Effectiveness of Evaluation from the Perspective of Outcomes on Research Units and Research-supportive and Administrative Departments in AIST

Chair: Osamu Nakamura
Presenters: Osamu Nakamura & Tomoko Mano
Discussant: Katsuhisa Kudo
Abstract

With the introduction of an evaluation system from the perspective of outcomes, research units in AIST have come to have a clear scenario of research and development toward outcomes by showing roadmaps with clear goals, milestones and benchmarks. The leaders of research units have good communication with members to discuss their strategies to induce innovations. The evaluation system has been encouraging research units to have strategic management in their research activities.

On the other hand, the evaluation of research-supportive and administrative departments has been leading a variety of advancement of their services with promoting changes in the consciousness of members. They have been challenging to have long-term approaches in order to collaborate with other departments to support the activities of research units for innovation. In this session, some good examples of research units and research-supportive and administrative departments through the evaluation system in AIST will be introduced.
AIST’s Role in S&T Administration

**MEXT**
- (64%)
- National Projects (space, nuclear)
- Grant for operating expense
- Grant to researchers

**METI**
- (17% of total S&T budget)
- Creation of technology seeds
- Establishment of new technology for next generation
- Subsidy for pre-competitive technology
- Contract research for social needs (National Projects)
- Tax credit on increased R&D expenses

**NEDO**
- New Energy and Industrial Technology Development Organization
- 22M US$
- Technology Transfer

**AIST**
- National Institute of Advanced Industrial S&T
- Technology Transfer
- Cooperation

**Universities**
- Grant to researchers

**TLO**
- Technology Transfer

**Industries**

**Tax Reduction**

**Economy**

Reform of national innovation system
(industry - university cooperation, national project reform, IPRs, etc.)
Strategy Structure of AIST

Basic principles: Social development through enhancing industrial technologies

Missions:
• Contribution to a sustainable society
• Contribution to industrial competitiveness
• Contribution to local industrial development
• Contribution to Industrial technology policies

Future visions:
* Future visions:
1. High quality life with good health and longevity
2. Intelligent, safe, and secure life supported by advanced information services
3. High industrial competitiveness and reduction of environmental load realized by new materials, parts, and manufacturing technology
4. Wealthy and comfortable life by overcoming environment and energy issues
5. Advanced industrial infrastructure developed by novel measurement technologies and evaluation systems
6. Construction of intellectual infrastructure through understanding of the earth
7. Dissemination of physical and chemical metrological standards
"Full Research" at AIST

Carrying on Type-1 and 2 research concurrently and coherently

Public Research Fund

People's concern and possibility of getting research funds

None!

Corporate Research Fund

Public research fund needed!

(J. Hatvany and H. Yoshikawa, 1985)

Research Period

e.g. 15 years

Dream Period
(Type-1 Basic Research)
Discovery & Investigation

Nightmare Period
(Type-2 Basic Research)
Integration & Application

Reality Period
(Product Realization Research)
Product Development and Realization

Academy

Industry

National research institutes (AIST and others)
AIST new schemes for innovation promotion

Focused points for innovation promotion

(1) Creation of innovation current in the society towards achieving sustainable society
(2) Integrated publicity of “full research” products
(3) Grasp on the needs of society
(4) Strategic allocation of research resources for practicing “full research”

Innovation promotion is thrust by the leadership of AIST management board.

Strengthening organizational structure

(1) Appointment of three vice-presidents in charge of innovation promotion
   ( “Innovation promotion core” in the AIST management board)
(2) Appointment of “Innovation Architect"
(3) Establishment of "Research and Innovation Promotion Office"
- Providing a new mechanism for collaboration among industry, academia and government
- Sharing a concrete scenario for new industries
- Developing a prototype with an enhanced budget for a limited term (2 or 3 years)

**Industrial Transformation Research Initiative (AIST)**

- **Existing Industry**
  - concrete scenario for industrialization
- **New Industry**
  - tangible result in the form of a prototype
- **Companies**
- **Universities**
- **Sustainable Society**

Technological potential
Research Fields in AIST

Future visions

(1) High quality life with good health and longevity
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Research fields

- Life Science and Technology
- Information Technology
- Nanotechnology, Materials, and Manufacturing
- Environment and Energy
- Geological Survey and Applied Geoscience
- Metrology and Measurement Technology
Effects of Evaluation from the Perspective of Outcomes on Research Units in AIST

Osamu Nakamura *, Shinichi Ito, Kunio Matsuzaki, Hironori Adachi, Tetsuo Kado, and Syuichi Oka

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* Future visions: Social development through enhancing industrial technologies.
Evaluation of Research Units

Midterm and Final Evaluation

Midterm Evaluation
Inspection of research achievements and management for directions

Final Evaluation
Summary of research activities for research plans in future

Decision on continuation of the Research Unit reflects the results of evaluation

To continue or not
Reorganization

Foundation

Startup Evaluation
Evaluation of research plans and management

Monitoring
To know activities of the Research Unit

Performance Evaluation
Evaluation of research plans, research achievements and management

Evaluation of Research Unit
Evaluation of Research Units

★ Purposes of evaluation
1) Activation and efficient management of Research Units
2) Reference to the top management of AIST
3) Accountability to the Japanese Nation

★ Viewpoint of evaluation

1st Mid-Term (FY2001-2004)
Evaluation based on Outputs and global level of research

2nd Mid-Term (FY2005-2009)
Evaluation from the viewpoint of Outcome
Evaluation System in AIST

From the Perspective of Outcomes

Subjects of evaluation

- Evaluation of Roadmaps toward Outcomes
- Evaluation of Outputs toward Outcomes
- Evaluation of Management toward Outcomes

PAST
Outputs in the past

PRESENT
Realized Outcomes
- Roadmaps
- Management
- Outputs

FUTURE
Expected Outcomes in the future
Evaluation Indexes

Evaluation of Roadmaps
Outcomes, milestones, technical elements, benchmarks

Evaluation of Outputs
Papers, patents, standards, academic activities, press releases, prizes, prototypical products, etc.

Evaluation of Management
1) Research strategy
   “Full Research”, innovations, human resource development
2) Other management
   Overall management, budget management, risk management
Correlated Electron Research Center: Overall Roadmap

- **Establishment of Research Field of Correlated Electronics**
- **Popularization of Correlated Electronic Products**

**Life Time of CERC**
Roadmap for Correlated Organic Electronics


1st Middle Term Program

2nd Middle Term Program

Establish Science
- Chemistry of Acid/ Base-type Ferroelectrics
- Physics of Molecular Semiconductor Interfaces
  - Ultrafast Carrier Control by Light
  - Novel Phase Correlated Organic Materials

Material
- Fabrication of Highly Reproducible (< 10%) OTFTs
- Ferroelectric Materials with High Dielectricity (~2,500)

Benchmark
- Fabrication of Highly Reproducible (< 10%) OTFTs
- Ferroelectric Materials with High Dielectricity (~2,500)

Development of Organic Ferroelectrics and Its Theory
- Berry Phase Theory/ 1st Principle Calculations
- Functional / System / Thin Film Technology

Carrier Control
- 2-Component Molecular Materials
- Photo-Induced Phase Control
- Control of Quantum Critical Phenomena

Experimental Technique
- Femto-Second Spectroscopy
- Synchrotron Radiation
- MEM Analyses

Development of Structural Analyses Method
- Synthetic Method
- Method for Organic Materials

Development of High Performance Organic FET
- High Mobility Molecular Semiconductors
- Controlled Doping
- Mott Transistors
- MI-Phase Switch

Ultrafast Phase Control
- Femto-Second Spectroscopy
- Synchrotron Radiation
- MEM Analyses

Establish Research Field
- Correlated Organic Electronics

Correlated Organic Electronics
- Light weight/ Flexible/ Large area/ Nonvolatile Electronic Devices

Into the Industry
- Mott Transistors
- MI-Phase Switch
- Photonics Switching Device

Subjects
- Achievements
- Milestones
- Outcomes

Roadmap for Correlated Organic Electronics

Life Time of CERC

~ 10 ps

10^12~10^15 cm^2

> 10 cm^2/Vs

10^12~10^15 cm^2

Development of Novel Electronic Phases
Platform formation of Nano-electronics strategy

Concept of AIST Open Network Platform

URVIC-net: University, Research Institute, Venture company, Industry Consortium Network

NPPP: Nano Processing Partnership Platform

SELETE: Semiconductor Leading Edge Technology

NV-RAM: Non-volatile Random Access Memory
Elemental Technologies of NARC

NARC: Nanoarchitectonics Research Center

0-dimension
- Nano Particle
- Nano Cluster
- Self-Assembly

1-dimension
- Nano Wire
- Enzyme Reaction

2-dimension
- Organic Tube
- Photo Electrode

3-dimension
- Silica Tube
- Gas Sensor

Thin film
- Supra molecule
- Hydrogen Storage

Nano Machine
- Medical Sensor

High Density Memory Storage
- Organic Synthesis

Characterization of Nano Properties
- DNA Separation Chip

Measurement of Single Molecule
- Optical Tweezers

Evanescent Wave
- Slab Optical Waveguide

Surface Plasmon Induced Light Emission
- Spin Probe Microscope

High Density
- Optical Near Field

Application
- Enzyme Reaction

Objective Properties
- Spin Probe Microscope

Nano Structure
- Nano Parts Evaluation

Assembly Technologies
- Enzyme Reaction

NARC: Nanoarchitectonics Research Center
Roadmap of Elemental Technologies in NARC

Elemental technologies for breakthrough:
- Self-Assembly (HARN team)
- Separation technique
- Patterning (HIAN team)
- Single Molecule Raman Spectroscopy (HARN team)
- Detection technique
- Single Molecule Array (HOMN team)

1st term:
- 2001: Organic Nanotubes, Nanofibers
  - Morphology control, surface functionalization, Clathrate.
- 2002: Size of one-dimensional hollow cylinder
  - 100nm
- 2004: Accuracy of Patterning
  - 10nm

2nd Term:
- 2005: Integration • Assembly into Glass Capillary and Microchips
- 2006: Fabrication shorter time, Higher saving energy
  - >1000 times
- 2007: Fabrication of Higher Integration
  - >1000 times

Final Year:
- ~2010: Analysis for content of single Cell:
  - 10^6 Cells (ca. 1 ml) to 1 Cell (ca. 1 pl)
  - High Resolution Separation
  - High Integration
  - Array of Micro Nano Chips, High Speed, & High Throughput
  - Highly Sensitive Detection and Identification of Biomolecules such as DNA and Protein

Targets:
- Higher Integration
- >1000 times
- Fabrication shorter time, Higher saving energy
- >1000 times

Design → Synthesis → Self-Assembly → Fabrication → Manipulation

Nanostructure by Bottom Up → Organizing to Nano & Micro Structure
Example of output of NARC

Image of Development of Highly Integrated Nano Chip

Self-Assembly Technology
to fabricate a channel structure with 100 \(\mu\)m
by integration of channels with 10 nm

Integration (\(> 10^3\) times)

Molecular Scale Device

Single Molecule detection technology, Single Molecule
Array technology
to detect target materials,
analyze and identify

Detection with a
sensitivity (\(> 10^6\) times)

Nano Channel
By Competence Centre for Microactuators (CCMicro)

1 cm

Micro-heater

Micro-sensor (temperature, pressure, flow)

Pattern Forming Technology
to fabricate micro heater and micro sensor with
ease and no waste, and in short time

Saving energy
(\(> 10^6\) times)
Communication in NARC

Diagram:
- Team leader (6)
- Researchers
- Peer review (1)
- Unit Office
- Head
- Discussion (5)

Numbers:
1. 2
2. 3
3. 4
4. 5
5. 6
Logic model preparation for development of organic nano-tube
The director of NARC noted that the evaluation system encouraged them to have a clear scenario from the perspective of outcomes, and comments by the evaluation committee have directed them to organize a strategic R&D plan with clear goals, applying technology elements in NARC. He organized a self-evaluation scheme inside of NARC, in which members critique other member’s researches in an effort to create clear, mutual communication among members.

The director of CERC noted that an evaluation system oriented toward outcomes might become the model in other research institutes. At first, they felt it difficult to prepare the roadmap because CERC had been performing Type I Basic Research. But, the flexible concept of outcomes provided by AIST’s Evaluation Department gave them with an appropriate logical framework.
Performance of AIST

★ Joint Researches
★ Venture Companies

- Both number of joint research and accepted fund increased by ~10 times in 5 years.
- Number of venture company constantly increased.
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Strategy of Research Fields

Strategy of Research Units

Research Subjects

Evaluation of Research Units
Spiral of R&D Evaluation

MIC: Ministry of Internal Affairs and Communications

METI

AIST

Programs

Management

Act

Plan

Research Units

Do

R&D

Check

Evaluation

Scenario of R&D
Notes:

- Evaluation is for *Encouraging with Love*.
- Evaluation is for *Communication*.
- Evaluation is for *Strategy*.
- Evaluation is for *Creation*.
- Evaluation is to be *fed back*.
- Evaluation *reflects the Future*.
- Evaluation is like a *Compass for Voyage*.

“Revised Evaluation System to Reflect the Future” (O. Nakamura, AIST, 2005)
Notes:

• Evaluation is for *Program*.
• Evaluation is for *AIST*.
• Evaluation is for *Innovation*.
• Evaluation is for *Socioeconomy*.
• Evaluation *reflects the Future*.
• Evaluation is *the Compass for Voyage*.