R&D project Application
PD's supplement (Moonshot Goal 9)

PD : KUMAGAI Seiji（Associate Professor, Institute for the Future of Human Society, Kyoto University）

  We plan to hold a call for proposals for additional PMs to "Aiming to relieve negative feelings and prevent related phenomena in children (e.g. depression, stress, anxiety, loneliness, abuse, suicide)", which is lacking in the current program portfolio.

1．Moonshot Goals

  In recent years, social issues related to our mental status have become increasingly severe. The key to creating a mentally healthy and dynamic society is to develop a comprehensive understanding of mental status, and kind interpersonal and intergroup communication that will lead us in the direction we wish.

  The Moonshot Goal 9 program aims to realize increased peace of mind and vitality by creating technology to realize "understanding of individual mental status and transitions" and "mental health support in terms of interpersonal and intergroup communication" so as to increase peace of mind and vitality. For more information, please refer to the "PD's Supplements to the FY2021 PM application" at the end of this policy.

2．Direction of research and development
（1）Area and field to promote challenging R&D

  This R&D program aims to develop technology that will support better knowledge of and healthier mental status, targeting individuals, groups and society. The program adopts R&D projects that center around the brain and neuroscience, from the molecular level to the population level (from mice to people), which integrate the humanities, for instance the arts and meditation, in order to conduct research and development that utilizes cutting-edge "comprehensive knowledge" related to the understanding of mental status and transitions. In addition, the program also includes R&D with the potential to significantly change the future structure of society, such as those related to data management systems and new forms of child-

rearing, education, and family systems, and consists of extremely challenging R&Ds that will span a wide range of areas from the molecular level to society.

The program portfolio consists of two types of R&D projects: "Core Research," which is pursued based on an overall scenario developed by backcasting from a vision of society in 2050, and "Feasibility Study," which boldly explore specific ideas, but for which it is difficult to depict an overall scenario at this stage. Each R&D project pursues its own R&D while also engaging in cooperation and collaboration with the other projects, aiming to achieve the program goal of realization of a mentally healthy and dynamic society.
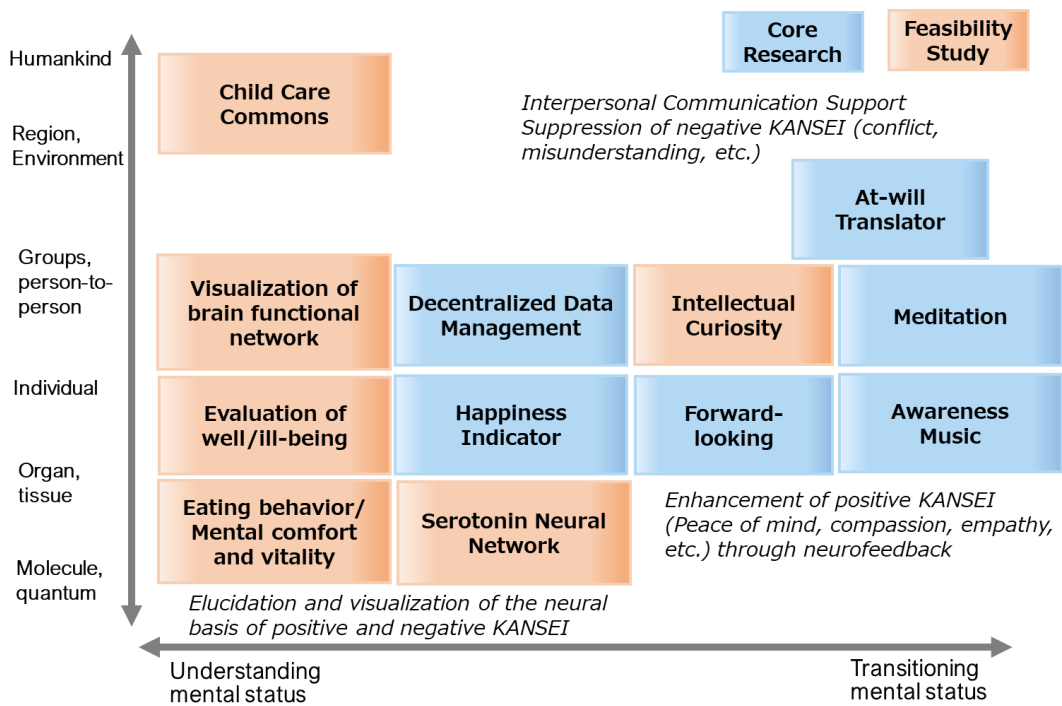

Fig. 1 Portfolio of this R&D program
※R&D project lead by Dr. Tomoda was closed on December 22.

（2）Current Initiatives

This R&D program consists of six Core Research projects and six Feasibility Studies which are conducting R&D while dividing roles as described on the previous page.

This MS Goal is pursuing R&Ds that will lead to happier mental status for individuals and groups through the development of "technologies for managing our own mental status" and "technologies that supports smooth

communication with others," but in order to achieve the goals for 2050, it is not enough for each PM-led project to proceed individually and deliver results. Addressing the ethical, legal, and social issues (ELSI) associated with new technologies related to mental status and the conditions for its use is essential. Therefore, we are attempting to maximize the results of the program as a whole by providing a forum for the PD, sub-PD, advisors, and PMs to come together to discuss and clarify the vision of society that the program aims for as a whole and problems in terms of ELSI, along with further deepening cooperation and collaboration among PMs. To backcast from our vision for society in 2050 and to be able to conduct small-scale proof of concept tests of the technology by 2030, we believe it is crucial to not only demonstrate the feasibility of the technology, but to also carefully examine social issues and ELSI as well as the potential for misuse of the technology and social conditions, and to build the foundations for social acceptance so that the new technology will be widely accepted in society.
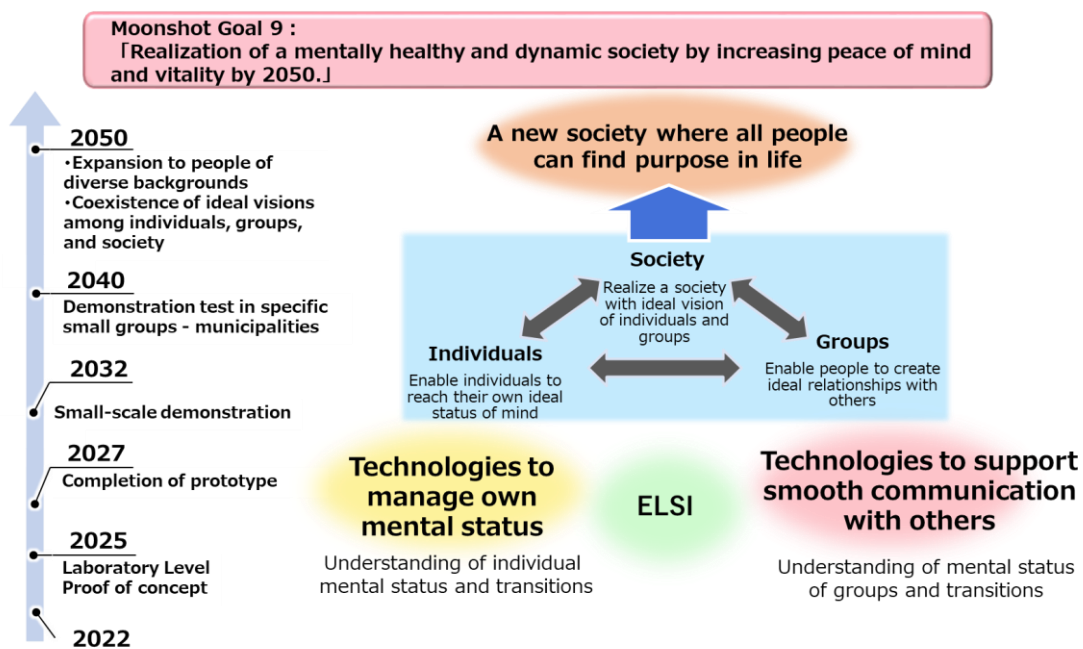

Fig. 2 Scenario for achieving goal

（3）Direction of research and development for realization of the Goals

In MS Goal 9, we aim to develop technologies to promote happiness along 2 axes: relieving negative emotional states and furthering positive emotional states. In doing so, we have actively pursued R&D related not only to adults

3

but also children. In response to the closure of the project "Breaking the intergenerational chain of child maltreatment through revolutionary diagnostics and positive intervention," for which Dr. Tomoda Akemi served as PM, this call is to solicit proposals for PMs to implement R&D programs related to "Aiming to relieve negative feelings and prevent related phenomena in children (e.g. depression, stress, anxiety, loneliness, abuse, suicide)."

Children have less social experiences than adults, which makes it harder for them to tolerate stress, and they are exposed to environments that can lead to negative emotional states more often than adults. In addition, it is believed to be much more difficult for children, who struggle to verbalize the situations they are in, to accurately recognize their own mental status than it is for adults. Furthermore, traumatic experiences in childhood may have long-term psychological effects after people reach adulthood. Therefore, we believe that R&D which aims to relieve negative feelings in children is a challenging area that can be developed in a mutually complementary manner with R&D projects that are already under way.

3．R&D themes and their requirements in the application
（1）R&D themes
　　Aiming to relieve negative feelings and prevent related phenomena in children (e.g. depression, stress, anxiety, loneliness, abuse, suicide)
　　※Applications exclusively related to medical treatment, such as R&D related to treatments for mental illness, will not be included in this MS Goal. Moreover, social applications for R&D projects that focus exclusively on animal models will not be considered; social applications must be based on research involving human subjects (children). As this is a short-term project that will run until March 2025, we expect applications to be for R&D which is focused primarily on proof of concept.

（2）R&D Type
　　Feasibility Study
　　　※This application does not call for Core Research

（3）Overall application policy
　　　When submitting the application for your R&D project, please clearly

indicate what kind of novel R&D challenge you will be undertaking and how much of a leap you expect to take compared to existing technologies and past research (or whether there is anything comparable), and set specific goals to be achieved by March 2025. Please explain the project objectives by stating the key components for achieving the MS Goal as well as the key challenges and bottlenecks to the overall objectives. Please include a description in the application form of how you yourself perceive the multidimensional structure of a "mental status" and which aspect you will approach from to broaden the scope of R&D. In addition, against the backdrop of actual society, in which individuals face problems including depression, stress, anxiety, loneliness, and suicide, and abuse, domestic violence, bullying, friction, conflict, and intolerance of diversity exist interpersonally and within groups, in relation to the goal of "Realization of a mentally healthy and dynamic society by increasing peace of mind and vitality," please clearly define "what kind of children will be saved and how children's lives will be changed by utilizing the research results of this R&D project," presented in terms of the specific image of society you aim to realize through your R&D project, and conceptualize scenarios. In addition, please describe how you would deal with aspects such as collaborating with diverse colleagues and interdisciplinary research, including any solutions or principles you might apply.

（4）Application Requirements
①R&D project

R&D related to "Aiming to relieve negative feelings and prevent related phenomena in children (e.g. depression, stress, anxiety, loneliness, abuse, suicide)" which carries out a feasibility study that tackles at least one of the following themes: (a) elucidating the mechanisms of mental status, (b) transitions of mental status, or (c) social applications (excluding, however, R&D that focuses solely on "(c) social applications").

During R&D period, verification and evaluation will be conducted as to whether the objectives set initially will be met, whether there is the possibility for research outcomes to be integrated as elements of core research, and whether the team is capable of addressing elements (a), (b) and (c).Regarding feasibility studies that can be developed or accelerated into core research, they could lead to R&D in 2025FY and f2026FY once they

have been designated for either integration into an existing core research R&D project or as new core research.

your project may be subject to substantial revisions during the elaboration carried out after adoption.

②The periods to implement R&D projects
  In principle, until FY2024 (March 2025).

③Monetary amount for R&D projects (Direct cost)
  The total amount should be between 30 and 50 million yen.
However, proposal for amounts significantly less than this are completely acceptable.

（5）R&D milestones
 MS Goal 9 places emphasis on linking the project to real-world environments through technological demonstrations. Therefore, in addition to the milestone that is set independently for each proposed R&D project, the following common milestone defined by MS Goal 9 must be achieved by the end of the fiscal year 2024.

●The ability to objectively grasp a part of one's own mental status, limited to a laboratory-level environment.
●Verification of elemental technologies that enable transitions between mental status, in the general direction desired by the individual.

*Within the limits of laboratory-level conditions and a laboratory environment, elemental technologies will be verified that increase peace of mind and vitality, such as technologies that allows people to objectively grasp some part of their own mental status, to transition between mental status in the general direction desired by the individual (positive, negative, etc.), and to communicate smoothly with others.

(Reference)
・Moonshot Goal 9 Website
  https://www.jst.go.jp/moonshot/program/goal9/index.html

・Moonshot Goal 9 Kickoff Symposium (September 12, 2022)
   https://www.jst.go.jp/moonshot/sympo/20220912/index.html

[Moonshot Goal 9] PD's Supplements

PD: Seiji Kumagai (Associate Professor, Kokoro Research Center, Kyoto University)

1. Policy for Selection and Proposal content.
 (1) Policy for Selection

　　Your approach can be deductive or inductive, objective or subjective, qualitative or quantitative– we are looking for brave proposals that aim to break new ground, integrating different research fields and elements. Please select and apply under one of the following two research categories:

　　i. Core research

　　Under *core research*, we are seeking applications for comprehensive R&D that builds on an overall scenario of the world of 2050 using backcasting. If you are selected in this research category, please propose a scenario with a specific vision of society under which a mentally healthy and dynamic society is realized by increasing peace of mind and vitality by 2050.

　　Please propose both "forecasting" thought, which predicts the future from the present society and technology, and "backcasting" thought, which works backwards, using society in 2050 as the starting point, and thinks about what we should do now. Please propose a scenario for 2050 and scenarios/R&D for the third year, fifth year, and tenth year after your adoption as a PM. The content of your proposed scenarios should contain the path to achieving the 2050 goal (the kind of society you envision). State the bottlenecks to be resolved from a diverse and comprehensive point of view. Make your proposed action pioneering and revolutionary, and consider ethical, legal and social issues (ELSI), and include your current analysis and evidence for how your scenario fits or adapts society.

　　ii. Feasibility studies

　　We are also seeking applications for feasibility studies that are highly original yet difficult to pursue as comprehensive core research R&D at this stage. Reasons might include that the feasibility of the proposed technology itself will only be able to be judged in the course of the R&D, that the scope

of R&D is to some extent refined, or that the team participating in the research is limited from the start of the project.

If you are applying under this category, please make an R&D proposal that sets clear objectives for three years only, based on the originality of the R&D and the extent of advances expected over existing or previous research (or is there nothing comparable?). Please explain the project objectives by stating the key components for achieving the Moonshot Goal as well as the key challenges and bottlenecks to the overall objectives.

(2) Proposal content
  i. Thinking about the targets

Two targets are set for this Goal (1. Understanding of individual mental status and transitions and 2. Support for mental status in terms of interpersonal and intergroup communication). Both are likely to require interdisciplinary R&D projects that include the three elements of (a) understanding mechanisms of the mind, (b) mental status transitions and (c) application in society.

Element (a) understanding mechanisms of the mind, applies to both "To know the mental status of your groups/society" and "To know your own mental status", while (b) mental status transitions applies to "To Know about mental status transitions and how to improve them". For (c) application in society, it is unlikely that researching (a) and (b) alone will link to a vision of society in 2050. As such, backcasting from that vision of society, it is assumed that demonstration projects in the community will be undertaken alongside research of (a) and (b) and outcomes.

Furthermore, the intention is to actively pursue the creation of "comprehensive knowledge" from interdisciplinary efforts between the social sciences and natural sciences in the form of new value-discovery perspectives and theories, including knowledge of the elements that influence the mind (tradition, culture, art, etc.) and their relationship to the mind ("To know what if deeply connected to the mental status"), which should be a strength for Japan.

Add to which - and this also relates to (c) application in society - relevance and interaction with society are particularly important to emerging science and technology. This means that ELSI, collaboration in

9

R&D not just with researchers but with stakeholders and RRI (Responsible Research and Innovation) are key elements to be included right from the conceptual stage of R&D projects.

As per the above, achieving the Goal and its targets will require a variety of R&D elements and related actions. Therefore we need collaboration between diverse personnel and research fields, exchange of personnel between projects and the positive engagement of external people and organizations.

ii. Proposal requirements

a. Common requirements of core research and feasibility studies

For your proposed R&D project, please state in the proposal how you view the mind as a multidimensional structure and are taking this into account, the elements you have chosen for your approach, and how you will expand your R&D area. Factors for consideration include depression, stress, anxiety, isolation or even suicide; violence, domestic violence and bullying; conflict, war and intolerance of diversity. Regarding the goal of *realizing a mentally healthy and dynamic society by increasing peace of mind and vitality*, please set the scene for your scenario by describing the specific kind of society (specifically what will change and how) that will be realized through your proposed R&D project.

In addition, please describe how you would deal with aspects such as collaborating with diverse colleagues and interdisciplinary research, including any solutions or principles you might apply.

Note that proposals for R&D related to treatment of mental illness or exclusively related to medicine are not the subject of this goal.

b. Core research

R&D projects toward this Goal are required to be core research with plans that include the elements of (a) understanding mechanisms of the mind, (b) mental status transitions and (c) application in society. Assuming a period of 5 years, there would be a R&D budget ceiling of around 700 million yen total in direct costs (approximately 300 million yen total for the first three years, then around 400 million yen in total for years four and five). However, it is not a problem if your proposal envisages a smaller spend. Note that

proposals for core research may also be selected as a feasibility study at the discretion of the PD.

 In terms of your team, in addition to the PM, tentatively propose staff for each implementation category for (a), (b), (c) and ELSI. Assume that the team member responsible for ELSI will not only have to consider challenges relating to ELSI on your R&D project but also participation in meetings to deliberate and discuss ELSI issues with other teams engaged in the Goal. However, this person does not need to be an expert in ethics, law or sociology. In addition, it is strongly recommended that you include in the team researchers from the social sciences or other disciplines outside of the natural sciences, in order to generate "comprehensive knowledge". As required, create a functional project structure by assigning sub-PM, group leader, etc.

   As stated in the R&D concept, no objective indicators exist specifically for peace of mind or vitality yet and there is no way of expressing these in quantitative terms. Therefore, under the overall Goal, we hope that an exploration of the qualitative values for peace of mind and vitality will allow the establishment of common quantitative indicators for their use across the entire project, which can then be reflected in the direction of R&D in future. Please offer your thoughts on this concept.

c. Feasibility studies

 R&D projects with potential to contribute to achieving the Goal are required to include one of the three elements of (a) understanding mechanisms of the mind, (b) mental status transitions and (c) application in society in their plans (although (c) cannot stand alone as the only element you include). Assuming a period of up to 3 years, there would be a ceiling of around 10-100 million yen total R&D spend in direct costs.

   During the 3-year period, verification and evaluation will be conducted as to whether the objectives set initially will be met, whether there is the possibility for research outcomes to be integrated as elements of core research, and whether the team is capable of addressing elements (a), (b) and (c). Regarding feasibility studies that can be developed or accelerated into core research, they could lead to R&D in their fourth and fifth year once they have been designated for either integration into an existing core research R&D project or as new core research.

2. Policy for promoting R&D
  (1) Review of the structure of the project for the overall Goal at the end of
the third year
    Even in the case of 5-year core research, please bear in mind that after
  year 3, the structure of the R&D projects may be overhauled dramatically in
  view of the optimal team for the overall Goal. Should your proposal be
  adopted, please understand that year 4 and 5 implementation plans may not
  necessarily reflect the content of your proposal. Note that the plan you
  submit in your application does not need to consider the possibility of future
  review.
   Regarding this review of the structure, it is envisaged that it will reflect the
  progress on achieving the objectives set by each R&D project, the state of
  progress with mutual collaboration among projects (including feasibility
  studies) and the state of the external environment among other factors
  toward optimizing the outcomes of the overall Goal. We expect that the PD
  will do this by assessing and conferring on these for each individual R&D
  project.
    We are aware that securing the people to make breakthroughs is a key
  challenge, so when it comes to compensation of researchers employed on
  the project, our intention is to make provision for salaries in core research to
  the maximum extent possible, even in the event of project restructuring.

  (2) Portfolio building
    Building the portfolio for the overall Goal will require cooperation and
  competition among PMs, with consideration given to the relationships
  among multiple R&D projects. In order to achieve this, during the period of
  elaboration after the recruitment of PMs, consultations will be held with the
  PD based on the scenarios proposed for each project to clarify milestones
  toward objectives and make logical revisions to programs and budget plans,
  for example. Furthermore, in consultation with the PD, it will be possible to
  adopt separate research approaches depending on the progress of research.
  A bold revision of this portfolio is scheduled for the third year, as noted
  above.

  (3) Links with other Moonshot Goals, external projects and organizations

Depending on the technology you are researching and developing, you may be required to cooperate and link with projects under other Moonshot Goals or other R&D projects. It is hoped that by engaging with others not just on R&D but on effective communications or with performers around Japan and worldwide, for example, unprecedented synergies might be found. It is envisaged that the overall Goal and the individual projects will require active pursuit of exchange with external people and groups and open-platform initiatives for a flow of personnel and ideas.

 (4) Industry-academia-government collaboration and application in society
In the R&D process, it is hoped that research outcomes will be generated that can create spinoffs for various industries. For this to happen, outreach activities to gain the endorsement of private companies and local government agencies will be needed. However, application in society under this Goal is not limited to industrial applications: it is also envisaged that there may well need to be tie-ups with NPOs and local governments too, for example.