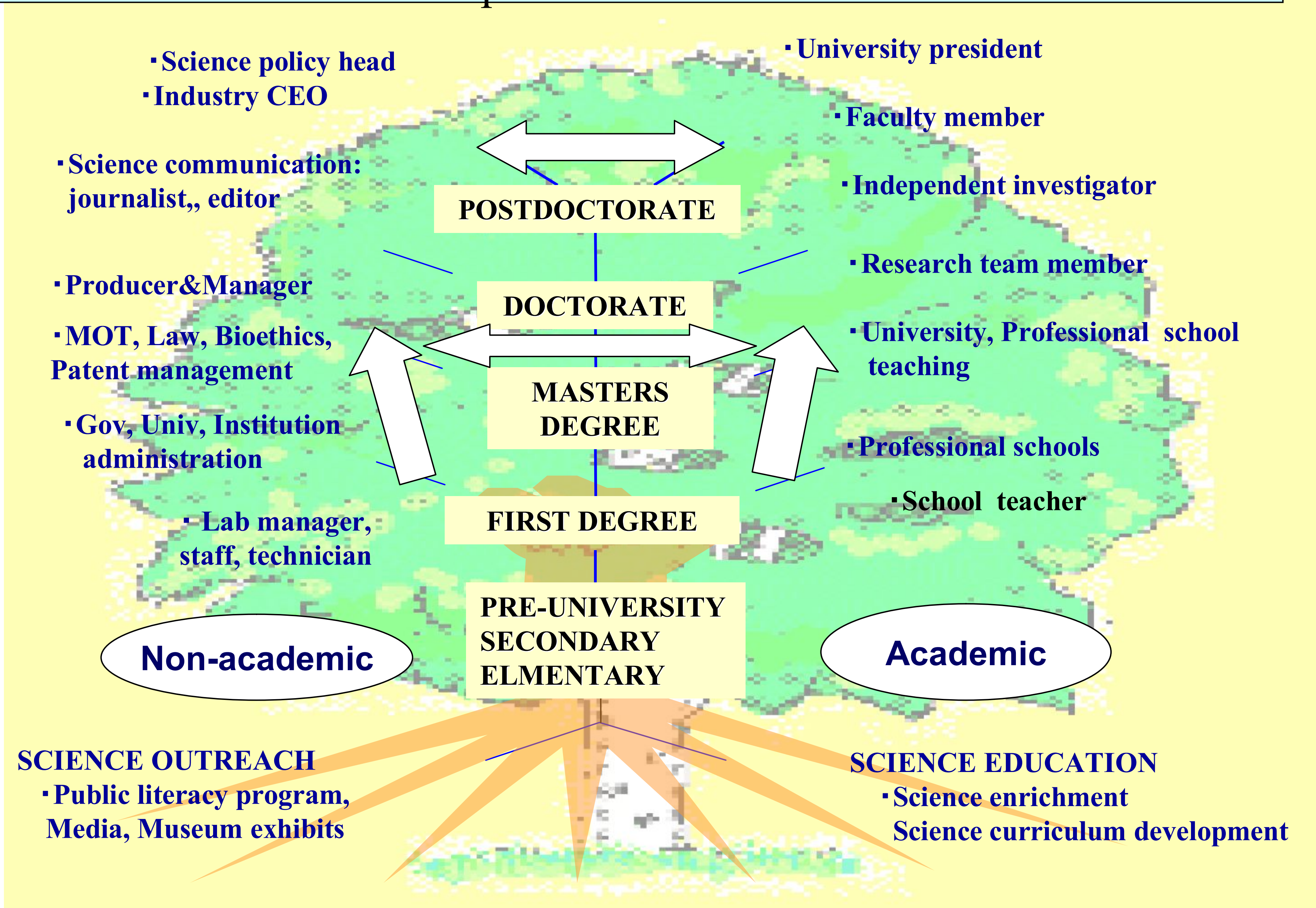




Number of researchers & engineers decreasing rapidly →Secure quality and quantity by reforming the market of human resources

Diversification
Brain circulation, Networking
Global universities

The pipeline and tree ; A new paradigm for training and career development in S&T and Innovation



Science, 29 April,2005. 21 April,2006

SCIENCE POLICY

Marburger Asks Social Scientists for A Helping Hand in Interpreting Data

Will the growing number of engineers graduating from Chinese universities be a boon or bane to the United States and the rest of the world?

John Marburger would like to tell his boss, President George W. Bush, how that trend might affect the U.S. technical workforce and the country's economy—or even how long it's likely to persist. But the president's science adviser says he'd be flying by the seat of his pants. "I won't take a position on whether it's good or bad based on the data," says Marburger, "because we don't have adequate models."

Last week Marburger challenged the scientific community to help him find answers to a host of questions like these that puzzle science policymakers. "I am suggesting that the nascent field of the social science of science policy needs to grow up, and quickly," Marburger told a Washington, D.C., gathering sponsored by AAAS (which publishes *Science*). Economists have applied "behavioristic" tools successfully in other fields, says Marburger, pointing to analyses of how changes in retirement patterns might affect Social Security. He urged scientists to incorporate "the methods and literature of the relevant social science disciplines" to explore trends such as the community's "voracious appetite" for federal research funding, the "huge fluctuations" in state support for public universities, and the continuing advances in information technology.

Marburger's call to statistical arms was generally welcomed by policy analysts, who agreed that their field hadn't made much progress on the big questions confronting decision makers. "We operate with blinders on," says Daniel Sarewitz of Arizona State University in Tempe, a former congressional staffer who studies the interplay of science and society. "Rather than simply tracking the growth in industrial R&D, for example, we also need to look at how that affects public sector investment. The set of assumptions that goes into S&T policy is unbelievably oversimplified."

That lack of rigor, speculates Harvard economist Joshua Lerner, part of a group studying U.S. innovation policy, could be a result of the limited interaction between the disciplines. "A lot of science policy has an amateur-hour flavor to it because it's done by scientists who aren't familiar with the principles of the social sciences," he says. "But it's also our fault. We economists haven't communicated as well with other disciplines as we should."

Another factor is the sheer difficulty of coming up with a theoretical framework that takes into account enough of the important variables to generate useful results. "Such a model has proved to be elusive," says Rolf Lehming, who oversees the National Science Foundation's biennial volume: *Science and Engineering Indicators*. Previous efforts to nurture such a community of scholars were abandoned, notes Mary Ellen Mogee, a science policy analyst at SRI International in Arlington, Virginia, including the 1995 elimination of the congressional Office of Technology Assessment.

Supermodel. U.S. science adviser John Marburger wants better econometric models of research trends.

Marburger says that he believes a new effort can be mounted at minimal cost. "We're not talking about a lot of money; … funding is not a rate-limiting factor in this equation." But others see a federal role as crucial. Connie Citro, who directs the National Academies' Committee on National Statistics, says that "there needs to be at least a signal [from the federal government] that proposals would be welcome." Sarewitz admits that a plea for federal support is self-serving, but he adds, "that's what drives academics in any field."

—JEFFREY MERVIS

SOURCE: MIT

I am suggesting that the nascent field of the <u>social science of science policy</u> needs to grow up, and, quickly, to provide a basis for understanding the enormously complex dynamic of today's global, technology-based society.

SCIENCE POLICY

NSF Begins a Push to Measure Societal Impacts of Research

When politicians talk about getting a big bang for the buck out of public investments in research, they assume it's possible to measure the bang. Last year, U.S. presidential science adviser John Marburger disclosed a dirty little secret: We don't know nearly enough about the innovation process to measure the impact of past R&D investments, much less predict which areas of research will result in the largest payoff to society (*Science*, 29 April 2005, p. 617). He challenged social scientists to do better.

Next month, the National Science Foundation (NSF) will invite the community to pick up the gauntlet. A Dear Colleague letter from David Lightfoot, head of NSF's social, behavioral, and economic sciences (SBE) directorate, will describe an initiative tentatively dubbed "the science of science policy." NSF is also holding three workshops for researchers to lay the intellectual foundations for the initiative. By fall, NSF

from Congress as a

Lightfoot envisions as

that would eventually support a half-dozen large research centers at U.S. universities and scores of individual grants.

In its 2007 budget request, released in February, NSF says the initiative will give policymakers the ability to "reliably evaluate returns received from past R&D investments and to forecast likely returns from future investments." Lightfoot cautions against expecting too much precision. "One shouldn't overstate this goal," he says. "Nobody is under the illusion that we're going to be able to hand these decisions over to the computers." But he believes that it should be possible to develop "a more evidence-based understanding of what happens to our R&D investments."

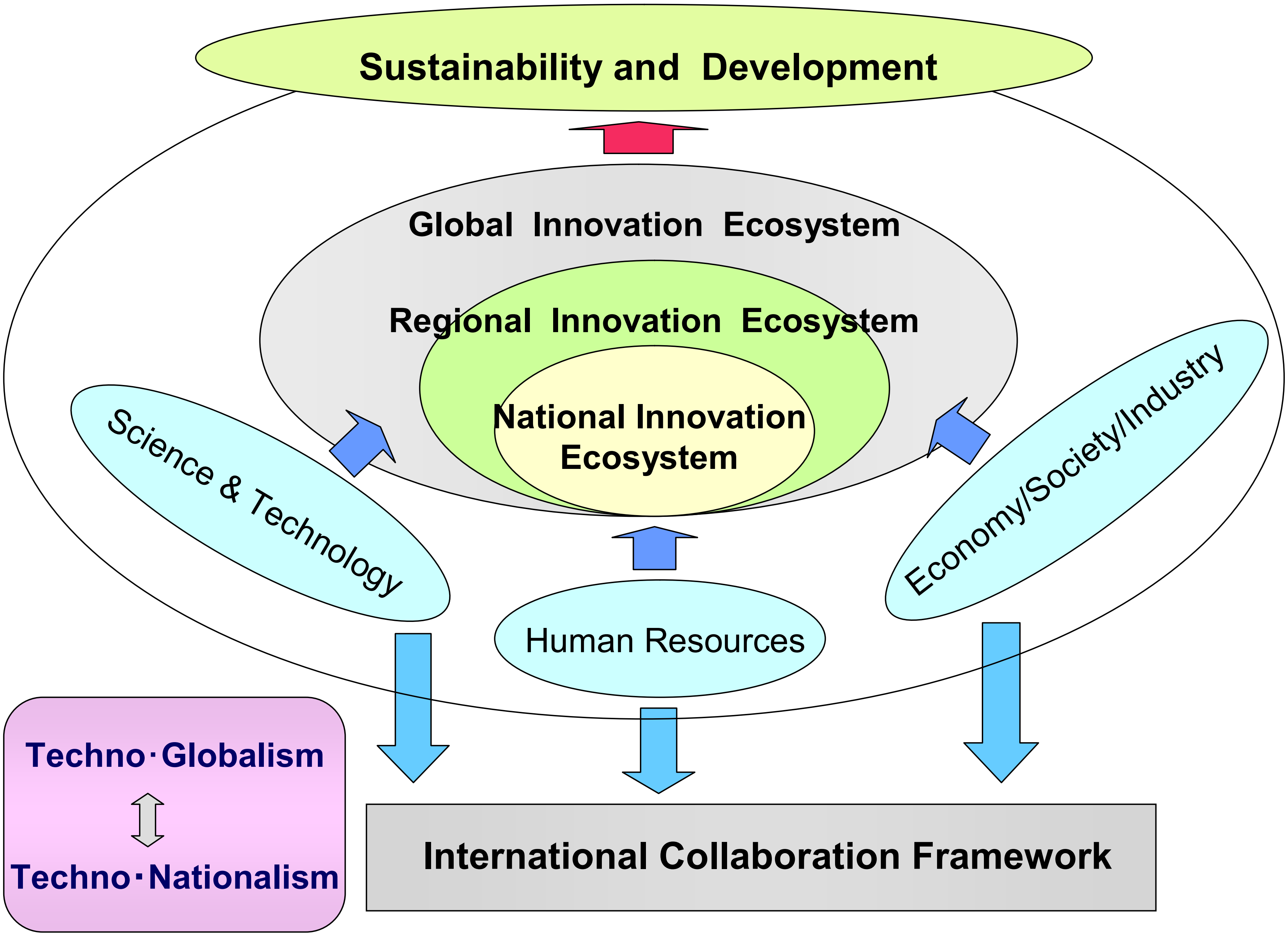
NSF officials have outlined a series of steps toward that goal. On 17 to 18 May, some two dozen cognitive scientists, social psychologists, and engineers will discuss the roots of individual and group creativity and

graphic, economic, and scientific patterns affect the creation and application of knowledge. In July, an international group of experts will suggest ways to improve existing surveys that measure various indicators of a nation's technological prowess, from publications to public understanding of science.

If the funding materializes, Lightfoot foresees a collection of interdisciplinary research centers, focused either on a particular discipline or an important technology. "To date, the criteria most commonly used—citation analysis or other bibliometrics—are science-neutral and field-independent," he says. "That strikes me as a mistake and a significant limitation. Chemistry and archaeology have different scientific cultures, and those differences affect innovation."

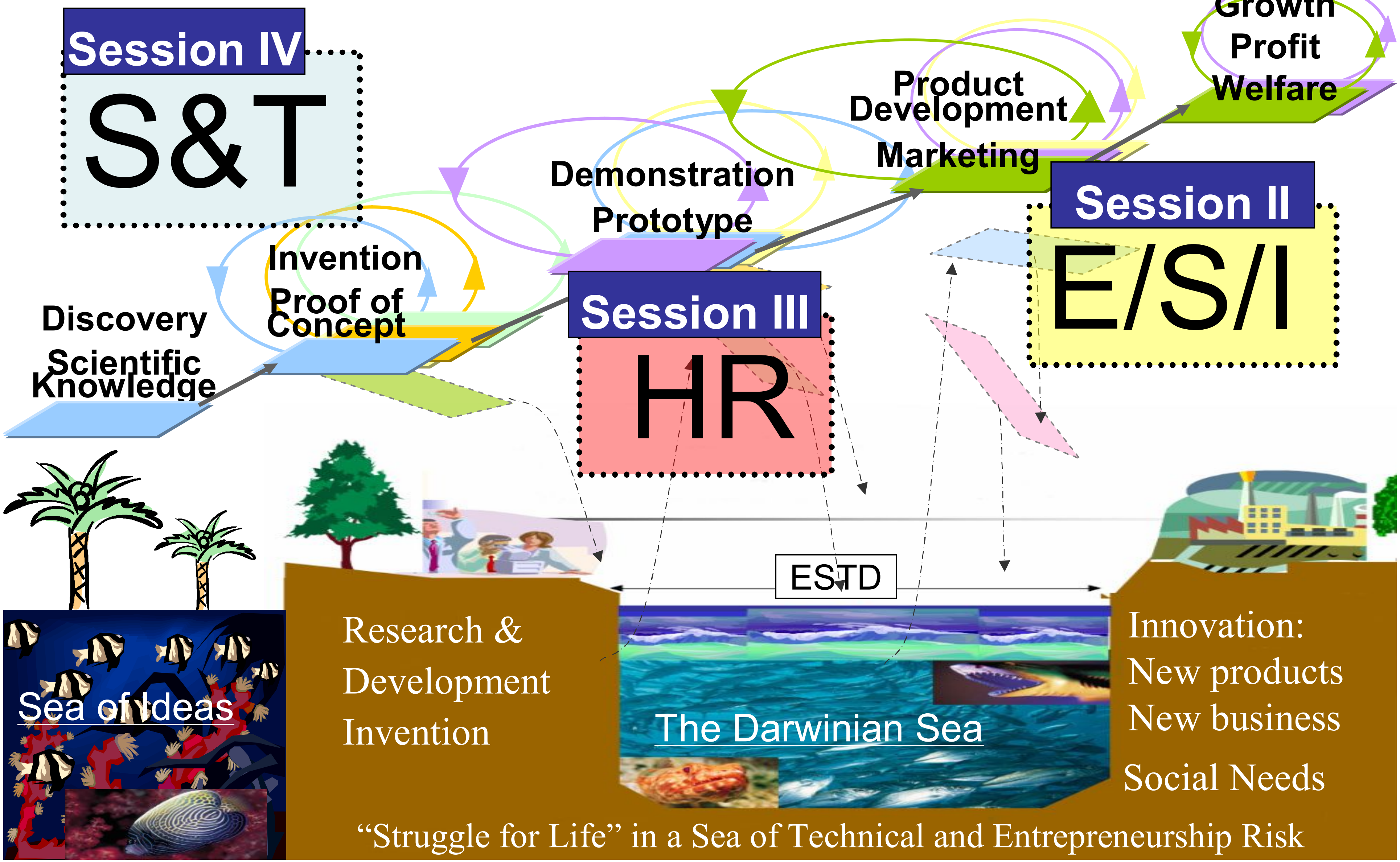
Lightfoot is in the process of hiring someone to coordinate the initiative within SBE and across NSF. The White House is

OECD Workshop on Science of Science Policy, Helsinki, July 2006


Sustainability and Development
Global Innovation Ecosystem
Regional Innovation Ecosystem
National Innovation Ecosystem
Science & Technology
Economy/Society/Industry
Human Resources
Techno･Globalism
Techno･Nationalism
International Collaboration Framework

SL(Step & Loop)Model
Science based Innovation

Modified of Branscomb's model by JST/CRDS.



Innovation Ecosystem