

Moonshot Goals for the Moonshot Research and Development Program

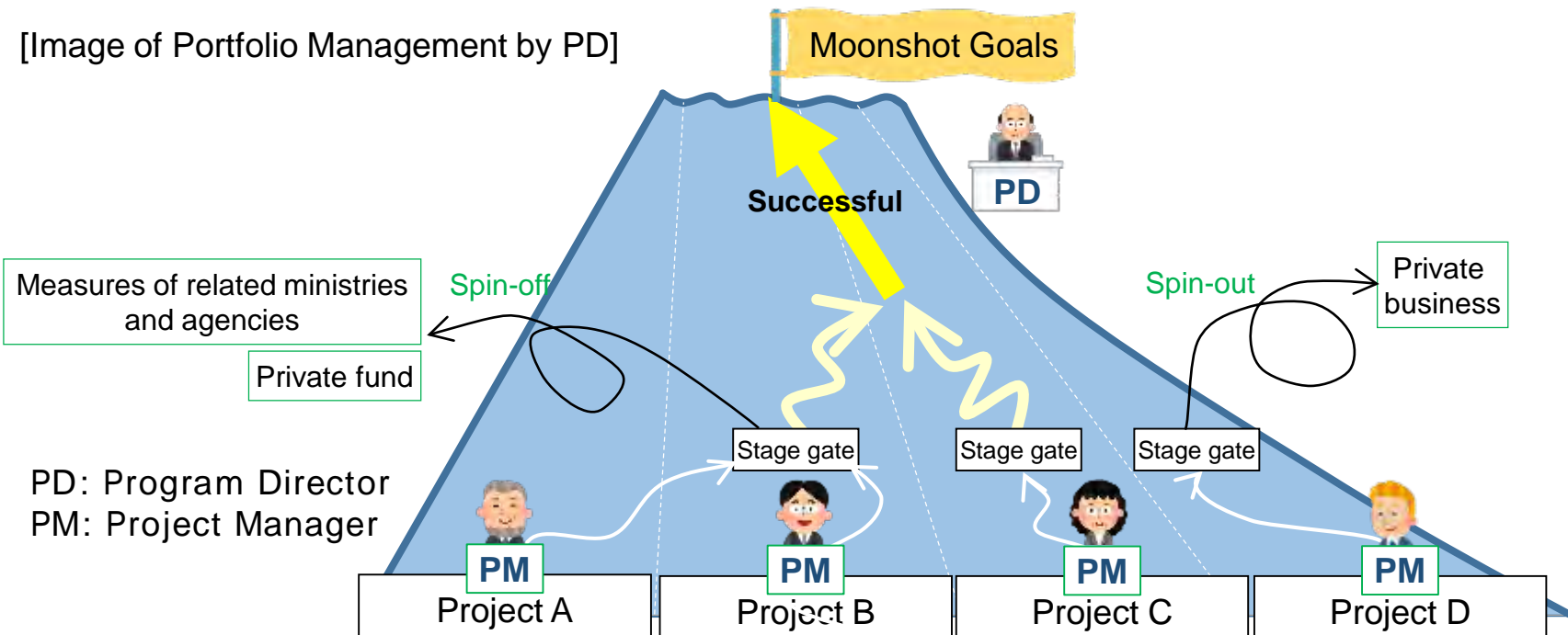
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Future Innovation Research Division
Bureau of Science, Technology and Innovation
Cabinet Office, Government of Japan



- (1) The government sets ambitious goals and concepts for societal issues that are difficult to tackle but will have profound impact once resolved.
- (2) Opens call for domestic and foreign top-class researchers as PM^{*1}s under the direction of the PD^{*2} who oversees multiple projects. ^{*1} Project Manager, ^{*2} Program Director
- (3) Builds a portfolio overlooking the program and promotes challenging R&D without fear of failure.
- (4) Reviews a portfolio flexibly by stage-gates and actively encourages utilization of the R&D results.
- (5) Establishes the most advanced research support system by utilizing a data management infrastructure.
- (6) 100 billion yen was appropriated in the supplementary budget for FY2018, and a fund was created. 15 billion yen was appropriated in the supplementary budget for FY2019.
- (7) Supports the program up to 10 years.

[Image of Portfolio Management by PD]



Outline of the Program and Moonshot goals

Outline

To develop radical solutions for difficult societal challenge, the Government of Japan (GOJ) set inspiring and ambitious goals for challenging R&D.

Goals

To realize “Human Well-being”, seven Moonshot goals (MS goals) were decided in the area of society, environment, and economics. (Goal #1 – 6 : Council for Science, Technology and Innovation. Jan.23, 2020. Goal #7 : Headquarters for Healthcare Policy. July.14, 2020.)

7 MS goals to be achieved

Society

Turning the aging society into the innovative and sustainable society by harnessing diversity through techno-social transformation

Environment

Recovery for global environment and growth of civilization

Economics

Exploring frontiers with science and technology

Goal #1: Realization of a society in which human beings can be free from limitations of body, brain, space, and time by 2050.

Goal #2: Realization of ultra-early disease prediction and intervention by 2050.

Goal #3: Realization of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050.

Goal #4: Realization of sustainable resource circulation to recover the global environment by 2050.

Goal #5: Creation of the industry that enables sustainable global food supply by exploiting unused biological resources by 2050.

Goal #6: Realization of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050.

Goal #7: Realization of sustainable care systems to overcome major diseases by 2040, for enjoying one's life with relief and release from health concerns until 100 years old”

“Moonshot for Human Well-being”

Moonshot Goal #1

Goal #1

Realization of a society in which human beings can be free from limitations of body, brain, space, and time by 2050.

<Target of Moonshot Goal>

Cybernetic avatar*1 infrastructure for diversity and inclusion

- Development of technologies and infrastructure to carry out large-scale complex tasks combining large numbers of robots and avatars teleoperated by multiple persons by 2050.
- Development of technologies and infrastructure that allow one person to operate more than 10 avatars for one task at the same speed and accuracy as one avatar by 2030.

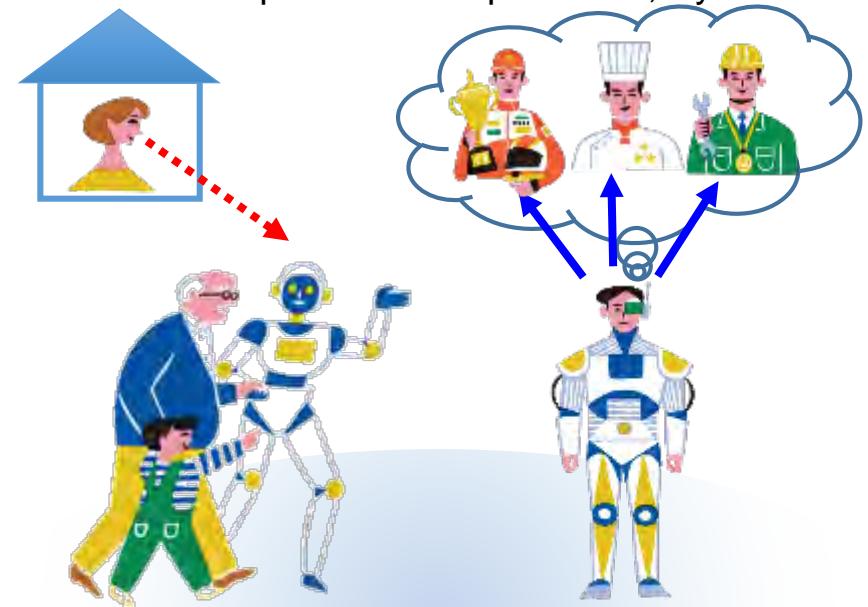
Cybernetic avatar life

- Development of technologies that will allow anyone willing to augment their physical, cognitive, and perceptual capabilities to the top level, and spread of a new lifestyle that will be welcomed by society, by 2050.
- Development of technologies that will allow anyone willing to augment their physical, cognitive, and perceptual capabilities for specific tasks, and proposal of a new lifestyle that will be welcomed by society, by 2030.

(Reference: Future Visions to be achieved)

A society in which everyone can participate in various activities

- Development of technologies that allow anyone to participate in social activities beyond the limitations of place and capabilities, by 2050.



No need to be on site

Possible to get required abilities by wearing devices

A society where everyone can participate in various activities

*1 Cybernetic Avatar is a concept that includes not only remote avatars using robots and 3D images as proxies but also empowerment of the physical/cognitive abilities of humans using ICT and robotics. Cybernetic Avatar aims to be active not only in the physical world, but also in the cyber-physical world, i.e. Society 5.0.

Moonshot Goal #2

Goal #2

Realization of ultra-early disease prediction and intervention by 2050.

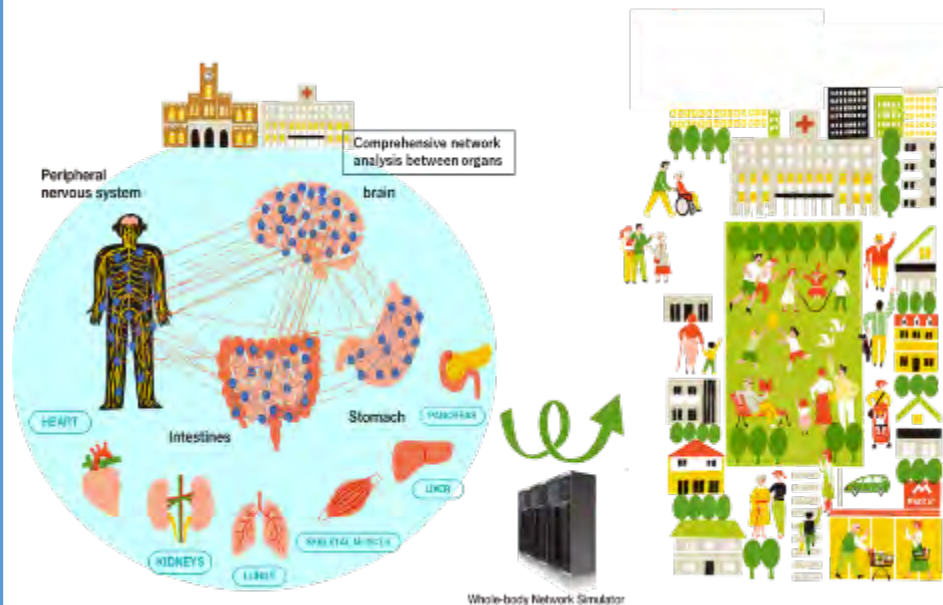
<Target of Moonshot Goal>

- Establishment of a system for disease prediction and evaluation of pre-symptomatic states in order to suppress and prevent disease onset, through integrated analysis of the entire functional network between human organs, by 2050.
- Establishment of a strategy that enables the conversion of a pre-symptomatic state to a healthy state, by clarification of functional changes in human physiology along life course considering the comprehensive network between organs, by 2050.
- Identification of disease-related network structures and establishment of innovative prediction and intervention methods by 2050.
- Understanding of the comprehensive network between human organs by 2030.

(Reference: Future Visions to be achieved)

Prevent diseases

- Development of technologies preventing serious diseases such as dementia and cancer by analyzing unclear networks between organs such brain and intestines, by 2050.



World's first 'Whole-body Network Atlas'

Moonshot Goal #3

Goal #3

Realization of AI robots that autonomously learn, adapt to their environment, evolve in intelligence and act alongside human beings, by 2050.

<Target of Moonshot Goal>

- Development of AI robots that humans feel comfortable with, have physical abilities equivalent to or greater than humans, and grow in harmony with human life, by 2050.
- Development of AI robots that behave well with humans under certain conditions, and allow over 90% of people to feel comfortable with them, by 2030.
- Development of an automated AI robot system that aims to discover impactful scientific principles and solutions, by thinking and acting in the field of natural science, by 2050.
- Development of an automated AI robot system that aims to support the process of discovery for scientific principles and solutions to specific problems by 2030.
- Development of AI robots that autonomously make judgements and act in environments where it is difficult for humans to act by 2050.
- Development of AI robots that operate unattended under human supervision in specific circumstances by 2030.

(Reference: Future Visions to be achieved)

A society in which humans and robots coexist

- Development of AI robots that have same sensitivity as humans and physical abilities equivalent to or better than humans, growing together with human life.



Moonshot Goal #4

Goal #4

Realization of sustainable resource circulation to recover the global environment by 2050.

<Target of Moonshot Goal>

Solutions to the global warming problem (the Cool Earth) and environmental pollution problem (the Clean Earth) through realization of sustainable resource circulation for the global environment.

Cool Earth & Clean Earth

- Global deployment of commercial plants or products utilizing circulation technology by 2050.

Cool Earth

- Development of circulation technology on a pilot scale for reducing greenhouse gases that is also effective in terms of life cycle assessment (LCA) by 2030.

Clean Earth

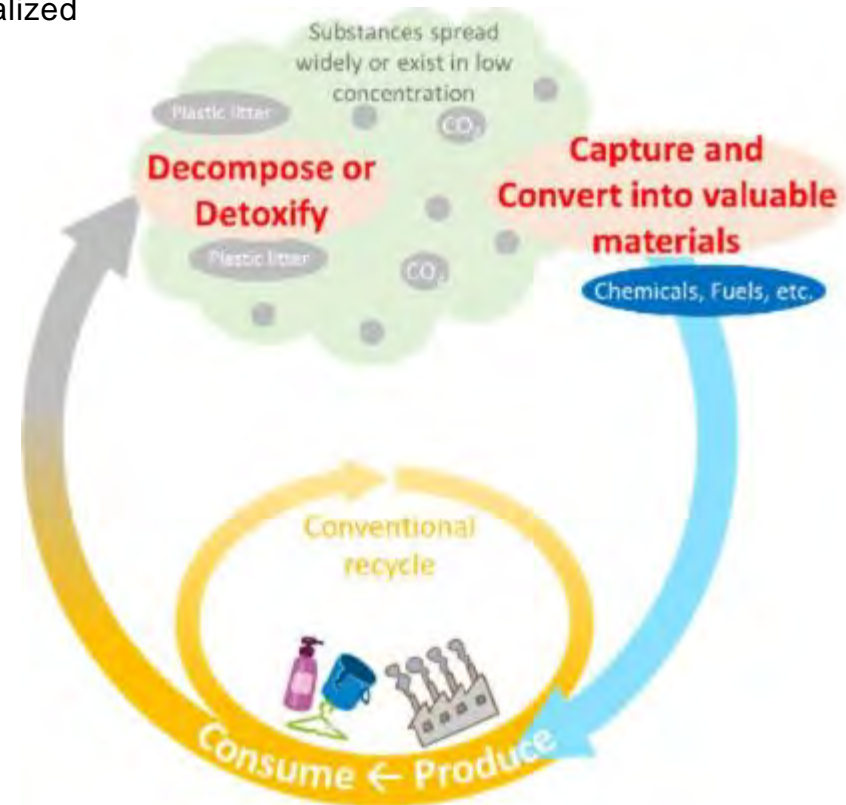
- Development of technology on a pilot scale or in a form of prototype that converts environmentally harmful substances into valuable or harmless materials by 2030.

(Reference: Future Visions to be achieved)

Cool Earth & Clean Earth

- Implementation of technologies such as DAC(Direct Air Capture) of CO₂, conversion of CO₂ into materials and decomposition of marine plastic litter, in society, by 2050.

Example of a new sustainable resource circulation to be realized



Moonshot Goal #5

Goal #5

Creation of the industry that enables sustainable global food supply by exploiting unused biological resources by 2050.

<Target of Moonshot Goal>

- Technical development of the circular food production systems by biological measures, e.g. utilizing microbes and insects, by 2050.
- Development of technical solutions for eliminating food loss and waste and for achieving both healthy life and sustainable food consumption by 2050.
- Evaluation of the technical achievements and discussion on the ethical, legal and social implications (ELSI) matters will be done by 2030, for global spread of the technology by 2050.

(Reference: Future Visions to be achieved)

Sustainable food supply without food-loss and environmental loading

- Creation of the industry that enables sustainable global food supply by exploiting unused biological resources by 2050.



Moonshot Goal #6

Goal #6

Realization of a fault-tolerant universal quantum computer that will revolutionize economy, industry, and security by 2050.

<Target of Moonshot Goal>

- Achievement of the large-scale integration required for fault-tolerant universal quantum computers*¹ by around 2050.
- Development of a certain scale of NISQ computer*² and demonstration of the effectiveness of quantum error correction by 2030.

(Reference: Future Visions to be achieved)

A universal quantum computer that will dramatically revolutionize our society

- Realization of a large-scale and multipurpose quantum computer that will revolutionize economy, industry and security, by 2050.



*¹ Fault-tolerant universal quantum computer is a quantum computer that realizes large-scale integration while guaranteeing on sufficiently high accuracy for various applications.

*² NISQ(Noisy-Intermediate Scale Quantum) is a small to medium scale quantum computer that does not have a function to correct errors.

Moonshot Goal #7

Goal #7

Realization of sustainable care systems to overcome major diseases by 2040, for enjoying one's life with relief and release from health concerns until 100 years old

<Target of Moonshot Goal>

[Realization of a society where everyone can prevent diseases spontaneously in daily life]

- Establish infrastructure to maintain good mental and physical health by developing technologies, in order to stay healthy and prevent the onset and aggravation of diseases by regulation of immune systems or sleep, etc., and to visualize individual physical and mental state in daily life and urge people to voluntarily take healthy maintenance actions most suitable for them by 2040.
- Develop technologies to monitor all living body trends with lower physical and mental load by 2030.

[Realization of medical networks accessible for anyone from anywhere in the world]

- Establish a medical network to provide the same level of medical care as a normal time regardless of region and even upon disasters and emergencies by developing diagnostic and treatment devices for simple tests and treatments at home, etc. and diagnosis- and treatment-free technologies for part of chronic diseases by 2040. In addition, develop methods for radical treatment and precision medicine for diseases such as cancer and dementia by substantially reducing the development period of drugs and medical devices, etc. through establishment of data science and evaluation systems by 2040.

- Establish a technology platform to provide quality medical and nursing care suitable for each individual appropriately even with less providers by developing compact, speedy and high-sensitivity diagnostic and treatment devices as well as technologies to further enhance doctors' medical opinion and diagnostic capability by 2030.

[Realization of drastic improvement of QoL without feeling load (realization of an inclusive society without health disparity)]

- Establish a social infrastructure to enable self-reliant life at home without depending on nursing care by developing such technologies as the recovery of body function with rehabilitation without feeling load, normalization of ailing biocontrol systems, regeneration or substitution of weakened organs and so forth by 2040.
- Develop technologies to improve body function through load-reducing rehabilitation and support self-reliant life at home and to improve ailing living biocontrol systems by 2030.

(Reference: Future Visions to be achieved)

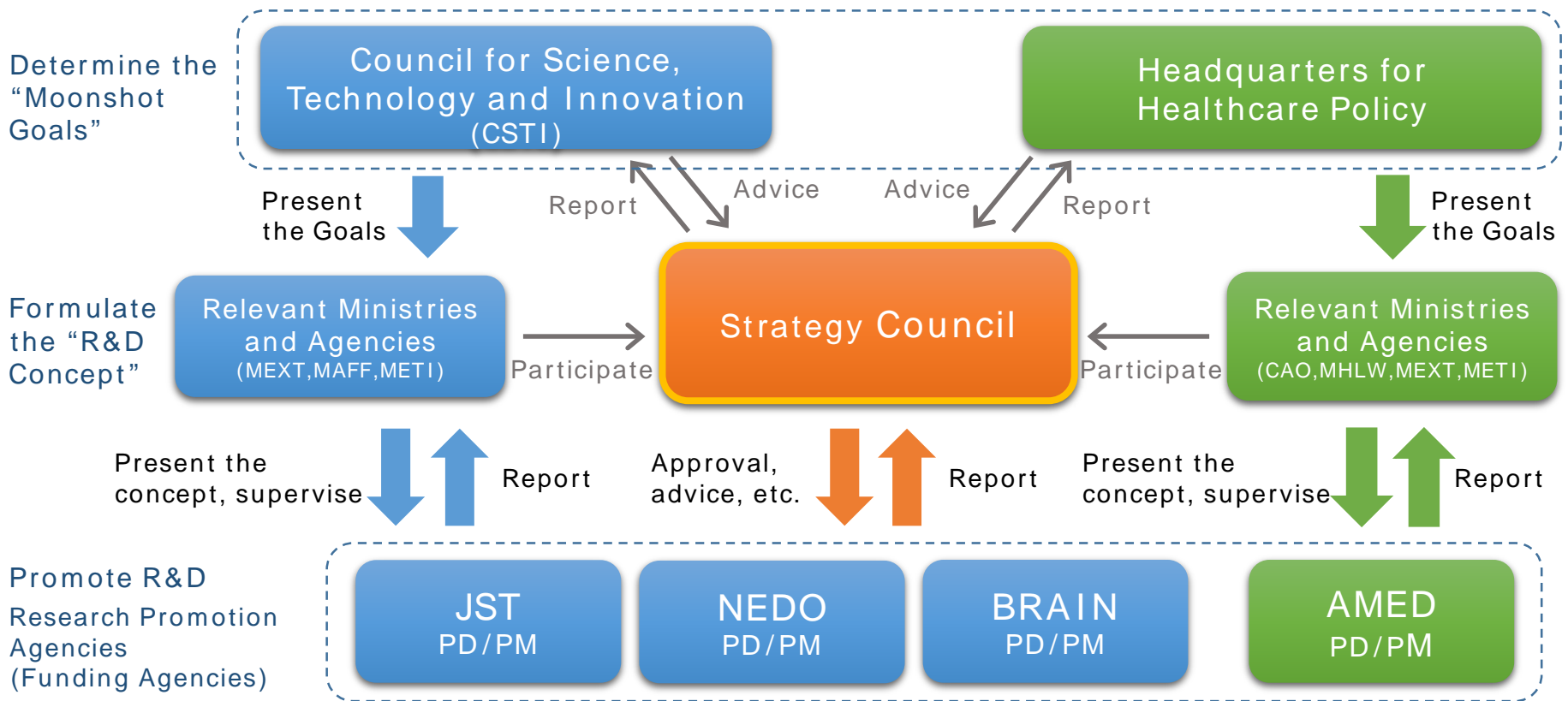
Sustainable care system for enjoying one's life until 100 years old



Promotion System of the Moonshot R&D

- OCSTI and Headquarters for Healthcare Policy determine the MS Goals.
- To achieve the MS Goals, Research Promotion Agencies (Funding Agencies) promote related R&D.
- A Strategy Council comprised of people from industry, relevant ministries and offices, and researchers, is established to strategically promote R&D, to accelerate the practical use of the R&D results in society, and to achieve effective cooperation and coordination among the relevant ministries/offices and the relevant FAs.

R&D promotion system



We choose to go to the Moon.

John F. Kennedy

The Moonshot Research and Development Program sets ambitious goals to attract people, and promotes challenging R&D projects with the aim of resolving difficult societal issues while bringing together the wisdom of researchers from all over the world.

Moonshot for Human Well-being