Application Guidelines: Attachment

Chapter6 Areas and Grand Challenges Targeted for Application

This chapter describes the philosophy of Program Officers (PO) for each area and the details of the Grand Challenges (GC).

The Grand Challenges are the basis for focused and collaborative efforts toward addressing important matters that benefit society. In considering the Grand Challenges direction, it is important to understand and mutually recognize significant research and development (R&D) trends and social issues perceived by the research community. Based on this idea, for the 2025 call for proposals, we conducted a questionnaire-based call for information from researchers, an online interactive session to introduce and discuss global technology trends, and an expert workshop to deepen the discussion on the Grand Challenges direction. We set the Grand Challenges based on the information obtained from these sessions.

In the 2025 call for proposals, Grand Challenges have been set for each Area. Please select the Grand Challenge of interest based on the policy of each PO and submit your R&D proposal.

Grand Challenges are set to invite and promote challenging R&D that is not bound by conventional wisdom. The technology and application examples described in this document are hypothetical, and the R&D proposals we seek are not limited to these examples. Therefore, when applying, please consider the relationship between the R&D issue you would like to challenge and the Grand Challenge widely.

Furthermore, following the FY2024 call for proposals, proposers can set their own GC00 other than the Grand Challenges (GC01 to GC06) presented above and submit their R&D proposals.

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6.1 Implementation of the program

Program Director
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Advances in information and communication technology (ICT) have not only brought convenience and efficiency to social life and economic activities; it is undeniable that they have also created new value and business in various fields as an essential infrastructure in society. The continuous development of ICT is a crucial factor in Japan's sustainable growth. Nevertheless, the rapid development of ICT has raised concerns concerning the increase in the proportion of recent research and development on ICT in terms of specific themes or themes on technological development as an extension of conventional research.

In this program, we aim to set challenging goals that will have a significant impact on society and create innovative technologies. To pave the way for a new era, we are eagerly awaiting challenges that break the conventional wisdom and push the boundaries of technology.

6.2 AREA 1（PO: NAKAO）: Mainly in the area of information and communication

Program Officer

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Ⅰ. Scope of the area

Information and communication technology is a core element that supports the foundations of all social and economic activities. In this area, we aim to realize a “next-generation cyberinfrastructure” to support the future society by fusing information and communication technology with information science. To achieve this goal, we will set and tackle “Grand Challenges,” which are technical and social issues, to promote innovative R&D that contributes to the sustainable development of social infrastructure, not merely academic evolution, and nurture human resources who will conduct it.

“Cyberinfrastructure” refers to the fundamental technologies and systems that support the generation, transmission, storage, processing, and utilization of information in modern society. This includes communication networks (wired and wireless), computational infrastructure (cloud, edge, and data center), artificial intelligence (AI), architecture that enables them to function in an integrated manner, and application services that utilize them.

The term cyberinfrastructure indicates that information and communication and computational technology are important infrastructures that support the foundations of human socio-economic activities, going beyond merely being a means of communication between humans. In other words, cyberinfrastructure serves as a social infrastructure that supports economic activities, social systems, the development of science and technology, and people’s daily lives.

In modern society, cyberinfrastructure technology supports cyber-physical systems（CPS）, which incorporate information from all objects in the physical world into the cyber world in real time and enable future predictions and decision-making through computational processing. It also promotes efficient economic and social activities using generative AI, providing an environment in which people can enjoy advanced services wherever they are

through AI. Furthermore, by interconnecting multiple AIs and working in cooperation, more advanced and comprehensive services can be realized.

This area is directed toward realizing research concepts that overturn conventional technological wisdom and lead to future social change. We aim to promote efforts to advance cyberinfrastructure technology, the foundation that supports the society of the future, in collaboration with researchers.

Ⅱ. PO policy for proposal selection and R&D management

1. Policy for proposal selection

In this area, we aim to pursue technological excellence, solve difficult problems, drive the evolution of information and communication technology, and provide value to future society. It is particularly important to be aware of contributing to the evolution of the entire information and communication system. For example, when proposing an application, in addition to its usefulness to society, considering how it will drive the evolution of information and communication is necessary. Moreover, when proposing components, clarifying how they will be used in the entire information and communication system and their connection to technological evolution is important.

In modern society, technology that pursues globally shared values is attracting attention. Future R&D proposals require a sharp perspective that looks ahead to global technology trends, contributes to the evolution of cyberinfrastructure technology centered on information and communications, and adds value to future society.

Furthermore, we must be aware that human resources in the information and communications field support the development of society and industry. These human resources are required to maintain a certain scale and quality. However, if the supply is insufficient, the pool of human resources will eventually dry up, and the foundation necessary for the development of industry and society may be damaged. To overcome this crisis, building a sustainable human resource development and supply system is crucial.

Given this context, CRONOS is a new competitive research grant established by the Ministry of Education, Culture, Sports, Science and Technology in FY2024. It is a significant turning point toward strengthening investment in human resource development in the information and communications field. The academic community must utilize this opportunity, encourage researchers to apply actively for competitive grants, and work

earnestly toward building a “cyber lifeline” that will support our future society.

2． Policy for R&D management

In promoting R&D, we will achieve progress in the R&D of outstanding technologies to realize the “next-generation cyberinfrastructure.” However, we position the following three pillars and confirm these perspectives through area conferences: (1) contributing to the evolution of information and communications, (2) aiming to provide value to future society, and (3) contributing to the development of human resources who will lead academic and industrial development in the information and communications field.

At the area conferences, researchers and Program Officers/Area Advisors will gather to form a community and achieve the three goals mentioned above over the long term while aiming for interdisciplinary synergy across fields.

Ⅲ. Grand Challenges in the 2025 application

Cyberinfrastructure plays a central role in supporting economic activity, social systems, the development of science and technology, and people’s daily lives. The Grand Challenges set to achieve this are focused on pursuing technological excellence, solving difficult problems, driving the evolution of information and communications technology, and providing value to future society.

In particular, when setting the Grand Challenges for FY2025, we sought the opinions of researchers. Subsequently, we examined them to ensure that important technologies for researchers are not excluded from the scope of the competitive research grants while maximizing opportunities for researchers through deeper mutual understanding between proposers and competitive research grant providers. Through this process, we established three pillars for the Grand Challenges.

In addition to the content of the Grand Challenges, as mentioned above, in this area, we have a major vision of “providing value to future society,” “contributing to the evolution of academic research in the information and communications field,” and “nurturing and supplying human resources in the information and communications field.” Therefore, for the Grand Challenges described below, **clarifying efforts to (1) contribute to future society, (2) drive the evolution of information and communications technology, and (3) develop and supply human resources is necessary. Proposals must clearly state**

the value that will be brought to society as a whole rather than merely focusing on technology development.

GC01 : Innovation in cyberinfrastructure architecture

[Grand Challenge Overview]

Cyberinfrastructure is the core foundation supporting economic activity, social systems, the development of science and technology, and daily life. Its configuration and design are crucial for the stability and evolution of modern society. **We must aim not merely to solve technical issues but to lead the evolution of information and communication technologies and to provide innovative value to future society. The next generation of cyberinfrastructure must be designed with a vision that creates new value for society rather than merely improving the architecture.**

A new information and communication architecture is necessary to meet the diverse and complex requirements of modern applications and services. For example, in cloud networks, which require low latency and extremely reduced overhead, non-traditional protocols and architectures have been proposed and put into practical use. In network architectures that require flexibility, efficiency, and continuous evolution, **new design concepts are essential to promote the evolution of the entire information and communication system** due to the integration of AI through software, the evolution of edge computing that realizes low-latency feedback, and the rise of non-terrestrial communications (satellites, HAPS, etc.) that expand coverage.

The role of the next generation of cyberinfrastructure goes beyond merely advancing technology. **It is expected to accelerate the evolution of information and communication technology and function as a "cyber lifeline" that supports the development of the economy and society.** In the current architecture, communication overhead increases, making the optimization of centralized and distributed control difficult. Furthermore, in fields that require large-scale computation and real-time performance, communication bandwidth and energy consumption are limited. Additionally, improving connectivity between terrestrial and non-terrestrial, wired and wireless, and optical and electrical systems and supporting communication in special environments such as underwater, underground, and inside the human body are unresolved. To overcome these

challenges, **it is essential to move away from conventional design concepts and instead come up with new architectural ideas that integrate a variety of advanced communication technologies, including computing and sensing.**

Notably, establishing a sustainable human resource development and supply system is essential to drive the evolution of information and communications technology. Securing the human resources to support the cyber society of the future is an issue as significant as technological innovation and a challenge that industry and academia should tackle together. Therefore, **to build a cyber lifeline that will support future society, we are calling for challenging research proposals incorporating the perspective of developing human resources to drive the creation of advanced technologies.**

In this Grand Challenge, we expect proposers to go beyond the framework of existing technology and design, have a vision for evolving and accelerating information and communications technology, and build the architecture for next-generation cyberinfrastructure. Thus, we aim to maximize the potential of cyberinfrastructure and make it a core foundation that supports the evolution of the economy, society, and technology.

[Examples of included approaches and technologies]

The following are examples intended to stimulate ideas for proposals, but the list is not exhaustive:

- AI and information and communications convergence network architecture (AI for Network, Network for AI)
- High speed and efficiency through new protocol configuration (breaking down OSI five-layer model and cross-layer optimization)
- Coexistence, cooperation, and harmony between autonomous distributed control and centralized control
- Architecture that can balance sustainability and high performance
- Information and communications infrastructure combining programmability with high and real-time performance
- Protocol design based on the minimum necessary functions, which can evolve flexibly
- Architecture based on KPIs that can minimize resource consumption and environmental load reduction

- Next-generation IoT architecture that can extend cloud-native technology to the device edge
- Integrated architecture for non-terrestrial and terrestrial networks
- Expanded coverage through low-orbit mega-constellations that can be achieved at dramatically lower costs
- Active and adaptive architecture to counter the threat of increasingly complex cyber-attacks, including sophisticated, commercial, and international attacks
- Cyber–physical system architecture with active cyber defense
- Architecture to defend against the spread of disinformation due to the diversification of social networks and information distribution
- Architecture that can proactively mitigate cyber-attacks, information theft, copyright infringement, and the spread of false information

[Points to consider when preparing a proposal]

Please describe how your proposal will lead to the evolution of information and communications technology and provide value to future society rather than merely pursuing technological excellence or solving difficult problems.

GC02 : Innovation in elemental technologies supporting cyberinfrastructure

[Grand Challenge Overview]

Modern information and communications infrastructure **requires the evolution of elemental communications technologies that support the overall architecture of information and communications systems** defined in GC01. To realize the next generation of cyberinfrastructure, **diverse elemental technologies, such as communications, computing, AI, sensing, and devices, must complement each other and function in an integrated manner.** Innovation in these elemental technologies is a technological evolution and a driving force that draws out the capabilities of the entire cyberinfrastructure and increases social value. To achieve this, dealing with the ever-increasing amount of data and increasingly complex systems is necessary, and technological breakthroughs are required **to overcome challenges such as those related to improving the efficiency of communication bandwidth, reducing energy consumption, and**

improving real-time performance.

For example, there is an increasing demand for elemental technologies for communication and sensing in special environments such as underwater, underground, and inside the human body; these technologies are expected to be significant in future society. Moreover, new elemental technologies, such as integrated communication, sensing, and energy transmission technologies that utilize wireless communication characteristics, as well as encoding technologies that use AI, are attracting attention. Technologies that efficiently utilize communication bandwidth are key to dealing with the increasing amount of data and improving the energy efficiency of the entire information and communication infrastructure. Furthermore, in fields such as industrial IoT, autonomous driving, and remote medical care, which require real-time performance, elemental technologies for low-latency and highly reliable communication are essential. Similarly, technologies that efficiently extract and process necessary information from excessive sensor data are directly linked to increased efficiency in industry and the creation of new value. Additionally, the evolution of communication technologies in special environments can contribute to scientific discoveries in unknown areas and the construction of sustainable social infrastructure.

Further, to support the next generation of cyberinfrastructure, stimulating technological innovation and developing highly skilled human resources who can drive such innovations are essential. **As society becomes increasingly digital, experts in the information and communications field are required to develop technology and understand how to convert it into social value.** However, the current human resources supply system is not sufficiently developing human resources to keep up with the rapid evolution of information and communications technology. While some people excel at developing elemental technologies, the number of people who can integrate these technologies and utilize them in the overall cyberinfrastructure is overwhelmingly scarce. **An urgent need exists to develop human resources who can bridge the gap between elemental technologies and communication systems and organically link the two.**

In this Grand Challenge, we seek to form research teams that will innovate a single technology and integrate it into the entire cyberinfrastructure, promoting the evolution of the whole and fostering talents who can bridge the gap between elemental technologies and communication systems. We expect applicants not to

view component technologies as separate, individual technologies but to be fully aware of the need to utilize them in an integrated manner to contribute to the development of future society.

[Examples of approaches and technologies included]

The following are examples intended to stimulate ideas for proposals, but the list is not exhaustive:

- Biometric data communication and internal/external communication infrastructure for medical and healthcare
- New communication protocols and interfaces that can meet the communication demands of excessive brain information and sensory data
- Highly reliable wireless systems with advanced integration of resource allocation, beamforming, and route optimization
- New communication infrastructure with autonomous control of UAV networks
- New underwater/underground IoT communication technology using composite technologies such as light, acoustics, and magnetic induction
- Integration of environmental sensing and information transmission using wireless communication with the same frequency band and waveform
- Virtualization technology for radio wave resources and communication hardware

[Points to note when preparing a proposal]

Please describe how your proposal will lead to the evolution of information and communications technology and provide value to future society rather than merely pursuing technological excellence or solving difficult problems. In particular, please think about your contribution to the evolution of information and communications systems, not merely the evolution of elemental technologies.

GC03 : Innovation in service and security that propels cyberinfrastructure

[Grand Challenge Overview]

The evolution of next-generation cyberinfrastructure will maximize its value only through innovation in services and security that utilize it. This Grand Challenge aims to **develop innovative services and security that will contribute to solving social issues and**

creating a future society based on cyberinfrastructure.

Current information and communication systems, as well as communication devices, are often managed in a closed manner within individual domains, making it difficult for multiple applications and systems to work together to achieve optimal processing and security. Furthermore, **to meet the needs of modern society, such as real-time performance, flexibility, diversity, robustness, and high reliability, a new approach that goes beyond conventional frameworks is necessary.** Addressing these issues is crucial for **creating new value that adapts to future society** using cyberinfrastructure.

For example, by constructing a mechanism for optimizing infrastructure across multiple communication domains, it will be possible to share resources, operate flexibly, and ensure enhanced security. Further, having technology that can rapidly provide an optimal communication environment according to the purpose and situation by dynamically constructing wireless areas using drones and mobile objects is necessary. Such dynamic technology will also contribute to solving social issues, such as disaster response and emergency communications. Moreover, human-augmented technology allows for sensory sharing and exercise support through wearable sensors, and real-time information processing is expected to have groundbreaking applications in health management and rehabilitation.

Developing applications that can efficiently extract necessary information from excessive sensor data and process it with low latency and low power consumption will contribute significantly to the efficiency and reliability of industry and infrastructure operations. Furthermore, integrated multimodal information processing using generative AI will be a driving force for creating new services with high social value. The evolution of such applications and services goes beyond mere convenience and serves to revitalize the entire cyber infrastructure and return its value to society.

Additionally, to utilize the next-generation cyberinfrastructure, developing highly skilled human resources to support it is essential. In particular, **to develop new services and security technologies, it is urgent to develop human resources who not only utilize information and communication technology as a black box, but identify the limitations of current information and communication technologies, understand that use cases and security requirements will drive the evolution of these technologies,**

and possess the ability to optimize the entire infrastructure.

In this Grand Challenge, applicants are expected to develop innovative services and security technologies and demonstrate how their proposed technologies will contribute to the evolution of cyberinfrastructure and provide new value to future society. We aim to form research teams that will develop interdisciplinary human resources familiar with services and security as well as information and communications systems. These teams will accelerate the evolution of services and security technologies based on next-generation cyberinfrastructure while remaining constantly aware that the requirements for enhancing these technologies will drive the overall evolution of information and communications systems.

[Examples of included approaches and technologies]

The following are examples intended to stimulate ideas for proposals, but the list is not exhaustive:

- Wide-area monitoring through the collaboration of satellite mobile direct communication and IoT sensors
- Anomaly detection technology that can utilize theory and data analysis to detect dynamic changes in social networks, enabling prevention and strategic response
- Realization of precision agriculture integrating agricultural digital twins and autonomous robots using innovative wireless technology
- A service model that can support network operations in disaster response and extreme environments
- Realization of sustainable social services through AI-driven dynamic network management
- Collective communication control technology for autonomous mobile bodies (microdrones and microbots)
- A new service model for logistics, disaster response, and environmental monitoring using autonomous mobile communication
- Healthcare through the communication and measurement of various biometric signals that can be integrated into daily life and worn at all times
- Advanced medical care made possible by high-precision environmental, biometric signals, and sensitivity sensing through the fusion of communication and

measurement technologies

- Improved sensing accuracy through the fusion of radio engineering and information communication technologies
- A human augmentation communication platform through sensory sharing
- Provision of new social infrastructure services based on sensory sharing, such as remote medical care, tourism, and agriculture
- An interverse platform beyond the metaverse

[Points to note when preparing a proposal]

Please describe how your proposal will lead to the evolution of information and communications technology and provide value to future society rather than merely pursuing technological excellence or solving difficult problems. In particular, when proposing an application, please be aware of its usefulness to society and how it will drive and contribute to the evolution of information and communications systems.

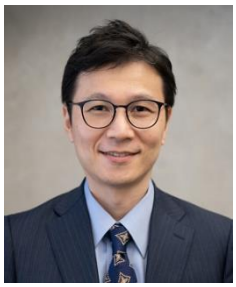
GC00 : Grand Challenge designed by applicants

“Grand Challenges set by the applicant” is a framework for researchers to utilize their expertise and perspectives to propose research themes that contribute to the development of the academic field of information and communications and the creation of value for future society through free thinking. We expect applicants to think outside the box and develop research concepts that look to the future with original and challenging perspectives.

[Points to note when preparing a proposal]

Please describe how your proposal will lead to the evolution of information and communications technology and provide value to future society rather than merely pursuing technological excellence or solving difficult problems.

6.3 AREA 2（PO: KAWAHARA）: Mainly in the area of information processing



Program Officer

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Ⅰ. Scope of the area

Information and communication technology forms the essential foundation of modern society and daily life, and many innovative ideas, such as TCP/IP, Wi-Fi, cloud computing, blockchain, and deep learning, have been implemented as solutions to the grand challenges of each era. However, with the recent emergence of 5G networks, edge computing, AI accelerators, and even Large Language Models, there is an increasing need for cross-layer design that would enable communication networks, OSs, terminals, services, and applications, which have traditionally tended to be optimized independently, to work more closely together.

For example, to achieve low-cost and high-speed AI learning and inference, it is necessary to optimize algorithms and have a cross-layer design that integrates the infrastructure architecture with services and applications. More specifically, by optimizing models trained using large-scale data in the cloud for edge devices through compression, quantization, and knowledge distillation, each layer can work together to build an efficient inference environment. Moreover, mechanisms that provide reliability and evidence for AI predictions, along with the development of domain-specific benchmarks, will help reduce uncertainty and hallucinations in decision-making, contributing to the establishment of an open research infrastructure.

These new challenges are difficult to realize technologically and are considered “mountains worth climbing”—goals that various stakeholders can empathize with and strive to achieve collaboratively. Looking back at history, although many innovative technologies initially had noticeable drawbacks, they ultimately became widely accepted through long-term perspectives and extensive improvement efforts. Rather than circumscribing ideas, hardware and software should be made public, shared, and utilized by the academic

community and developers as research platforms. We believe that bold predictions based on the knowledge, experience, and intuition of leading researchers, along with close collaboration between fundamental technologies and applications, are key to creating the next generation of information and communications infrastructure.

Ⅱ. PO policy for proposal selection and R&D management

1. Policy for proposal selection

This area focuses on information services, information processing infrastructure, information security, devices, computing methods, etc.

We expect proposals that clearly indicate specific applications and desired breakthroughs, maximizing the strengths of the proposing researchers. In other words, we welcome challenges that are based on new technologies, new theories, new discoveries, and are also of interest to the academic community. Please explain in an easy-to-understand manner why working on the selected challenge is important not only for the applicant personally but also for surrounding researchers and future society. Furthermore, after the research period ends, we welcome proposals that are expected to lead to smooth development that will lead to the creation of new businesses and the practical application of new technologies.

2. Policy for R&D management

In addition to Fundamental Research, you may receive additional funding to undertake Applied Research. Examples of Applied Research include proof of concept (POC), open sourcing, production, and distribution of software infrastructure and hardware, holding workshops, social implementation, sharing datasets, and establishing benchmarks. Please use this as an opportunity to go back and forth between research and social implementation, such as involving society to highlighting new issues, and reviewing Fundamental Research. We hope that Applied Research will be used effectively to standardize, build business models, involve and collaborate with a wide range of stakeholders, and evaluate impact.

Ⅲ. Grand Challenges in the 2025 application

GC04 : Creating new value by closely aligning infrastructure architecture with services and applications

[Grand Challenge Overview]

Infrastructure architectures such as communication networks, operating systems, and terminals have evolved in a mutually interrelated manner with services, edge devices, and applications. Traditionally, these layers were optimized independently, but efforts have also been made to design and operate them in a cross-layer fashion to bring out the best in each other's performance. In recent years, the emergence of deep learning and LLM has enabled advanced recognition and inference. However, this has not led to a trend of leveraging the evolution and performance improvements in infrastructure technologies, such as improved 5G networks, terminal advancements, and the emergence of AI accelerators. New applications are expected to emerge and fully utilize rich sensor information from the environment, leverage high-performance computing resources and storage on edge devices and in the cloud, and account for collaboration with large-scale AI models.

To resolve these issues, physical devices, communications, control, applications, and social issues must be designed and operated in an integrated, cross-layer manner. Nevertheless, the R&D communities remain divided, and full implementation cannot be claimed at present. Therefore, the key to creating the next stage of innovation lies in actively promoting such cross-layer collaboration to maximize synergy. Ultimately, this is expected to advance the efficiency and sophistication of industrial sites and social infrastructure, bringing significant benefits to various situations requiring immediate responses and advanced decision-making.

[Examples of included approaches and technologies]

The following are examples intended to stimulate ideas for proposals, but the list is not exhaustive:

- Integrated design of network x OS x edge devices x applications (and control, learning, and inference)
- Integration of sensing x communication x AI, which would allow body-worn and environmental sensors to be directly fed into LLMs and AI systems for real-time inference and decision-making
- New information architecture that can access and organize the extensive information recorded globally, efficiently extracting the information needed
- Software technology maximizing the hardware performance of advanced devices (optical communication, high-frequency wireless, etc.)

GC05 : Data-driven decision support systems and overcoming forecast uncertainty

[Grand Challenge Overview]

In recent years, AI predictions have directly influenced social activities in areas such as weather forecasting, traffic management, disaster response, and medical care. However, even with the construction of highly accurate models, uncertainty, hallucination, and bias cannot be eliminated. Identifying these risks is difficult if decision-making is largely left to the system. Therefore, the safe and reliable introduction of AI remains a major challenge for the information and communications technology field.

To address these issues, many studies focus on mechanisms that provide “reliability” and “evidence” for AI prediction models and present them in a form easily interpretable by humans and other systems. In addition to reducing misjudgments, data-driven decision support systems must quickly take measures and verify predictions when they are incorrect.

Furthermore, for the safe implementation of real-time predictions in society using large-scale open and distributed data, innovations in communication and learning/inference models are necessary. Here, rather than having humans input data into AI tools, AI agents could enter the data and actively make judgments. If an architecture could properly link high-speed processing on edge devices with large-scale AI models in the cloud and dynamically exchange data as needed, it would be possible to increase immediacy and flexibility in various fields, such as transportation, infrastructure management, and disaster response. The need of the hour is a way to make more accurate and faster decisions and improve the safety and productivity of society while accounting for the uncertainties of AI.

[Examples of included approaches and technologies]

The following are examples intended to stimulate ideas for proposals, but the list is not exhaustive:

- Explainable AI that considers Bayesian inference, probabilistic programming, risk analysis, etc.
- A platform that utilizes mathematics and AI to promote consensus-building among multiple stakeholders (local governments, companies, citizens, etc.), along with UI/UX for large-scale data integration, prediction, and decision-making
- New models for sharing responsibility in decision-making based on uncertain

prediction results, auditing AI operation logs, and tracking model modifications

- Methods to help individuals recognize and overcome biases in decision-making, such as filter bubbles, and mechanisms for verifying that data and algorithms do not disadvantage certain groups
- AI systems that realize a sustainable society by addressing the shortage of engineers, passing on skills, and managing aging infrastructure, etc.

GC06: Development of new fields in information and communications driven by benchmarks and datasets

[Grand Challenge Overview]

Benchmarks and large-scale datasets have accelerated research in fields such as image recognition and natural language processing, yielding significant results. However, in real-world issues such as weather forecasting, disaster management, manufacturing, and the content industry, organizing diverse and vast datasets to align with research objectives and creating an environment in which new methods can be compared fairly remain a challenge. Japan's manufacturing and content industry is highly regarded, but much of the data and processes are kept within individual companies, and the research infrastructure is not sufficiently open. To support innovation in these industries, there is an urgent need for a system that is easy for researchers to use, facilitates data and process sharing, and establishes benchmarks to make them de facto in the future.

Moreover, there are no established standards for cross-sectional comparisons of methods for new devices, unestablished architectures, and real-world tasks such as robots. To solve these issues, it is necessary to first model the specific issues within each industry or field and create "domain-specific benchmarks" prepared as standard tasks and evaluation indicators. For example, by identifying specific and practical challenges, such as a creativity support benchmark that extracts a part of content production or an automatic optimization task using operation data from a factory line, it would be possible to encourage broader participation from diverse researchers.

Furthermore, for stakeholders, such as companies, governments, and creators, to share data and processes voluntarily, clear incentives must be designed, such as the allocation of benefits and results. By developing an ecosystem that brings together industry, academia,

and government and invigorating the research community by holding ongoing evaluation meetings and contests, we can foster an environment in which difficult problems can be addressed, expanding the possibilities for new trends and groundbreaking technological innovations. These efforts will strongly support advanced innovation and the creation of new value originating in Japan. Thus, this Grand Challenge calls for proposals to establish benchmarks and datasets and foster communities based on technological advancements that contribute to the evolution of information and communications technology with academic novelty.

[Examples of included approaches and technologies]

The following are examples intended to stimulate ideas for proposals, but the list is not exhaustive:

- Benchmarks for industries such as manufacturing (factory line automation and quality control), agriculture (smart agriculture), the content industry (anime production process), disaster prevention (disaster area simulation), etc.
- Mechanisms for data collection, organization, and publication that make it easier for companies, governments, and creators to provide data (incentives, licensing, and intellectual property rights management)
- Community management strategies that raise the level of the entire industry by promoting open know-how while fostering performance competition in a competitive format
- New metrics that lead to improvements in composite indicators, focusing on accuracy, creativity, efficiency, cost, and user satisfaction
- New cross-field innovations, such as HCI research using anime, manga, and art data, as well as creativity support tools

[Points to note when preparing a proposal]

Proposals for this Grand Challenge are also expected to contribute to the creation of innovative information and communication technologies, which is this program's purpose. Specifically, proposals must include challenging R&D elements as part of Fundamental Research. We seek proposals that focus on benchmarking and community formation initiatives, which are essential to promoting these efforts. For Applied Research, we expect

ideas that will further develop the initiatives in Fundamental Research.

GC00 : Grand Challenge designed by applicants

"Grand Challenges set by the applicant" is a framework for researchers to utilize their expertise and perspectives to propose research themes that contribute to the development of the academic field of information and communications and the creation of value for future society through free thinking. We expect applicants to think outside the box and develop research concepts that look to the future with original and challenging perspectives.

[Points to note when preparing a proposal]

Please describe how your proposal will lead to the evolution of information and communications technology and provide value to future society rather than merely pursuing technological excellence or solving difficult problems.