JST-Mirai Program;
Overview and Int'l Activities

IMABAYASHI Fumie,
Manager, Department of R&D for Future Creation

科学技術振興機構

2021.1.22 @ EU Counsellor's meeting

JST-Mirai Program by the Numbers

2017

5, 8

7.3

6/188

196

3

The JST-Mirai Program launched in 2017

Japan's STI Policy

(FY)	(Government)	(Cabinet Office)	(Research org./agency etc.)
1995	**Science and Technology Basic Law** enacted		
1996	**The 1st Science and Technology Basic Plan (1996-2000)**		
			JICST and JRDC were merged into Japan Science and Technology Corporation (JST)
2001	**The 2nd Science and Technology Basic Plan (2001-2005)**		
		Council of S&T Policies (CSTP) established	
2003			JST, NEDO, JSPS, RIKEN etc. reorganized
2004			Corporatization of National University
2006	**The 3rd Science and Technology Basic Plan (2006-2010)**		
2007		"Innovation 25" (Long-term strategy)	
2008	Act on Improving the Capacity, and the Efficient Promotion of R&D through Promotion of R&D System Reform		
2010		"Action Plan for Important Science and Technology Policies"	
2011	**The 4th Science and Technology Basic Plan (2011-2015)**		
2013	Act on Strengthening Industrial Competitiveness		
		"Comprehensive STI Strategy" formulated	
2014		Council of S&T Innovation (CSTI)	
2015	National Research and Development Agency redefined		
			AMED established
2016	**The 5th Science and Technology Basic Plan (2016-2020)**		
		"Comprehensive Strategy on Science, Technology and Innovation 2016"	
2017		"Comprehensive Strategy on Science, Technology and Innovation 2017"	
2018	"Council for Integrated Innovation Strategy" established (chaired by chief cabinet secretary)		
		"Integrated Innovation Strategy 2018"	
2019		"Integrated Innovation Strategy 2019"	
2021	**The 6th Science and Technology, Innovation Basic Plan (2021-2025)**		

REF: Provisional translation from JST-CRDS "PANORAMIC VIEW Japanese Policies for Science, Technology and Innovation" (CRDS-FY2019-FR-03)

The 5th S&T Basic Plan

Acting to Create New Value for the Development of Future Industry and Social Transformation (Chapter 2)

"In particular, **the process of setting the bar high, and boldly attempting to consistently create unrivaled innovation without fear of failure, is important**. New knowledge and technologies are created by breaking out of the current customs and paradigms, continually challenging the frontiers of our present knowledge and technology, which are the roots of social transformation, and by conducting trial social implementation. Thereafter, **creating groundbreaking value from such new knowledge and technologies is essential**. Such value may have a major impact on competitive strength by completely changing the current rules of the competition. "

"**a suitable method for promoting "challenging" R&D in the R&D projects** conducted by the government ministries."

- **introducing R&D management through project managers**,
- **granting opportunities to researchers possessing new ideas** by enhancing their authority,
- **implementing an evaluation that encourages research that may not necessarily have a high probability of yield (high-risk research) but that can be expected to have a significant impact if successful**,
- **implementing a stage-gate system for developing groundbreaking but highly risky research** while confirming results at each stage of progress,
- **adopting an awards system that provides incentives to research based on novel ideas**, as well as efforts.

"In doing so, the following should be noted: **"In high-risk R&D, failure is an indispensable part of the process; there is also value in pursuing the challenge itself."** Under this concept, it is clearly also important to create a framework that will make full use of such failure going forward to the next stage, or to solving other issues"

Research Funding Agencies in Japan

Japan Society for the Promotion of Science (JSPS)

Support academic research and themes of calls are open to researchers. <Grant-in-Aid>

Japan Science and Technology Agency (JST)

Operate thematic calls for research funding to implement STI Policy of Japan <Strategic funding>

Japan Agency for Medical Research and Development (AMED)

New Energy and Industrial Technology Development Organization (NEDO)

JST-Mirai Program

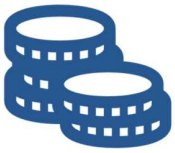
Since FY2017

The JST-Mirai Program promotes **high-risk and high-impact research and development (R&D)** to establish Proof of Concept (POC), where practical application feasibility may be properly judged by investors and industry.

The R&D projects set the technologically challenging goals by considering the needs of industry and society.

JST-Mirai Program

"Mirai" means future in Japanese



FY2020 Annual Program Budget

7.3 billion JPY

(approx. 58 million EUR)

EUR=126 JPY

Japan's STI Funding Programs

(FY)

1995 **Science and Technology Basic Law** enacted

1996 **The 1st Science and Technology Basic Plan (1996-2000)**

2001 **The 2nd Science and Technology Basic Plan (2001-2005)**

2002

2003

2006 **The 3rd Science and Technology Basic Plan (2006-2010)**

2007

2008

2009

2010

2011 **The 4th Science and Technology Basic Plan (2011-2015)**

2013

2014

2016 **The 5th Science and Technology Basic Plan (2016-2020)**

2017

2019

2021 The 6th Science and Technology Basic Plan (2021-2025)

ERATO (1981-), PRESTO (1991-)
CREST (1995-)

Strategic Basic Research Programs (2001-)

The 21st Century COE Program (2002-2008)

SICP (Strategic International Research Cooperative Program) (2013-)

Global COE Program (2007-2013)

The World Premier International Research Center Initiative (WPI) (2007-)

SATREPS (S&T Research Partnership for Sustainable Development) (2008-)

FIRST(Funding Program for World-Leading Innovative R&D on S&T) (2009-2013)

NEXT Program (Funding Program for Next Generation World-Leading Researchers) (2010-2013)

Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT) (2013-2018)

Center of Innovation S&T based Radical Innovation and Entrepreneurship Program (COI STREAM) (2013-)

SIP (Cross-ministerial Strategic Innovation Promotion Program) (2014-)

PRISM (Public/Private R&D Investment Strategic Expansion Program) (2017-)

JST-Mirai Program (2017-)

The Moonshot Research and Development Program (2019-)

Japan's STI Funding Programs

(FY)

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NEXT Program (Funding Program for Next Generation W

-2013)

Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT) (2013-2018)

Radical

SIP (Cross-ministerial Strategic Innovation Promo

rogram

Program) (2014-)

PRISM (Public/Private R&D Investment Strategic Expansion Program) (2017-)

JST-Mirai Program (2017-)

The Moonshot Research and Development Program (2019-)

Top Science

From Top Science to Top Innovation

Japan Science and Technology Agency

Blue & Bold; JST funding program/ Blue; JSPS funding program/ Red; CAO/CSTI funding program

国立研究開発法人 科学技術振興機構 Japan Science and Technology Agency

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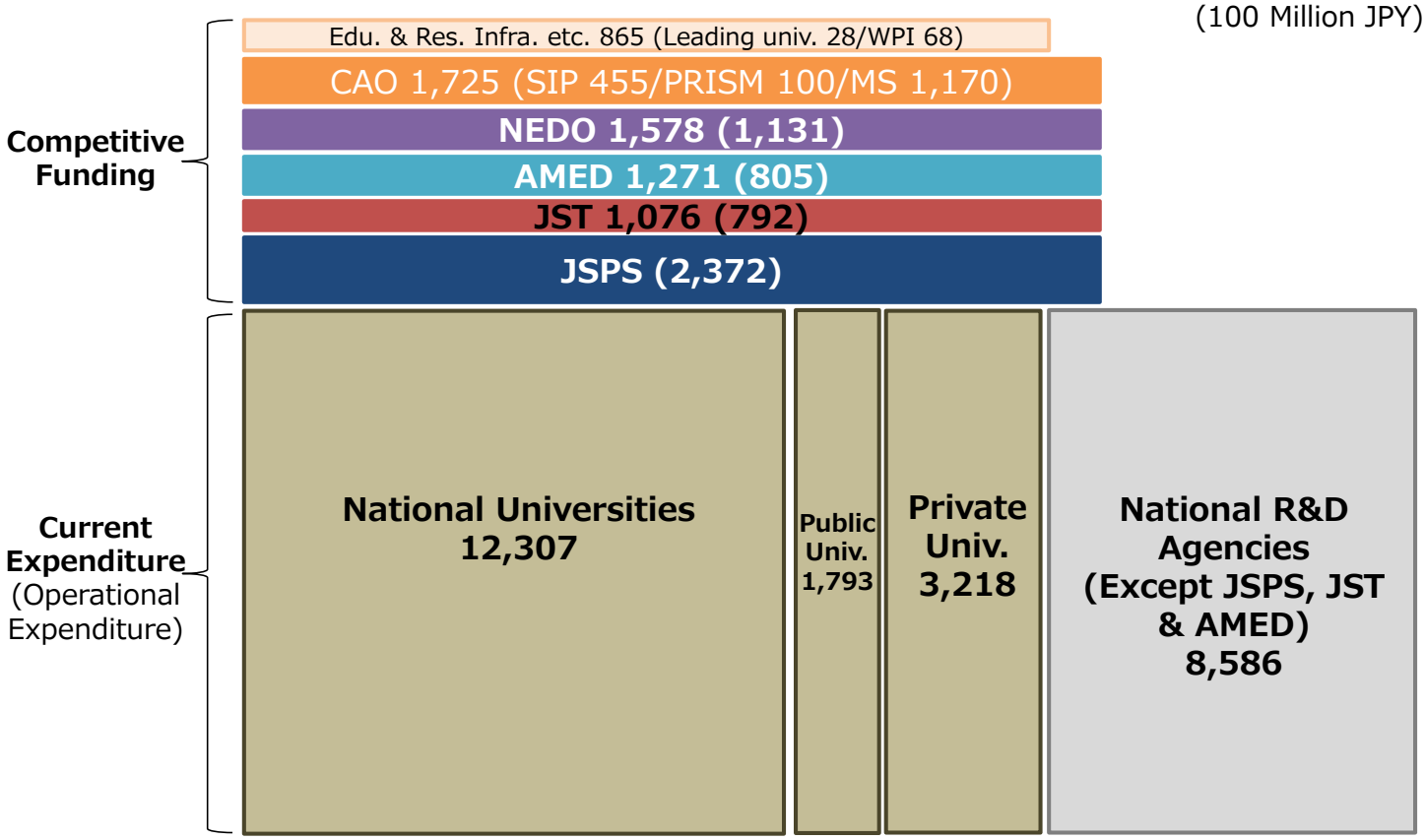
STI Budget in Japan (FY2019)

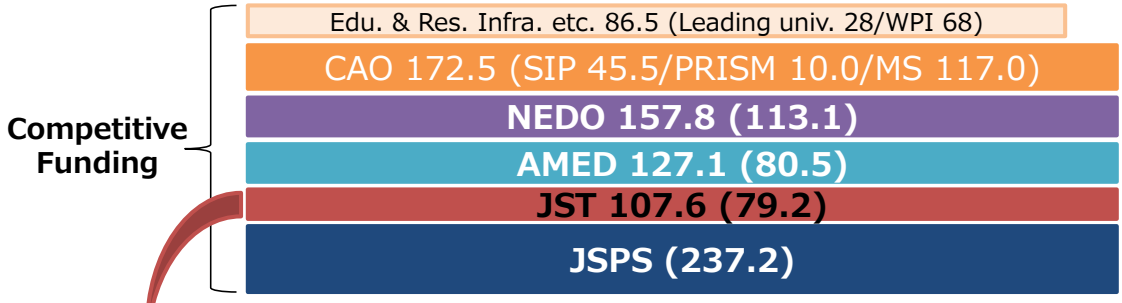
(100 Million JPY)



REF: Provisional translation from JST-CRDS "PANORAMIC VIEW Japanese Policies for Science, Technology and Innovation" (CRDS-FY2019-FR-03)

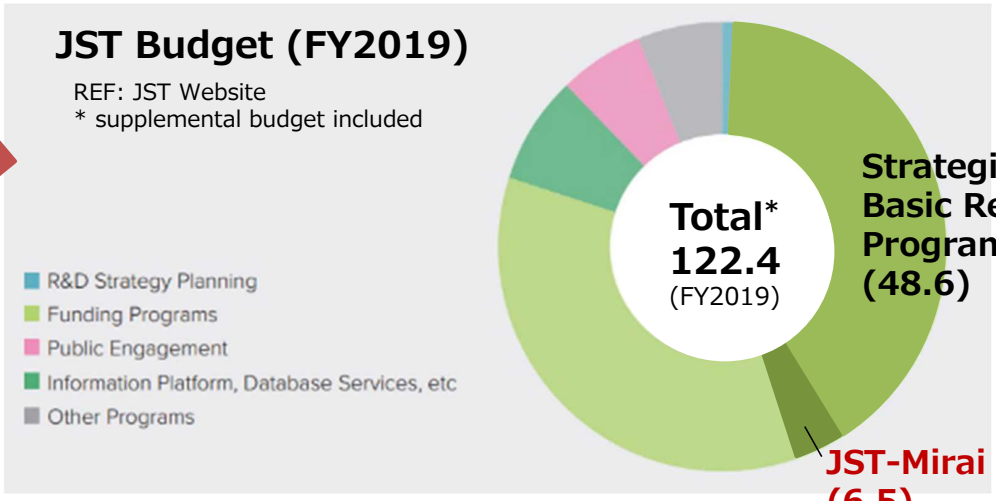
Competitive Funding and JST Budget

(Billion JPY)



JST Budget (FY2019)

REF: JST Website
* supplemental budget included



REF: Provisional translation from JST-CRDS "PANORAMIC VIEW Japanese Policies for Science, Technology and Innovation" (CRDS-FY2019-FR-03)

As of today,
196 projects
have been launched.

- “Small-start Type” 188
- “Large-scale Type” 8

Two Project Approaches

Small-start Type

MEXT

Areas based on the 5th S&T Basic Plan

Super smart Society , Sustainable Society, Safe and Secure Society, Low carbon Society

Needs of Industry and Society

S&T Trends investigated by JST

JST

Prioritized Themes

Call for proposal research projects (FS)

Feasibility Study

Full R&D Project

Feasibility Study
Up to 3 years
20-45 million JPY/project

Full R&D Project
Up to 5 years
750 million JPY/project

Large-scale Type

MEXT

Technology Themes
to change current technology system and to be future basic technology

JST

Call for proposal

R&D Projects

R&D Project
Up to 10 years
4.5 to 6.0 billion JPY/project

Program Management

<Program Director committee >
Program Director : Katsuaki WATANABE
Shojiro ASAI, Koichi ABE, Masashi MUROMACHI, Hisashi YAMAMOTO, Yoshimasa GOTO

< R&D Management committees >

R&D Supervisor leads and conducts flexible management

<Large-scale Type>
PO (Program Officer):
Yoshihiro OISHI
Senior Research Fellow, General Manager, Research and Development Unit, Mitsubishi Research Institute, Inc.
R&D Management committee members

<Small Start Type>
[Super Smart Society]Area
PO (Program Officer):
Akira MAEDA
Former Corporate Engineer, Hitachi Ltd.
R&D Management committee members

<Small Start Type>
[Sustainable Society] Area
PO (Program Officer):
Hideyo KUNIEDA
JST Senior Advisor /Councilor at Nagoya Univ.
R&D Management committee members

<Small Start Type>
[Safe & Secure Society]Area
PO (Program Officer):
Kenichi TANAKA
Senior Engineer, Mitsubishi Electric Corporation
R&D Management committee members

<Small Start Type>
[Low carbon society]Area
PO (Program Officer):
Kazuhito HASHIMOTO
President, National Institute for Materials Science/ALCA PD
R&D Management committee members

<Small Start Type>
[Common Platform] Area
PO (Program Officer)
Nobuyuki OSAKABE
General Manger, Strategy Division, Smart Life Business Management Division/Chief Executive of Healthcare Business Unit, Hitachi, Ltd.
R&D Management committee members

*Each Small start Type Area has a Prioritized Theme. R&D project are promoted under each prioritized theme.
*Large-scale Type has several Technology Themes. R&D project are promoted under each technological theme.

5 Areas
stipulated by MEXT
in “Small-start Type”
8 Technology Themes
in “Large-scale Type”

Small-start Type

Areas & Prioritized Themes (1)

Area	Prioritized Themes
Super Smart Society (Society 5.0)	Establishment of a service platform that enables collaboration between various components and creation of new services
	Modeling and AI that connects the cyber and physical worlds
	Innovative AI technologies for sophisticated integration of cyber and physical world
	Making full use of AI and simulation technologies across different fields for a human centered society
Sustainable Society	Innovation in manufacturing for new process of sustainable resource recycling
	Improving intellectual capabilities to enable “a Socially Active Life” for all members of society, helping overcome labor shortages
	Creation of innovative food production technologies responding to future changes in climate and social demands
	Enhancement of product durability and usability for a resource efficient society
	Breakthrough technologies to accelerate breeding and strain improvement in biological production for a sustainable society

Small-start Type

Areas & Prioritized Themes (2)

Area	Prioritized Themes
Safe and Secure Society	Development of a crisis navigator for individuals
	Creation of "humane service" industries
	Realization of safe, secure, and comfortable urban areas free from hidden hazardous substances
	Self-management of health based on the action mechanism of daily behaviors such as food, exercise and sleep
	Realization of wellbeing by feedback based on psychological states evaluated by objective methods
Low Carbon Society	Realization of a low carbon society through game-changing technology
Common Platform	Realization of common platform technologies, facilities, and equipment that create innovative knowledge and products

Large-scale Type

Technology Themes (1)

Technology Themes	R&D Project (Program Manager, Title, Affiliation)
Laser-plasma acceleration technologies leading to innovative downsizing and high energy of particle accelerators (2017-)	**Development and demonstration of laser-driven quantum beam accelerators** (Noritaka KUMAGAI, PM, JST / Honorary Fellow, Japan Synchrotron Radiation Research Institute (JASRI))
High-temperature superconducting wire joint technologies leading to innovative reduction of energy loss (2017-)	**Social implementation of super-high field NMRs and DC superconducting cables for railway systems, through advancement of joint-technology between high-temperature superconducting wires** (Hideaki MAEDA, PM, JST / Senior Visiting Scientist, SPring-8 Center, RIKEN)
Quantum inertial sensor technologies leading to innovative high precision and downsizing of self-localization units (2017-)	**Development of high-performance gyroscopes with matter waves** (Mikio KOZUMA, PM, JST / Professor, Department of Physics, Tokyo Institute of Technology)
Ultrahigh precision time measurement technologies leading to a new time-business (2018-)	**Space-time information platform with a cloud of optical lattice clocks** (Hidetoshi KATORI, Professor, Graduate School of Engineering, The University of Tokyo /Chief Scientist, Quantum Metrology Laboratory, RIKEN)
Development of innovative adhesion technologies for realizing Society5.0 (2018-)	**Innovative Adhesion Technology Based on 4-dimensional Multi-scale Analysis of Interfaces** (Keiji TANAKA, Professor, Department of Applied Chemistry, Kyushu University)

Large-scale Type

Technology Themes (2)

Technology Themes	R&D Project (Program Manager, Title, Affiliation)
Innovative hydrogen liquefaction technologies desired in future society (2018-)	**Development of advanced hydrogen liquefaction system by using magnetic refrigeration technology** (Nobuyuki NISHIMIYA, Executive Advisor, National Institute for Materials Science (NIMS))
Innovative thermoelectric conversion technologies for stand-alone power supplies for sensors (2019-)	**Utilizing magnetism to develop high performance thermoelectric materials and devices** (Takao MORI, Group Leader, International Center for Materials Nano-architectonics, National Institute for Materials Science (NIMS))
Innovative device technologies to achieve ultra-high level information processing in the age of trillion sensors (TSensors) (2020-)	**Innovation of Photoelectric Technologies using Spintronics** (Satoru NAKATSUJI, Director, Trans-scale Quantum Science Institute, The University of Tokyo)

How to decide the Prioritized Themes

Multiple measures are combined:

Ideas from the Public
Hearing the voice from Society and Industry

Knowledge of Experts
Interview / Workshop

Investigation and Data Analysis
Policy trends
STI trends

R&D Supervisors lead the discussion

The themes are supposed to:

- ✓ Represent **a new value** that society and industry desire to create through S&T
- ✓ Bring the value that gives a **big impact on the economy and society**, if it realizes
- ✓ Be realized by **Science and Technology (Challenging R&D)** even though it is difficult
- ✓ Encourage **interdisciplinary R&D**

Portfolio for "Sustainable Society" area

Creating a Sustainable Society in terms of Environment and Resources

Living together with natural environment

Realizing a comfortable, rich and sustainable society

Responding to super-aging and population decline

Securing and Circulating Resources	Securing Food Supply and Stability	Conserving Ecosystem and Natural Environment	Responding to Climate Change	Sustainable Energy Use
Forests Ocean, Ocean floor Heredity, Genetics Organisms Minerals Waste New materials etc.	Livestock Animal husbandry Fishery Biotechnology Breeding Insect Soil ・・・	Biodiversity Ecosystem service Microorganisms Terrestrial region Aqua sphere, coast Eco-tourism Green infra ・・・	Adaptation Mitigation Assessment ・・・	Reused energy Unused energy Med.& small hydro Biomass Methane hydrate Electricity storage Energy mix ・・・

Food Production (FY2018)

Resource Circulation (FY2017)

Breeding and strain improvement(FY2020)

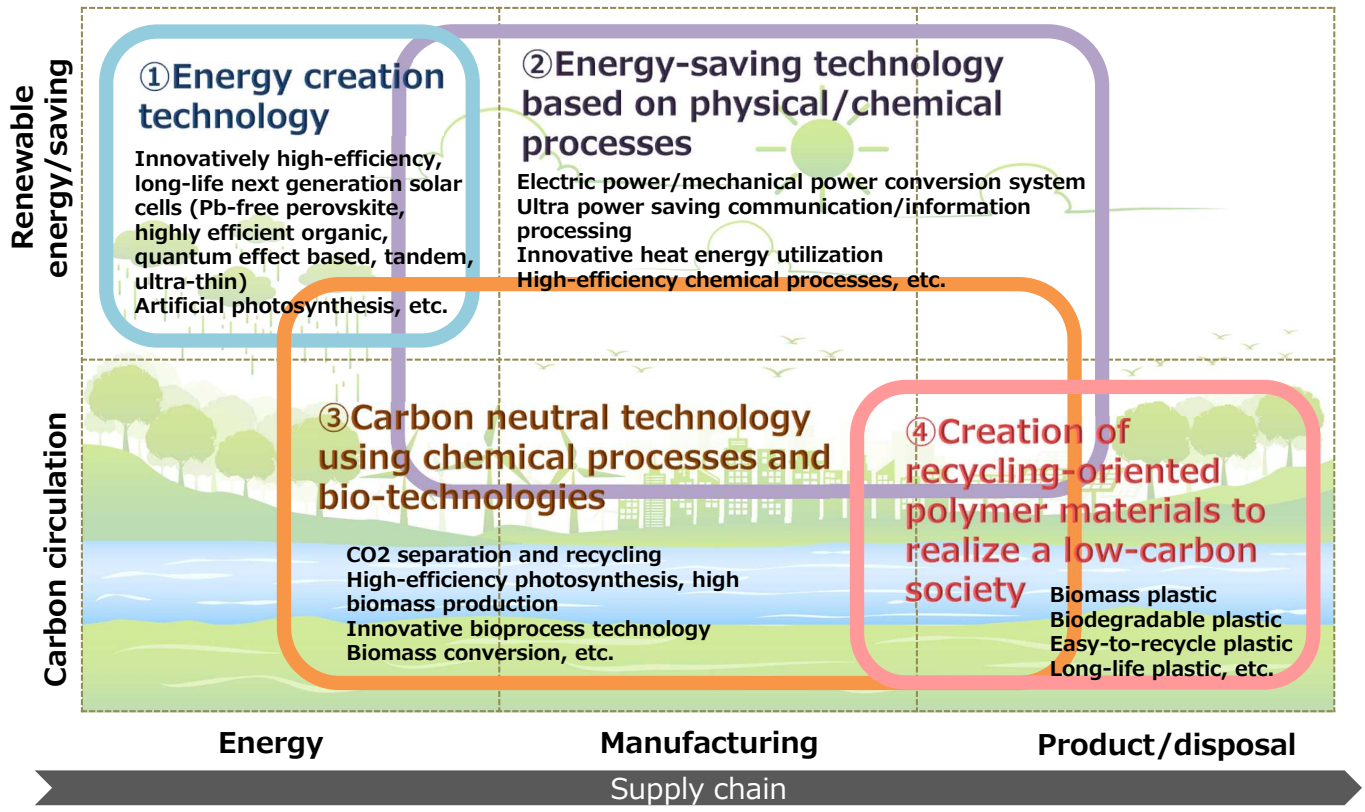
Innovative Manufacturing/ Competitiveness	Infrastructure Transformation	Work and Live *like yourself*	Human Resource Development	Mental & Physical Health
Resource efficiency, Energy saving 3R-reduce, reuse, recycle Supply chain High added value Process improvement (Production process efficiency improvement, diversification) Economic productivity (Human-machine collaboration, labor intensity) etc.	Building Road infrastructure Urbanization Tap water, sewers, watersheds Resilience Green infra・・・	Self-support Barrier-free Life & functional support (robot) Human-machine collaboration Communication Sharing	Metacognition Interaction Cognition Education Learning ・・・	Self-management Measurement Diagnosis Prevention, Mibyou Peridentosis (inflammation around a tooth) Mental health Dementia Cognitive function ・・・

Manufacturing (FY2019)

Intellectual Wellness (FY2017)

Creating a Sustainable Society in terms of Human and Society

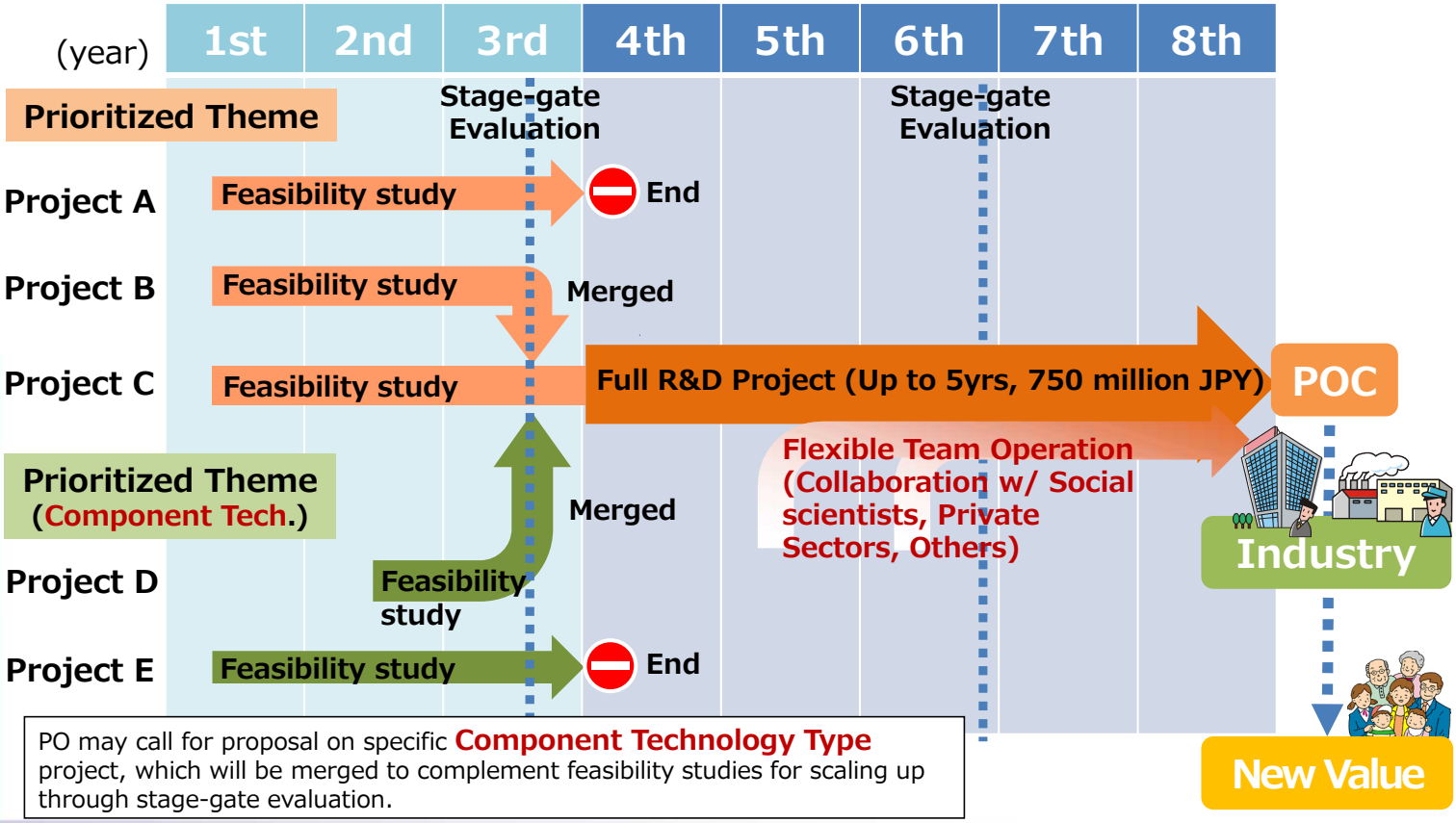
Portfolio for "Low Carbon Society" area



Flexible R&D Project Management (1)

- R&D Supervisor (PO)
  - Organize R&D Management Committee with experts
  - Set R&D portfolio for prioritized themes and area
  - Review proposals, progress and plans of project (annual report, site-visits, workshops etc.)
  - Advice integration and merge of projects for maximizing R&D impact (collaboration with social science/ private sectors/ others)
  - Pre-evaluate full-scale R&D proposal
  - Report R&D project management to Program Director Committee

Flexible R&D Project Management (2)



PO may call for proposal on specific **Component Technology Type** project, which will be merged to complement feasibility studies for scaling up through stage-gate evaluation.

6 full R&D Projects/188 have been implemented through "Stage-gate Evaluation".

Stage-gate Evaluation Implemented

- Stage-gate (SG) evaluation
  - Verify concept to be proven, strategy of full R&D plan, necessary technologies and other research elements (private funding for Large-scale Type; ELSI, standardization, etc.) in addition to scientific merit
  - Advice to spin-out or to collaborate with other sectors
  - Judge whether to scale-up, continue or terminate projects

Evaluation Criteria

Selection Criteria	SG Evaluation Criteria
1 Impact of the Proposed Goals	**1 Progress of the FS**
2 R&D Plan	**2 Social and Economic Impact**
3 Technological Difficulties	**3 R&D Team (more than 20% of private fund)**
4 R&D Team	**4 Trends in Japan and Overseas**

Impact of concept to be proven, in addition to scientific merit

Full R&D Projects (1)

"Sustainable Society" Area; Innovation in manufacturing for a new sustainable resource recycle

Construction of integrated circular production system by product lifecycle management and innovative dismantling technology development

(PL; Chiharu TOKORO, Professor, Faculty of Science and Engineering, Waseda University)

Development of the novel separation technology between different materials by pulsed electric discharge and the life cycle simulation to optimize product design/ manufacturing assuming separation for reuse/recycling, toward the construction of a novel integrated circular production system.

"Safe and Secure Society" Area; Creation of "humane service" industries

Providing humane services by expanding the function of flavor and fragrance

(PL; Kazushige TOUHARA, Professor, Department of Applied Biological Chemistry Graduate School of Agricultural and Life Sciences, The University of Tokyo)

Development of new technologies to design and control flavor and fragrance based on the biological principle, and new methodologies to evaluate the effects on human, leading to create new services to efficiently utilize previously-unappreciated benefits of flavor and fragrance.

Full R&D Projects (2)

"Sustainable Society" Area; Creation of innovative food production technologies in response to environmental changes in the future

Development of the production technology for next generation-meat using 3D tissue engineering techniques

(PL; Shoji TAKEUCHI, Professor, Graduate School of Information Science and Technology, The University of Tokyo)

Establishment of the technology for the industrial production of cultured steaks using bovine muscle cells, contributing to a sustainable and healthy society.

"Safe and Secure Society" Area; Development of the crisis navigator for individuals

Crowd control adaptive to individual and group attributes

(PL; Katsuhiro NISHINARI, Professor, The University of Tokyo)

Development of highly accurate crowd simulator and optimum control system of whole crowd, which provides mobility information services to individuals by taking individual and group attributes into account for safe and secure society.

Full R&D Projects (3)

"Super Smart Society" Area; Modelling and AI for Integration of Cyber and Physical World

Engineerable AI Techniques for Practical Applications of High-Quality Machine Learning-based Systems

(PL; Fuyuki ISHIKAWA, Associate Professor, Information Systems Architecture Science Research Division, National Institute of Informatics)

Development of techniques for construction of AI by incorporating human knowledge into deep learning and for assurance and improvement by extracting and analyzing factors affecting the target quality to promote practical applications of high-quality AI systems.

"Common Platform" Area; Realization of Common Platform Technology, Facilities, and Equipment that creates Innovative Knowledge and Products

Accelerating Life Sciences by Robotic Biology

(PL; Koichi TAKAHASHI, Team Leader, Center for Biosystems Dynamics Research, RIKEN)

Development of a package of technologies including a formal experimental protocol description language, IoT systems architectures and their implementations to enable coordinated operations of various robots and machinery, and demonstration of their performance in several important applications areas including proteomics, genome editing, and stem cell culture

3 pillars of International Activities

International Activities

1. Dispatching or inviting researchers for knowledge exchange

- Funding from both sides (Japan/JST and overseas)
- NDA if necessary, to protect IPs/ know-how etc.

2. Organizing international workshop/symposium

- Co-funding workshop/symposium from both sides
- Co-organize committee for realizing standardization on new technologies

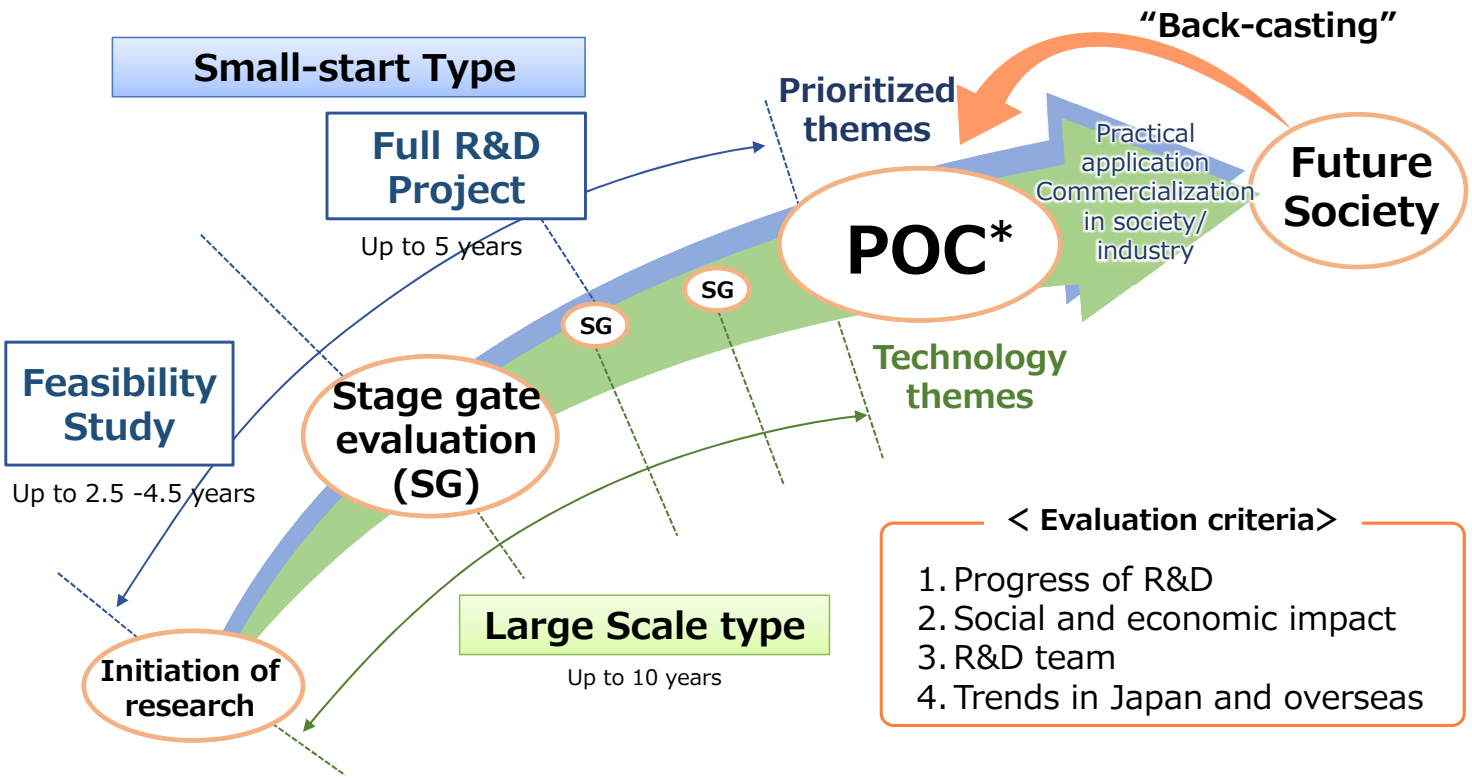
3. Participating in the JST-Mirai R&D Projects

- Funding from JST
- Agreement required between JST and overseas institute

Examples of International Activities

No.	Area/Themes	Content
1	Large-scale Types/ Ultrahigh precision time measurement	ONLINE International Symposium (December 2020) among Japan, U.K. and Germany
2	Sustainable Society /Food Production Tech.	International Workshop for Clean Meet Production Technologies (November 2019) @Tokyo, Japan
3	ALCA /Biotechnology	International Workshop (March 2019) @Japan
4	ALCA /Superconductivity	Researcher Dispatch (Collaboration Work)
5	ALCA/ White Biotechnology	International Workshop (December 2018) @Thailand
6	Light material	International Workshop for International Standard (Reproductive Ceramics)@Japan

Scheme of the Program



*POC: **Proof of concept** where practical application feasibility may be properly judged by investors and industry

Thank you for your kind attention!

For details, please visit our website (https://www.jst.go.jp/mirai/en/index.html)