

**The 4<sup>th</sup> Strategic Basic Research Programs  
International Review Report**

**Japan Science and Technology Agency (JST)  
The 4<sup>th</sup> Strategic Basic Research Programs  
International Review Committee  
February 1<sup>st</sup>, 2021**

## Preliminary Remarks

This is a formative evaluation conducted by the Japan Science and Technology Agency (JST) Strategic Basic Research Programs (hereinafter, "Programs"), to obtain recommendations and advice on program improvement based on dialogue between the program management side and external experts in Japan and overseas, and to conduct organizational learning on its own. The name has also been changed to International Review, reflecting the change from a purely international evaluation as a more summative one. Focusing mainly on the five years (FY2016-2020) since the previous international evaluation, we reviewed the entire programs based on performance reports of efforts to promote target-oriented basic research, research results, and impacts. In particular, regarding the evaluation process of the research areas, we discussed the direction of improvement by referring to the status of program evaluation of overseas Funding Agencies (FA). These results are summarized as recommendations and advice to JST for the future.

In October and December 2020, the International Review Committee was held via two online meetings in the context of the global COVID-19 crisis. Despite it being the first time it was implemented in such a way, meaningful discussions were held including a round-table inviting executive directors and experts from three major Japanese FAs: the Japan Society for the Promotion of Science (JSPS), the New Energy and Industrial Technology Development Organization (NEDO), and the Japan Agency for Medical Research and Development (AMED). Since external experts from overseas have been watching JST's activities for many years, they could offer valuable opinions looking back across the programs and make recommendations for program improvement. From the perspective of promoting JST organizational learning, we hope to continue dialogue with overseas experts in the future.

The Programs are distinctive among the basic research programs implemented by FAs in Japan and overseas, and considering the research results and the impact they have had on the research community so far, their value as a model of funding is significant. We recognize that it is extremely important to maintain their sustainability and integrity in the future.

The next section describes the review of the Programs and the recommendations to JST. We hope that they will be used to improve program operations in the future, and wish for further development of the Programs.

International Review Committee  
Chair: Yuko Harayama



## **1. Structure and Operation of the Programs**

### **1-1. Programs in general**

- (1) The mission of the Programs is to create innovative technology seeds that will create science and technology innovation that will transform society and the economy by promoting challenging basic research to overcome important issues facing Japan. Therefore, they are designed to be located between JSPS's Grants-in-Aid for Scientific Research (KAKENHI) and NEDO's as well as AMED's R&D expenses, and have a complementary structure that benefits the whole country. The system of virtual network-based research institutes enables flexible R&D responses to important issues. In recent years, the AIP Network Lab has fully utilized its advantages. By giving the Research Supervisors (POs) the authority to assemble and coordinate projects under their respective themes, it is possible to form a balanced research portfolio for each research area, and this method is particularly effective for launching new fields.
- (2) In these Programs, we expect to set strategic objectives and research areas that will create and lead new trends around the world, rather than a stance that follows global trends. In doing so, in view of the importance of diversity and transdisciplinarity, it is increasingly important to respond to integrated and systemic issues. In order to make the Programs more transdisciplinary, the evaluation process must also be addressed.
- (3) In order to maximize the value of individual research results, it is essential not only to cooperate with other JST programs, but also to cooperate with both domestic and overseas FAs. We would like JST to try to further build relationships and promote international joint research projects, such as sharing information and exchanging opinions regularly. In addition, as shown by the AIP Network Lab, the coordination mechanism among programs and research areas is important, and we expect coordination beyond JST.

### **1-2. Each Program**

- (1) ERATO is highly evaluated by overseas researchers because it provides a generous research budget to a single PI and allows for flexible research management with relatively high degrees of freedom.
- (2) ACT-X and PRESTO are positive initiatives for young people. The promotion of international joint research such as CREST should continue, although the number of partner countries is still limited.
- (3) Although social actors such as industry are not conditioned to participate in these Programs early in the research, adjustments by Program Managers with industry experience, as implemented in the ACCEL project, are potentially worth referencing depending on the characteristics of the field.

### **1-3. Program Operations**

- (1) The management costs of these Programs are higher than those of overseas FAs. Digitization of program operations, streamlining of management and evaluation processes, and constant checks of them will contribute to reducing the management costs of the Programs. A database of information

on Funding would not only improve operational efficiency, but also facilitate cooperation with other FAs.

- (2) In addition to clarifying the relationship between strategic objectives and research areas, coordination between Program Directors (PD) and Program Supervisors(PO) is important when formulating the research area management policy for calls for proposals. International cooperation should be factored into the management policy from the beginning.
- (3) It is important to ensure diversity in program operations and to reflect women's perspectives. In addition, from the perspective of innovation, JST should continue to strive to create an environment and improve systems that allow female researchers to be more active in research.

## **2. Assessment of Research Results and Impacts of the Programs**

### **2-1. Contribution of Research Results from a Scientific and Technological Point of View**

- (1) The scientific and technological contributions of the Programs are remarkable. The high quality of the funded research is suggested by aggregate bibliometric data, whereas, these data would be further explored to better grasp research outcomes. The Programs attract top-level scientists in Japan, and the prestigious awards and numbers of them awarded to funded scientists is telling. The Programs as a whole can be said to contribute greatly to the progress of science and technology in Japan.
- (2) JST is required to contribute to the creation of high-impact research results as an FA, but it is difficult to measure the impact at an early stage in an emerging field. When evaluating such projects, they should be considered from a medium- to long-term perspective, without too much emphasis on the number of citations of the paper. In addition, it is important to further strengthen the dissemination of research results by JST and researchers themselves to society.
- (3) When evaluating the contribution to human resource development, including the development of young researchers, it is necessary to track the mobility of young human resources after commissioned research expenses, and to verify their impact on the research community. For this reason, the implementation of a medium- to long-term tracking system by constructing a database will be effective.
- (4) As an indicator of internationalization, it may be useful to measure the participation status of foreign researchers in projects and the proportion of co-authored papers with foreign research institutes.

### **2-2. Contribution of Research Results from a Social and Economic Perspective**

- (1) Although it is not easy to confirm the social and economic impact due to the long-term view required, a medium- to long-term perspective is indispensable for these Programs. They are expected to clarify the contribution of JST to the creation of venture companies, practical application of research results,

and problem solving. In addition, it is necessary to devise a timeframe and index for the evaluation.

- (2) In evaluating the outcomes of programs and research areas from a social and economic point of view, we believe that cooperation with other FAs is effective. This will facilitate the process of maturing research results toward innovation and tracking the path of development into new research areas and technologies.
- (3) With a view to utilizing external resources and collaborating with other institutions, JST would also benefit from researching and studying methodologies for evaluating social and economic impacts.

### **3. Review of Research Area Evaluation Process**

In 3-1, the Committee's recommendations for the current research area evaluation are written, and in 3-2, the Committee's opinion on the "direction of review" proposed by the JST Secretariat is described.

#### **3-1. Current Research Area Evaluation**

- (1) The setting and operation of research areas and programs use advanced methodologies compared to overseas, and are highly evaluated. However, since there is no database interoperability among research areas and programs, it is currently difficult to conduct relative evaluations across research areas and programs. For example, it seems difficult to compare the contribution of each research area of "CREST" and "PRESTO" related to the same strategic objective, and to compare and examine the outcomes between research areas in different strategic objectives. In order to comprehensively view different programs and evaluate them as portfolios, there should be a database of research projects across all of the Programs.
- (2) Ex-post evaluation of research areas should be more focused on verifying the validity of research area settings than individual research projects. In addition, as mentioned in 2-2, it takes a long time to track the impact of basic research, so it will be effective to conduct a survey to follow up on the impact at a time when, for example, about 10 years have passed since the end of the program.
- (3) In evaluating these Programs, evaluations from an international perspective, such as the use of international experts, should be introduced.
- (4) We encourage JST to become a more dynamic organization by using the results of the evaluation to set new strategies and objectives, without keeping the ex-post evaluation as a milestone of termination.

#### **3.2 Direction of Review**

- (1) By evaluating the larger group of research areas collectively, it is possible to conduct relative evaluations among strategic objectives and provide feedback on important knowledge in setting strategic objectives, which can lead to the formulation of more strategic 'strategic objectives'
- (2) We agree with the larger grouping of evaluations and the abolition of rankings based on scores or grades, but JST should clarify the criteria for larger grouping and be careful not to drop transdisciplinary perspectives.

- (3) In order to promote interaction and network activities not only from the viewpoint of evaluation but also among research areas, it is effective to cluster several research areas. In doing so, there is a risk that the focus will be weakened if we make a large group of life sciences, nanotechnology and materials, green innovation, ICT, etc., so it is necessary to be careful about how to do so.
- (4) The new evaluation committee is expected to function more proactively, including hearing opinions from not only diverse experts from industry, academia and government, but also from PDs and POs, and conducting discussions that contribute to the improvement of R&D management and recommendations of new strategic objectives and research areas. At the same time, JST should invite experts from other FAs such as JSPS, NEDO and AMED to have discussions about the impact of the results and bridging to them.
- (5) From the perspective of assessing social impact, it is also worth considering a portfolio of possible social issues and a bird's-eye view of which projects in which areas contributed to which issues. In doing so, JST should construct a database of all projects and carry out overall management as a matrix consisting of a research areas vertical axis and social issues horizontal axis.

#### **4. Others**

- (1) Much of the R&D that has had a significant impact has resulted from overlapping areas of basic R&D with society. The evaluation committee should recognize the importance of connecting the gap, and it is also important to have contact with the receiving side of the results.
- (2) While we should pay close attention to the overlap in the allocation of research funds to projects, we hope that FAs will coordinate to create better science and technology innovation outcomes so that this does not result in discontinuity of research.

#### **5. Recommendations for Program Improvement**

##### **➤ Improvement of Research Area Evaluation Method**

- (1) It is important to evaluate the results created in different programs and research areas from a multifaceted and relative perspective, and to link them to effective and efficient feedback on strategic objective formulation and program operations.
- (2) As a means to achieve the above, it is effective to make larger groupings of evaluations of research areas than were previously carried out individually. When reorganizing the evaluation committee, it is also worth considering that the transdisciplinary areas (where breakthroughs are expected) should be collectively set together. Due to the larger grouping the evaluation axis becomes mixed and it may be difficult to narrow down the focus, so attention should be paid to this point.
- (3) Regarding the evaluation committee, we expect it to function more proactively, including the participation of diverse experts from industry, academia and

government including other FAs. It should evaluate the validity of research area setting, and feed back evaluation results to relevant ministries and agencies.

➤ **Improvement of Program Operations and Evaluation Methods**

- (1) Regarding the management and evaluation of programs and research areas and bridging to results, it is important to build a portfolio database that provides a bird's-eye view of all programs and research projects, and to promote collaboration with other funding agencies and external experts and expert organizations. In addition, utilizing this database, JST should rationalize the operation management and evaluation process and reduce the management costs by constant checks of them, and effectively and efficiently develop results for the creation of innovation.
- (2) To reaffirm that strategic objectives, research areas, and research supervisors are the pillars of the Programs, the following initiatives should be strengthened:
  - Contributing to the process of formulating strategic objectives by utilizing JST's functions and capabilities.
  - Tackling new integrated and systemic issues that require diversity, interdisciplinary knowledge and a systemic approach.
  - Clarifying the relationship between strategic objectives and research areas.
  - Activating communication between Program Directors and Program Officers in formulating and improving management policies in research areas.
- (3) Looking to the example of overseas FAs, program evaluation can be improved from conducting a summative evaluation focusing on ranking by scores and grades to a formative one.

➤ **Assessment of Scientific, Social and Economic Impacts of Research Results**

- (1) JST, as an FA, should continue to contribute to the creation of high-impact research results not only in science and technology but also in society and the economy. However, past success stories have shown that it takes a long time to view contributions from a social and economic perspective as tangible facts. Therefore, it is extremely important to promote surveys and assessments that track impact over a long range of 10 years, and to use the results to promote the importance of basic research to the general public and policymakers. In doing so, in cooperation with other FAs, it is desirable to work with overseas experts to make efforts to examine JST's substantial contribution and use it to improve program operations.
- (2) Instead of considering only the research results of researchers who have received research expenses as a result of the Programs, challenges to

institutional bottlenecks, during research and movements towards practical implementation, should also be considered and evaluated as impact.

- (3) The creation and utilization of intellectual property from basic research is important, and we recognize the role of JST in complementing the intellectual property support system of universities and public research institutes. For this reason, it is necessary to further enhance JST's capacity regarding patent assessment and the personnel in charge, but the appropriate use of external expert organizations also deserves consideration.
- (4) Ex-post evaluation should focus more on evaluating the validity of research area setting, rather than individual research results. It is also important to verify the validity of the research area setting from a medium- to long-term perspective, such as 5 or 10 years later, taking into account global trends.

➤ **Others**

- (1) International joint research and collaboration with overseas FAs and overseas experts should be further promoted. While enhancing the system and environment that can fully demonstrate the potential of young researchers and female researchers, we should continue to improve existing mechanisms and environments.
- (2) It is recommended that implementation be considered because it contributes to the improvement of program operations by setting up round tables and regular meetings with other FAs at the Program Director and the Research Supervisor level, sharing information, examining common issues, and linking to project management.