

Summary of remoteization/automation of research facilities

The background and the issues to be addressed

- In June 2020, visits/entrance to research facilities was restricted due to prevention of the spread of the novel coronavirus (COVID-19). Researchers including employees from private companies have still limited access to experimental works, etc., using research facilities/equipment.
- There is also concern over a sudden decrease of private R&D investment. While considering promotion of digital transformation to maintain the new normal in the research field, it is inevitable to ensure that research activities will continue uninterrupted.

Summary of initiative

1. Efforts to address the issue

- For improving the environment for the National Research and Development Agency, the funds are allocated from PRISM to accommodate remote operation of shared research facilities/equipment which are frequently used by the outside researchers from private companies, etc., and automation of experimental works.
- To flexibly address the issues, the governing board directly selects and decides on the measures in accordance with the guideline for Public/Private R&D Investment Strategic Expansion Program (*Refer to "Decision/Screening process").



2. Results of the screening

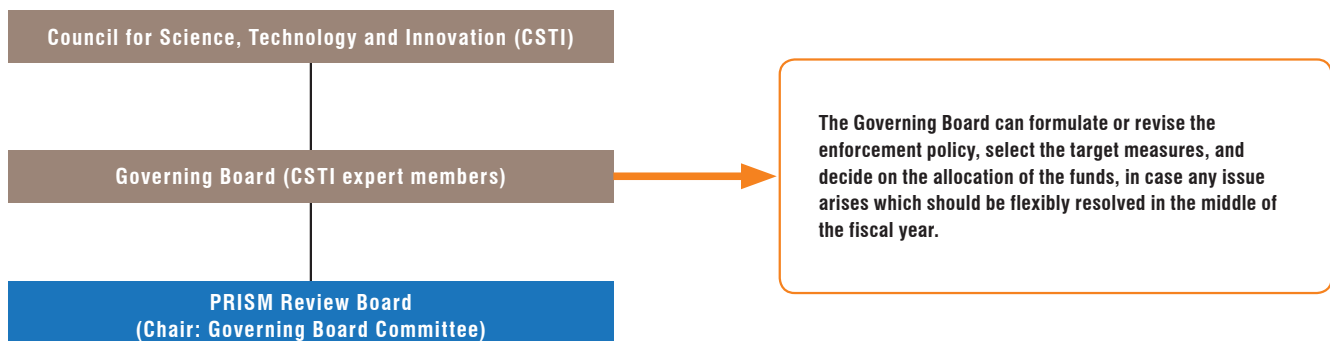
- The governing board selected four schemes and the PRISM Review Board examined details. On June 25, 2020, the board and committee decided on the allocation of 290 million yen to four measures.
- In the screening process, the importance of security was reconfirmed. Also, a decision was made to promote remoteization/automation of research facilities, paying close attention to information security and security of control systems.



3. Subsequent initiative

- As the initiative on remoteization/automation of research facilities is considered important, it should be addressed as one of the R&D-related themes (will be screened in the same process as a regular R&D model).

Decision/screening process



Examples of Remoteization/Automation of Research Facilities

Remoteization and Automation of the Use of the Fundamental Shared Research Facilities in Materials Science

Remoteization of the Transmission Electron Microscopes

Main Functions of the Existing Devices

- A **fully equipped device**, of which there are only a few introduction cases in Japan, applied for **microstructural evaluation of extensive materials** such as metals, ceramics, semiconductors and high polymers. (Physical Characterization TEM)
- **Microstructural evaluation** of metals, semiconductors, high polymers and such **at monoatomic level** is made possible with the device **boasting the highest energy resolution in Japan**. (Atomic-Resolution Analytical Electron Microscope)
- An **effective device for in-situ observation equipped with the functions** such as elemental analysis, evaluation of integration state and **operando measurement responding to application of heat and voltage** as well as a **high-speed video-recording camera**. (Electron Holography Microscope)

Function to be added

- Remote access/control from distant locations via internet



Effects and Benefits

This allows researchers to continue with their research activities through remote operation even when a stay-at-home request is in effect.

Remoteization of NMR

Main Functions of the Existing Device

- Provides various information such as crystal structures, electron states, molecular motions and ionic conduction on various solid materials.
- **Particularly effective for analysis on the materials** such as light elements and amorphous materials **which are difficult to analyze** with other methods like x-ray and neutron scattering.
- Provides 500MHz high resolution and contributes to development of diverse materials such as steel, glass, high polymer and cement produced by materials/consumer products manufacturers.
- Since **the technology developed in NIMS over a long period of time is adopted** at the heart of this device, such as its probe, **the measurements are hard to be substituted by the other institutions**.

Function to be added

- Remote access/control from distant locations via internet



Real-time data acquisition and analysis from distant location.

Remoteization/Automation of the Physical Property Analysis Device

Main Functions of the Existing Device

- Capable of **automatic measurement and analysis of film thickness/refractive index** for materials invented for the development of new materials.
- Microscopic functions **allow local analysis of the device**.
- **Particularly effective in developing multilayer films and composite materials**.
- Applicable to various items from small pieces of heteromorphic samples to large-diameter wafers and **contributes to R&D in various phases ranging from basic and generic research to application development**.

Function to be added

- Remote access/control from distant locations via internet



Contribution to enhancement of technological capabilities of students and young researchers