Case Study and Analysis for Economic and Social Impacts on National R&D Projects based on the Results of Follow-up Monitoring and Evaluation

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Takahisa Yano
Project Evaluation and Public Relations Department
yanotkh@nedo.go.jp

New Energy and Industrial Technology Development Organization

1. NEDO's Mission and R&D Promotion Scheme

(1) Position of NEDO in Japan's Technology Development System

R&D Budget of the Government $29.2billion

MEXT
$ 19.2 billion

METI $4.2 billion （including nuclear energy, accounts for patent, NEDO)

Mission 1 Strategically prioritize and promote R&D projects on industrial, energy and environmental technology **($1.2 billion ※)**

NEDO $1.8 billion※

FY2007

R&D on industrial, energy and environmental technologies

Fundamental Research at Universities, etc.

Exploration of Industrial Seeds ($49.2million)

Mid- to Long- Term/ High Risk Research ($1.0 billion)

Support for Practical Application （$140 million）

Product Development by the Private Sector

Life science, IT, Nanotechnology, Materials, Machinery, etc

Environment, Energy efficiency, Alternative energy, etc.

Demonstration Projects

Introduction/ Promotion

International Projects ($56.7 million)

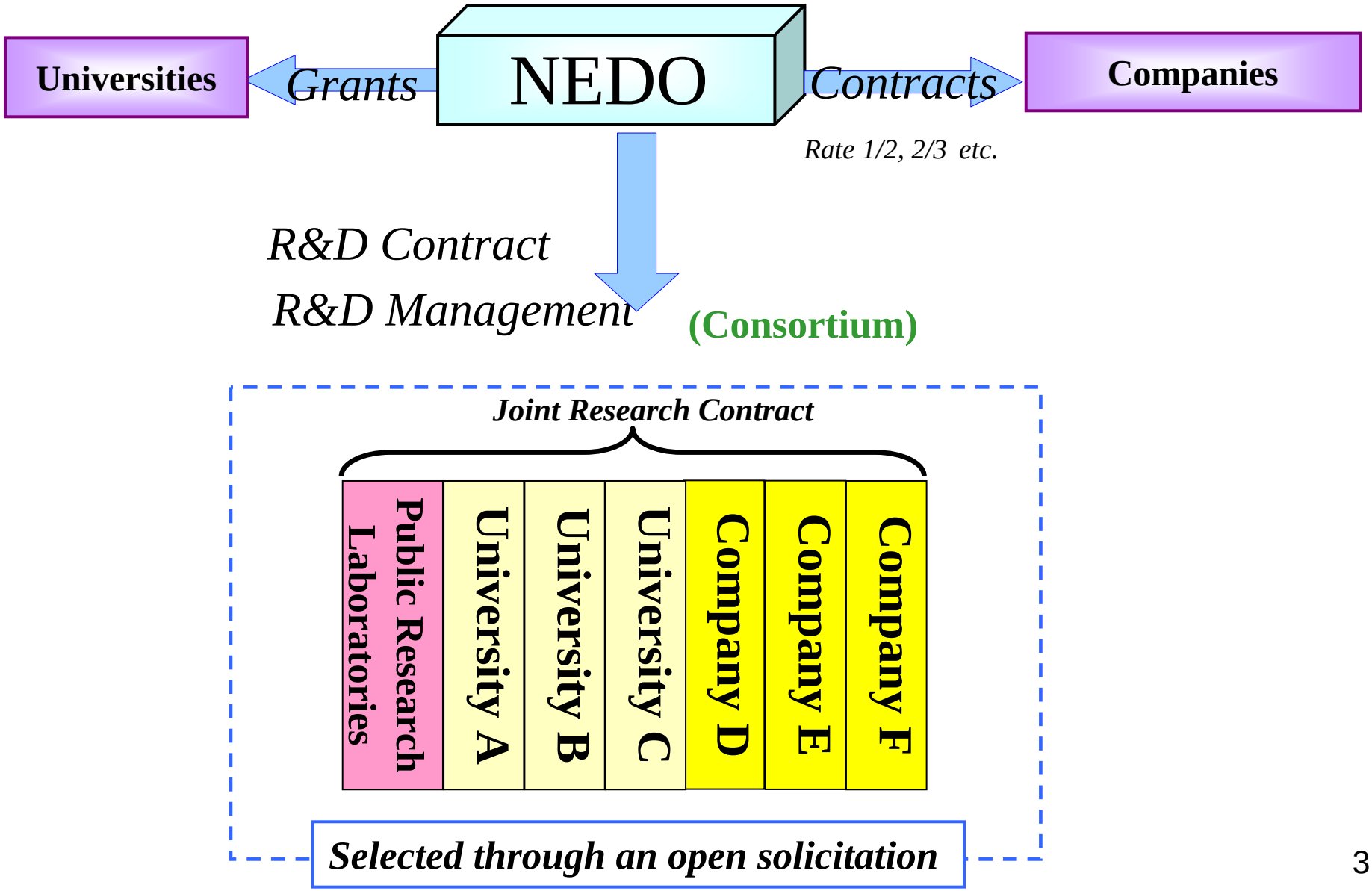
Kyoto Mechanisms Credit Acquisition ($108 million)

$ 1=120yen

※ Due to overlaps in some projects, the sum of the budgets for 2 missions exceeds the total budget of NEDO.

Mission 2 Contribute to solving energy and environmental problems **($652 million ※)**

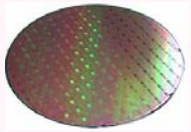
(2) Funding Style and Project Formation Process



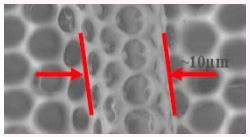
(3) R&D Technology Areas of NEDO

Industrial Technology Field

Electronics and IT



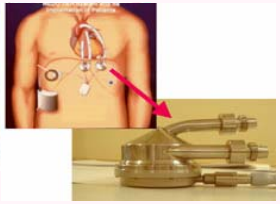
Nanotechnology and materials

Machinery systems

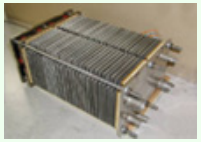

Biotechnology and medical technology





Energy Technology Field

Fuel cells and hydrogen




Environment


Alternative energy


Energy efficiency


NEDO's R&D Technology Areas

2. Outlines

Based on the results of follow-up monitoring at NEDO, this presentation will cover

- the case study of the project outcome

- the expected and actual time required from the end of projects to commercialization

- the derived technology

- the qualitative effect of the project

- the way to secure accountability to the tax-payers

3. Process of follow-up monitoring

Preliminary Preparation	**Preparation for monitoring and evaluation** 1) Set final post-projects goals (Research, Development, Practical application, Commercialization) 2) Selection of contact persons to conduct follow-up monitoring
【Step1】 Simplified Monitoring	**Understand the current situation of an organization's activities** 1) Conduct for five years 2) Gather data by questionnaires (patents, publications, awards, competitiveness, collaboration with university, etc.)
【Step2】 Detailed Monitoring	**Detailed monitoring based on simplified monitoring** **Questionnaires** or **interviews** (sales, market share, reason for discontinuance, reason for success, contribution to job creation, establishment of a new enterprise, contribution to the acceleration of R&D, other spin-off effects, etc.)
【Step3】 Evaluation	**Evaluation based on the information collected above** 1）Assess the impact of NEDO's R&D projects 2) Improve R&D management 3) Plan future R&D strategies

4. Case Study

Advanced Photon Processing and Measurement Technologies

1. Outline

A project to develop an advanced measurement technology and a processing technology using high-quality laser beam was conducted.
Examples of technologies developed: (1) Macro-micro processing technology, (2)Non-destructive measurement, (3) All solid-state laser

2. Period FY1997-FY2001

3. Budget 7,199 millionYen ($60.0million)

4. Participants

Consortium

<Public Entity>1

Manufacturing Science and Technology Center

<Company>13
Kawasaki Heavy Industries, Matsushita Electric Industrial, Shinku Yakin, Yokogawa Electric, Kubota, Shimadzu, Seiko Instruments, Toshiba, Fanuc, Hoya, Hamamatsu Photonics, Mitsubishi Electric, Kogakugiken,
<University and Research institute＞8

Osaka University, University of Tsukuba, Konan University, Tokai University, University of Tokyo, University of Electro-Communications, AIST, Applied Laser Engineer Research Institute

5. Output

(1) Development of high quality welding technology with high aspect ratio for thick iron or aluminum alloy
(2) Making for trial purposes and verification of super high-density element
(3) Making for trial purposes and verification of adaptive optics
(4)Development of X-ray detectors by using superconductor
(5)Development of diode pumped solid-state laser
(6) Development of high-power solid-state green laser

6. Expected Outcome

By achieving the development of advanced measurement technology and the processing technology, and introducing high-quality laser beam into the machining technique and the measurement technology, it will enhance reliability and efficiency in industry, improve safety in the society and contribute to the creation of a new industry.

Logic Model (The Result of Follow up Monitoring)

Advanced Photon Processing and Measurement Technologies

Outputs of NEDO project	Outcomes (5 years after the completion of the project)	Future

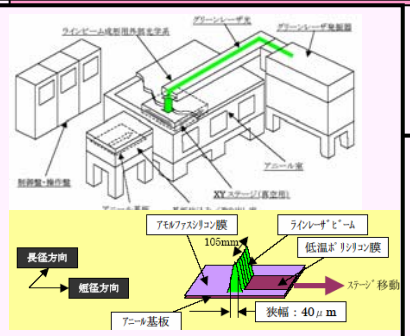
Primary

1kW Green laser technology

Development of wavelength converter cell

collaboration between Univ. and Industries

10kW LD-pumped all solid-state laser technology



Solid green laser annealing system

Replaced the excimer laser, making the manufacture of a high-quality low temperature polysilicon film manufacturing possible.

Stable and low cost manufacturing of high-quality low-temperature polysilicon TFT for flat-panel display.

High beam quality LD-pumped YAG laser system

Terminated
(Market for 10kW LD-pumped YAG laser system is too small)

[Patent]
139 patent applications, 21 patents issued
[Paper]
281
[Recipients of an award]
Company 11, University 4
As of March, 2008

Secondary

<4.5kW LD-pumped YAG laser system

Saving power and space, and reducing maintenance

High power Q-switch

High peak power pulse laser

High quality cutting and welding for automotive steel
Surface modification by means of hardening or rust stripping

5. The expected and actual time required from the end of projects to commercialization

(1) Subject

The companies which participated in the NEDO projects completed in FY2001 or FY2002.

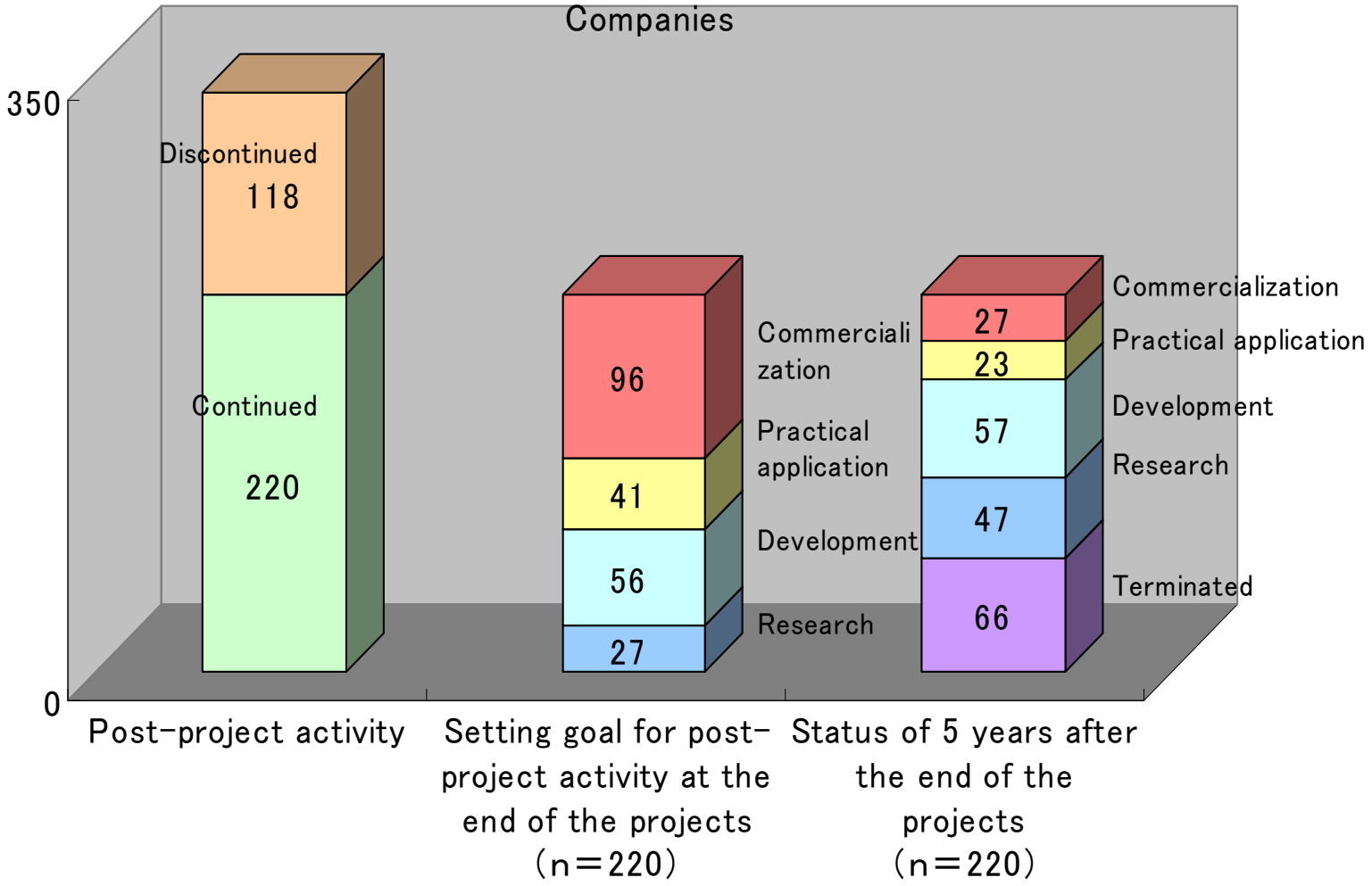
Budget 2,728Million yen / project
Term 5.25Year
Participants 6 companies/ project
Total number of projects 56
Phase of development / high-risk R&D

Project completion year	Number of projects	Companies Surveyed		
		Preliminary Preparation	Simplified Monitoring	
		Setting goal for post-project activity at the end of the projects	3 years after the end of the project	5 years after the end of the project
FY2001	27	131	80	71
FY2002	29	207	140	122
Total	56	338	220	193

Project completion year	Nanotech. and materials	Biotech. and medical tech	Machinery systems	Environment	New type of battery	Alternative energy	Energy efficiency	Novel process	Total
FY2001	3	6	2	6	1	4	1	4	27
FY2002	3	10	3	4	0	4	3	2	29
Total	6	16	5	10	1	8	4	6	56

(2) Result
1) Setting goals and current situation of companies

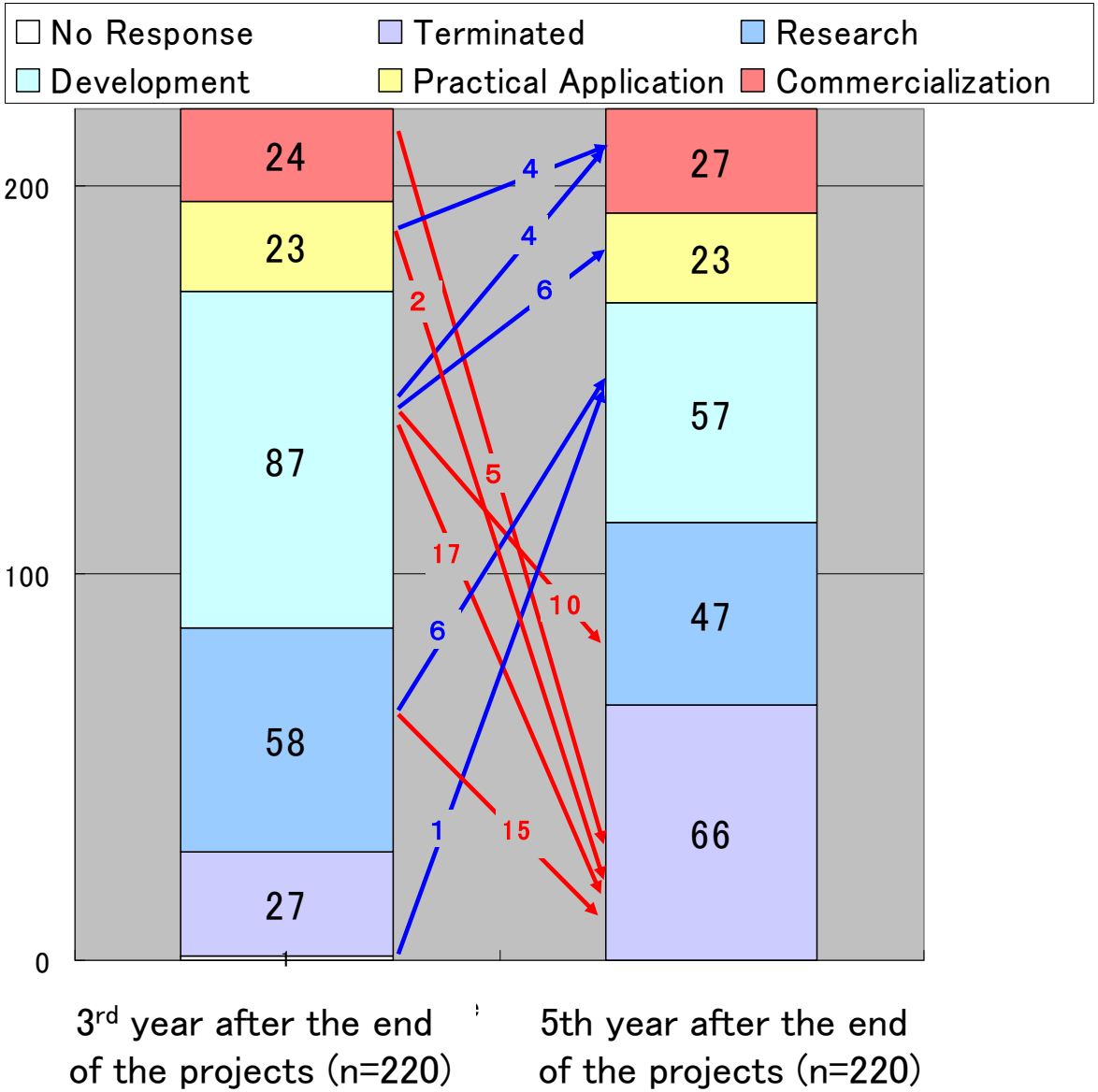
At the end of the projects, 96 companies set goals for post-project activity to commercialize technology. Five years after the end of the project, 27 companies achieved commercialization.



(note) Since 24 companies have not responded to our survey for “Status of 5 years after the end of the projects”, this evaluation used their responses for “Status of 3 years after the end of the projects”.

2) Progress of post-project activities by companies

The progress of post-project activities toward commercialization does not correlate with the time.



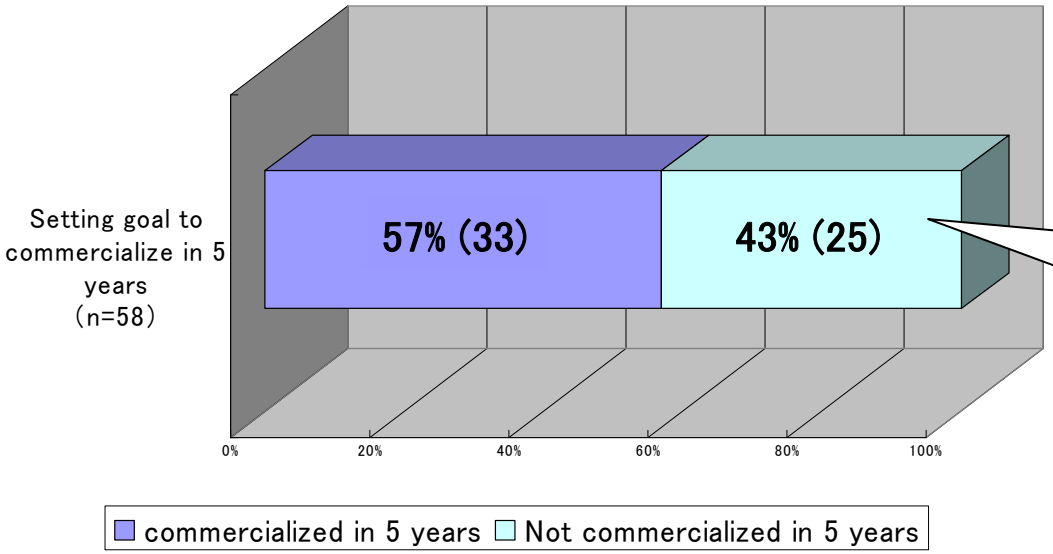
Numbers in arrows: number of companies which changed the status of post-project activities

Blue: progress
Red: retrogress

3) The expected and actual time from the end of the projects commercialization

96 companies planned to achieve commercialization in the future.
They estimated that it would take 5.1 years in average.

58 of 96 companies set goals to achieve commercialization in five years.
Out of 58 companies, 57%(33) companies achieved commercialization in five years.
However, 43%(25) companies failed to commercialize in five years.



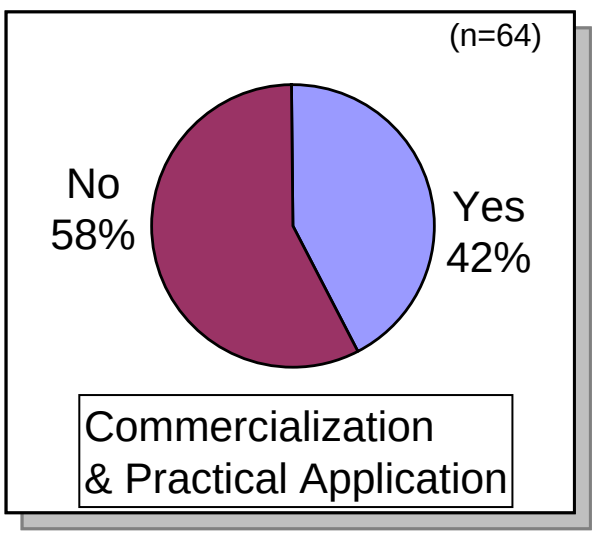
The reason for delay was "faced to unexpected difficulty in further technology development", etc.

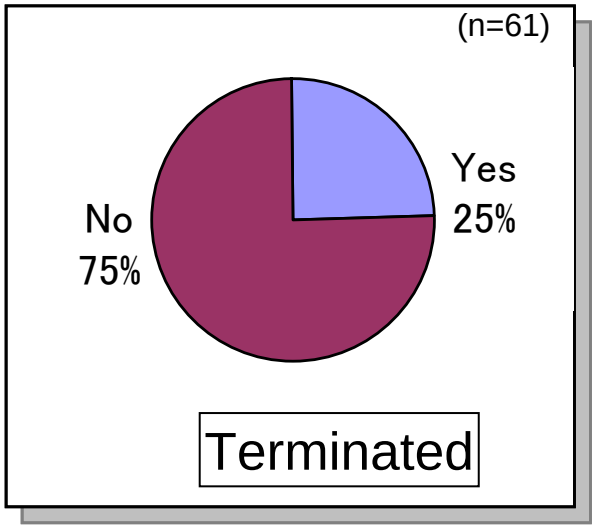
Five years after the end of the projects, only small numbers of companies achieved commercialization. It suggests that the evaluation effort would require more time to measure the impact of the NEDO projects after the commercialization. Also, additional indicator would be necessary to measure the short-term impact to secure accountability of the projects.

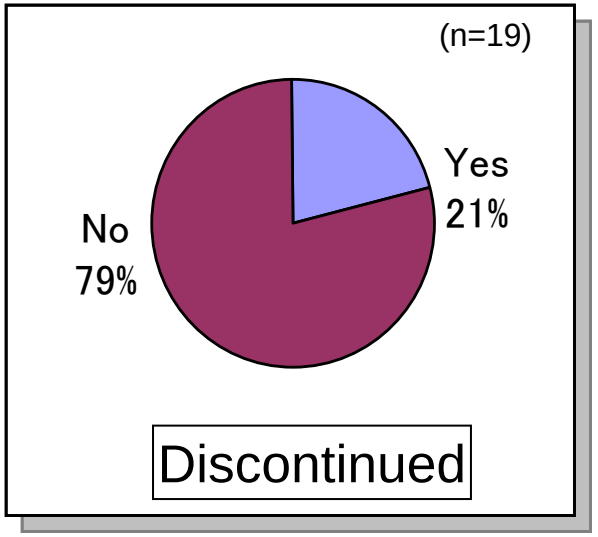
6. Derived technology

The companies that achieved commercialization or were in the process of practical application were more likely to develop derived technology than those who terminated post-project activities.

Do you have derived technology from NEDO project?







<Example of derived technology >

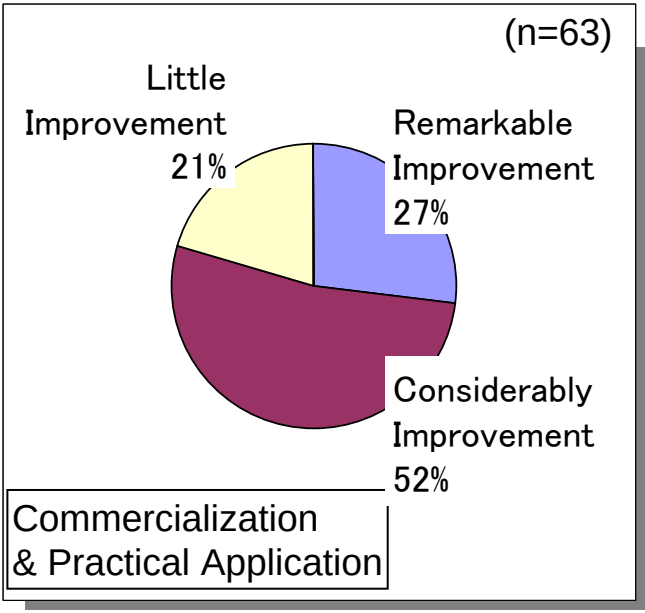
Photovoltaic cell development project

Amorphous Silicon Deposition technology for making photovoltaic power cell → **For making liquid crystal television**

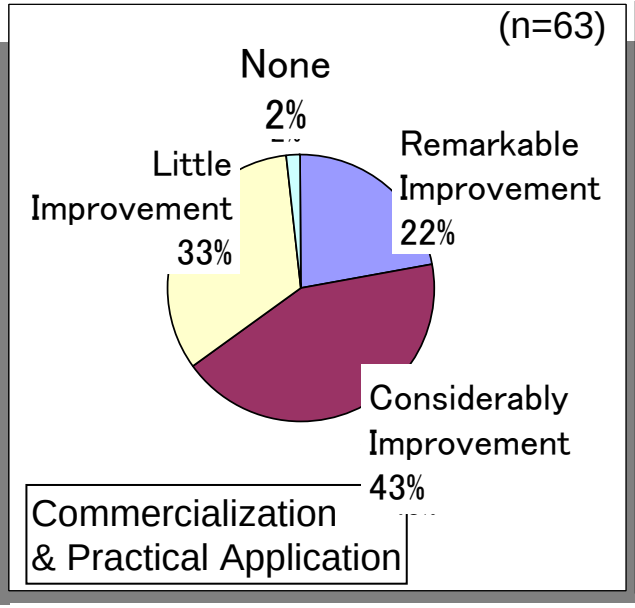
7. Qualitative effect of the project

We asked the companies that achieved commercialization or were in the process of practical application about the impact on the projects on their products. 79% saw “Remarkable” or “Considerable” improvements in the product performance, 65% in the product quality, and 45% in the cost reduction.

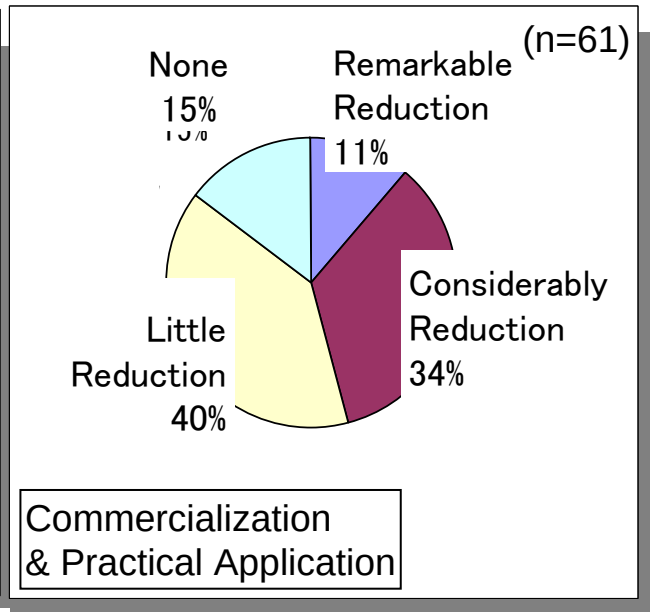
◇Performance of Product



◇Quality of Product

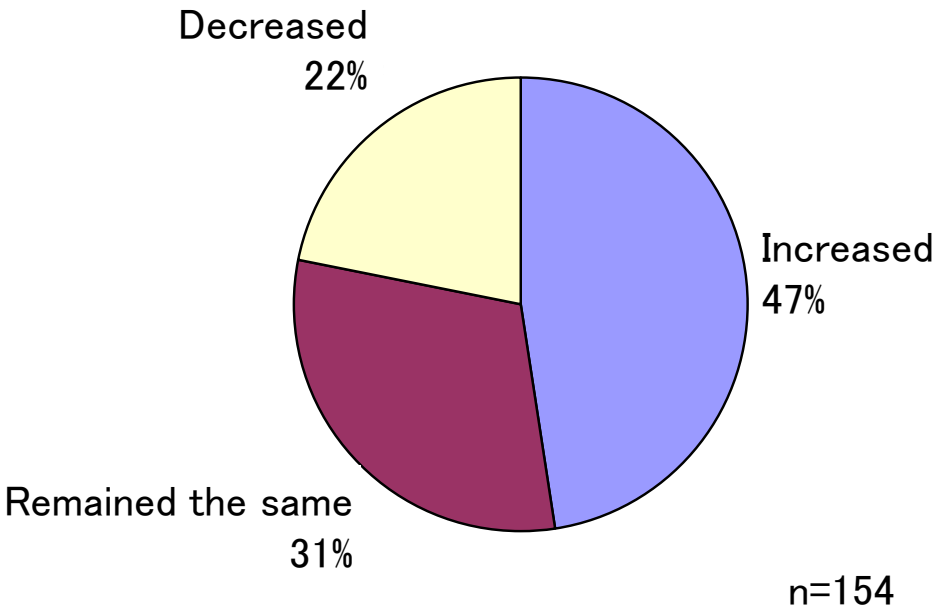


◇Cost Reduction of Product



8. Effect on research and development investment by the companies during the project (Input Additionality)

We asked the companies how their own R&D investment to the same technology area as the NEDO project they participated has changed during the project. 47% companies increased their R&D investment as the result of participation in the project.



9. Standardization , Database

(ex) Standardization of fuel cell
Genetic resource database
Wind energy prediction system
Chemical risk assessment and management system

10. Patent, Journal paper

Citation analysis

⇨ Contribution to the improvement of industrial technology.

11. Conclusion

- It might be soon to measure the economic impact of the NEDO projects in five years after their completion because commercialization of technologies developed in these projects often takes more than five years. Therefore, it is necessary to take more time to understand the effect of the projects on the economy as well as the society.

- It is critical to have various indicators, including derived technology and induced R&D investment, in addition to the number of commercialization achieved.

Thank you

Takahisa Yano
yanotkh@nedo.go.jp

Appendix

Definition of Stages

(1) Research stage	Responsible unit in a company : R&D units Phase: Basic research (to understand novel phenomenon or improvements of performance, etc.) Outputs: Corporate internal reports, patents, papers, etc.
(2) Development stage	Responsible unit in a company : R&D units Phase: Research towards commercialization (understand technological/cost advantages as well as technological issues associated with mass production, by distributing free samples or conducting market/user research.) Outputs: Research results which might help decision-making toward commercialization
(3) Practical application stage	Responsible unit in a company : business units Phase: Testing and demonstration of mass production techniques (corporate internal approvals for commercialization, production of working prototypes, approvals by governing/regulatory agency, capital investments in production facilities) Outputs: Onerous samples for distribution, pre-mass-production activities including design/constructions of new manufacturing lines
(4) Commerciali-zation stage	Responsible unit in a company : business units Phase: Product sales in the market Output: Product lines (product catalogue distributions), continuous revenue generations

Outline of Follow-up Monitoring

Purpose

I. To ensure accountability to Japanese taxpayers

～To assess the technological impact of NEDO's R&D projects in relevant fields. This can be assessed by monitoring post-project activities of project participants with regard to the practical application of R&D achievements.

II. To provide feedback for improving NEDO's R&D management

～ To provide feedback for improving NEDO's R&D management by reviewing past post-project evaluations and post-project activities.

III. To contribute to the planning of future R&D strategies

～ To contribute to the planning of future R&D strategies by understanding technology trends in post-project research activities.