AIST REPORT 2022

Create the Future,
Collaborate Together

Sustainability Report

AIST

AIST VISION

Create the Future, Collaborate Together

Designing and co-creating the future with society.

Encouraging mutual respect and endeavors.

Charter of Environment and Safety

1. We strive to promote research activities that contribute to the global environmental protection and the security of mankind and pursue our work to realize a safe and reliable society of high quality of life harmonious with the environment.
2. In compliance with the applicable laws and regulations related to environmental protection, we establish the autonomous standards of the institute such as Safety Guidelines, etc. and with this in mind, we shall endeavor to conserve environment and promote health and safety at all times.
3. We promote the dissemination of information related to the environmental protection and make every effort to be in harmony with and coexist with the local community. Naturally, in case of disasters or emergencies, we take prompt and proper measures to deal with the situation. Furthermore, in conformity with the ‘principles of disclosure,’ we shall endeavor to return the knowledge acquired and accumulated to society.

Editorial Policy

The National Institute of Advanced Industrial Science and Technology (AIST) first published an environmental report in fiscal year (FY) 2004. Since FY 2010, AIST has published the AIST Report, which is an environmental report combined with a report on its activities on corporate social responsibility (CSR).

AIST Report 2022 Social and Environmental Report presents as an opening article the overall picture of integrated fields projects that aim at spearheading solutions to social problems, and the projects that have started to show results in an easy-to-understand manner. Additionally, the Report presents AIST's activities that cover a wide range categorized into contents for stakeholders such as those related to industry–academia–government collaborations, workers, and those of regional society. Through these contents, AIST aims for its activities to be understood by various stakeholders, and for building a deeper relationship of trust with society.

AIST's official website: www.aist.go.jp/

●Activities covered by the report
Research activities at all AIST research bases

●Period covered by the report
April 2021 to March 2022

●Areas covered by the report
Key areas covered include organizational governance, human rights, labor practice, fair operating practice, community involvement, environmental report, occupational health and safety and open innovation activities.

●Rounding of numbers
Numbers are rounded off to the specified whole number.

●Referenced guidelines and other sources
- 2018 Environmental Report Guidelines, Ministry of the Environment
- Law Concerning the Promotion of Business Activities with Environmental Consideration by Specified Corporations, etc., by Facilitating Access to Environmental Information, and Other Measures
- Guidance on Information to be Provided in the Environmental Report (3rd Edition), Ministry of the Environment
- ISO 26000: 2010 Guidance on Social Responsibility, Japanese Version, Japanese Standards Association
- Global Reporting Initiative

●Scheduled date of the next edition
September 2023 (Japanese edition)

CONTENTS

Top Message 02

Opening Article Spearheading Solutions to Social Problems 04
—Integrated Fields Projects—
- Responses to energy and environmental constraints
- Measures for the declining birthrate and aging population
- Contributing to a resilient country and disaster prevention
- Measures for epidemic control and infectious diseases

AIST and Environmental Problems 14

Industry–Academia–Government Collaboration 20

AIST and Its Staff 32

Community Involvement 38

Basic Information 40

Reference Data 48

Third Party Opinion 58

Research Bases 59

Becoming the Core Participant of a National Innovation Ecosystem

～Pursuing diversity and launching the Marketing and Business Development Headquarters～

TOP MESSAGE

The National Institute of Advanced Industrial Science and Technology (AIST) originated as the Geological Survey of Japan, established in 1882 by the Ministry of Agriculture and Commerce. Following a number of reorganizations, AIST was established as an independent administrative agency in 2001. Over 140 years now, we have continued research activities contributing to the development of Japan's economy and society.

In the Meiji Era, when “the industrial policy of Japan” was set forth, and in the high economic growth period post World War II, Japan’s industries strove to speedily catch up with the advanced industries of Europe and the US, upon which they modeled themselves, by leveraging the homogeneity of the Japanese populace. As a result, Japan's industries achieved exponential growth. In the last 30 years, however, we have lost ground in international competitiveness and the image of Japan as a great technological power has receded into the past. The cause of that decline, it seems to me, is that we did not nurture an ecosystem that autonomously produces innovations inside Japan.

In 2021, AIST instituted a new management policy based on a desired future vision of its being “the core participant of a national innovation ecosystem.” The innovation ecosystem is a mechanism that continuously creates innovations through collaborations among diverse organizations of Industry-Academia-Government. Even without casting our eye over the 17 Sustainable Development Goals (SDGs), we are already confronted by a number of challenges, i.e., resource and energy limitations, climate change and infectious diseases, that require immediate solutions. We do not have the time to wait for rare sparks of genius. Rather, we must act to bring the intelligence of Industry-Academia-Government together through open innovations and find solutions as soon as possible. To that end, we must take the initiative to establish an innovation ecosystem by collaborating with industry and academia, with AIST at its core.

The key to this ecosystem is seamlessly and rapidly advancing technology development and bringing the results to social implementation. In July 2022, AIST set up its new Marketing and Business Development Headquarters with the mission of efficiently linking AIST's research outcomes to social implementation. The Marketing and Business Headquarters has three functions: formulation of business concepts, execution of empirical projects, and promotion of AIST-initiated startups. In the meantime, the establishment of a new corporation to further enhance said functions is under consideration. Key to sustaining the ecosystem is to create a cycle in which profits generated by the social implementation of new technologies are invested in the next research initiatives. To this end, shifting the premise of research funds, i.e., joint research funds, to a “value provided basis” is of high importance. The concept of “value provided” is that the amount of research fund is determined based on the value that a developed technology may produce in society. The difference between the research funds and the actual research costs becomes the capital that generates the next technological seeds, a power that drives the ecosystem cycle. We aim for an early establishment of an ecosystem prototype by shifting to these new initiatives and perspectives.

So, how will we make such groundbreaking inventions and discoveries which underpin innovations? The keyword, contrary to the homogeneity that once bolstered Japan’s manufacturing advances, is “diversity.” Interaction of diverse individuals creates opinion fusions, which lead to generation of new concepts. AIST aims to effectively generate ingenious research outcomes by promoting interdisciplinarity among different research fields within the organization. Aside from the top-down cross-disciplinary projects, many ambitious research themes have been proposed in response to the internal call for bottom-up research projects predicated on interdisciplinarity, such as cross-disciplinary challenges for young researchers and problem-solving initiatives. We will continue to develop initiatives to promote interaction of people from diverse backgrounds, to make AIST’s collective strength a core competence.

[See the Feature Article on AIST’s initiatives based

on cross-disciplinary projects to solve social problems, starting on page 4.]

Improving engagement is another important perspective for boosting organizational performance. In April 2022, we introduced an initiative that enables management and employees to communicate directly and enhance mutual trust. Here, management carefully explains to employees the objectives of management reformation and taking on board the views and opinions voiced by employees, reflects them in the AIST's management and organizational operations.

This report outlines AIST's newly introduced initiatives, as well as our activities of FY 2021, all categorized under four pillars. AIST is committed to enhancing research activities and improving transparency by disseminating such endeavors to society, thereby raising stakeholder's understanding and increasing public trust.

Today, as awareness of SDGs grows, businesses of all kinds seek solutions to social problems. In such a climate, expectations of AIST are becoming greater than ever. We will strive to fulfill the role as a core participant of the national innovation ecosystem, whilst remaining aware of the weight of social responsibilities that fall on our shoulders. We will remain ever grateful to your understanding and appreciate your further support to AIST.

ISHIMURA Kazuhiko

President & CEO
National Institute of Advanced Industrial Science and Technology (AIST)

To Collaborate with Companies and Create the Future

AIST Vice-President (part-time),
President and CEO, Hitachi, Ltd.

KOJIMA Keiji

Following on the Management Policy for Research in FY 2020, the AIST Vision "Create the Future, Collaborate Together" and the 5th Term AIST Management Policy were published in FY 2021 under the leadership of President Ishimura. This fiscal year, AIST will be moving forward with concrete actions. So, allow me to share my thoughts on the reform of AIST.

The societal challenges that beset us are becoming increasingly more difficult to resolve in the short term due to their increasing complexity, and thus we need to look at them with a mid -to -long term perspective. Furthermore, there are limits to what individual companies can achieve on their own to solve the challenges in society. From this perspective, AIST, with its many cutting-edge technologies, holds an important position. There is growing recognition in industry that when there is a need for technology to resolve a certain challenge, that AIST will be at the center of things. Given this, I believe we can create a positive spiral by gathering the aspirations of industry, creating technologies, and giving back to society.

What is most expected of AIST is that it will serve as the hub of an innovation ecosystem. In addition to technology, AIST has human resources, tangible and intangible assets, regional bases around Japan, a leading position in standardization activities and has built relationships with a diverse group of stakeholders. It can connect stakeholders from basic research through to application and, being a public institution, can bring together competing companies. AIST has the strengths to be the hub of the ecosystem and create innovation. This represents a significant change from the previous role of "technology bridging" and will become a new value creation model.

One of the themes to be tackled by this ecosystem is achieving carbon neutrality. The industry sector has set targets for 2050, but concrete measures are still under discussion. Working together with AIST on the roadmaps will naturally lead to AIST serving a central role.

I hope that with the establishment of the new Marketing and Business Development Headquarters, we can greatly accelerate the work to build this innovation ecosystem.

As I have indicated above, President Ishimura has shared an important message, and in order to implement this, the most important point will be on how quickly we can change the mindset of all AIST staff. The AIST Vision "Create the Future, Collaborate Together," which was formulated to involve all executives and staff, will be key. I hope that this vision will help to naturally set the goals of each team.

Companies place great importance on their employee engagement index. The employees' understanding of the company's vision and management policy, and proactively aligning their goals, is extremely important for the growth of a company. I encourage each and every member of the AIST staff to think deeply about what is needed at AIST and put that into practice.

The world is working on solutions to many societal challenges such as decarbonization and the circulation of resources. We will need an innovation system that comprehensively applies a diverse range of technologies to resolve societal issues. AIST has incredible potential to utilize digital technologies and connect broad-ranging cross-disciplinary efforts, and drive global societal change through the creation of new value. With the bold initiative of One-AIST, I hope that we can drive the realization of Society 5.0 in Japan.

Leading the World in Solutions to Social Problems

～ Integrated Fields Project ～

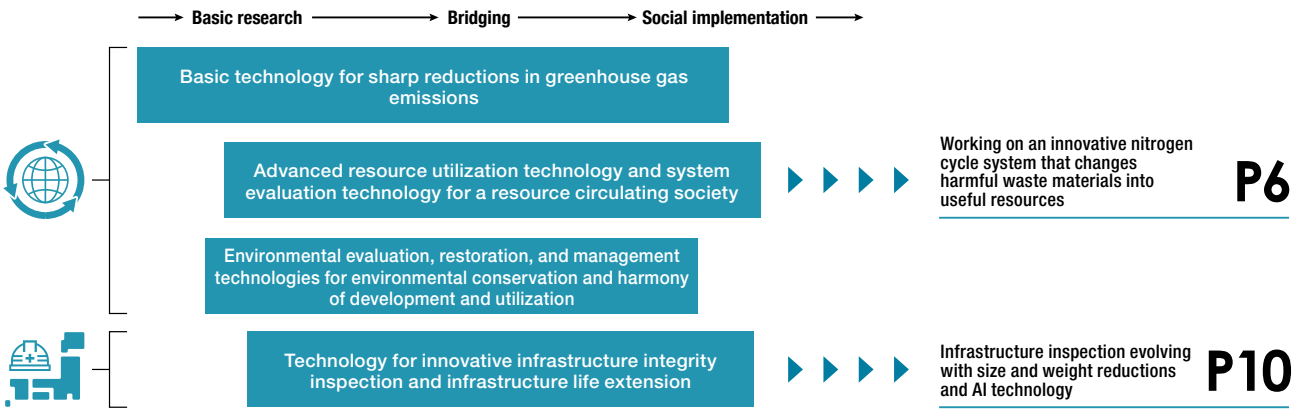
Responses to energy and environmental constraints

Centered on the Global Zero Emission Research Center (GZR), we are developing basic technology for sharp reductions in greenhouse gas emissions. Centered on the Resource Circulation Technology Research Laboratory, we are developing advanced resource utilization technology and system evaluation technology for a resource circulating society. Centered on the Research Laboratory on Environmentally-Conscious Developments and Technologies, we are developing environmental evaluation, restoration, and management technology for environmental conservation and for harmony of development and utilization.

Contributing to a resilient country and disaster prevention

Centered on the Sustainable Infrastructure Research Laboratory, we are developing technology for innovative infrastructure integrity inspection and prolonging infrastructure life to make society sustainable, safe, and secure.

Research reports index



AIST has declared spearheading solutions to social problems as one of the missions of the Fifth Medium- to Long-term Plan. Particularly to achieve the SDGs, breakthrough innovations are needed to address social problems, such as energy and environmental constraints, the declining birthrate, and aging population, and to contribute to sustainable economic growth and stronger industrial competitiveness in Japan. We have specified four social problems that need to be addressed: responses to energy and environmental constraints; measures for the declining birthrate and aging population; contributing to a resilient country and disaster prevention; and measures for epidemic control and infectious diseases. The whole Institute will work on strategic research projects to contribute to solutions to these social problems. Synergistic initiatives beyond the scope of existing research departments will be needed for these solutions. As a system for all parts of AIST, we are setting up integrated research centers and integrated research laboratories.

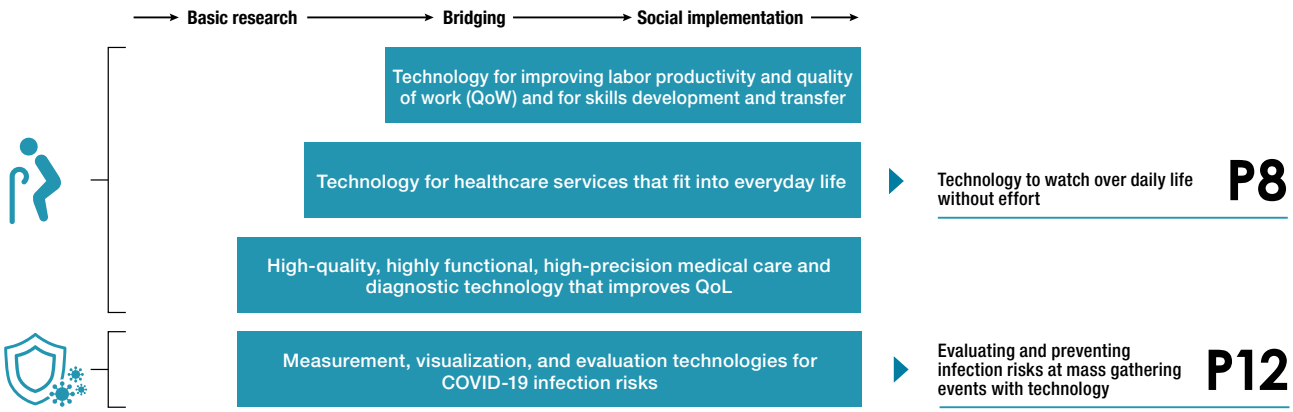
Measures for the declining birthrate and aging population

Centered on the Industrial Cyber-Physical Systems Research Center, we are developing technology that contributes to improvements in labor productivity and to skills development and transfer in all industries. Centered on the Advanced Healthcare Service Research Laboratory, we are developing technology that contributes to next-generation healthcare services using advanced technologies that fit into everyday life. Centered on the New-generation Medical Treatment and Diagnosis Research Laboratory, we are developing high-quality, highly functional, high-precision medical care and diagnostics technology that improves quality of life (QoL).

Measures for epidemic control and infectious diseases

Centered on the Research Laboratory for COVID-19 Infection Risk Assessment, we are developing measurement, visualization, and evaluation technology for COVID-19 infection risks

Research reports index



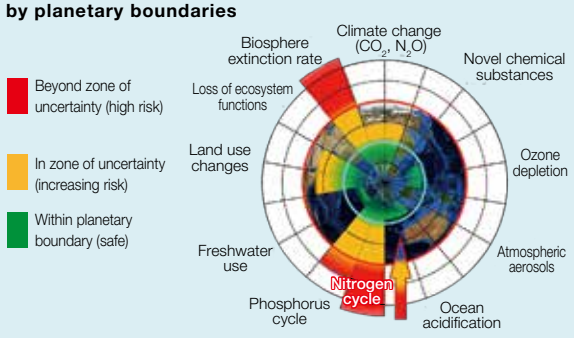
Working on an innovative nitrogen cycle system that changes harmful waste materials into useful resources

Large-scale synthesis of ammonia became possible about a century ago. In proportion with ammonia production, nitrogen compounds produced by human activities have increased about ten times since then, becoming one of the hardest to recover causes of environmental pollution. AIST aims to establish technologies that can sustain industrial activity without releasing nitrogen compounds into the environment. We will not simply detoxify nitrogen compounds but use the power of science and technology to create nitrogen cycle systems on earth.

Planetary boundaries: Sounding the alarm about nitrogen waste overshoot

As industry develops and lifestyles become more affluent, environmental pollution emitted by human activities is increasing. Thresholds on what the Earth can tolerate are represented by planetary boundaries. According to the planetary boundaries framework, nitrogen compounds are overshooting the Earth's limits by more than carbon dioxide (CO_2) and phosphorus, posing a serious problem for the international community.

The state of Earth represented by planetary boundaries



Graphic prepared by AIST, based on the graphic on page 5 of Annual Report on the Environment, the Sound Material-Cycle Society and Biodiversity in Japan 2018 (Japanese version)

Kawamoto Tohru describes the social problem of nitrogen: "Global production of nitrogen compounds has increased about tenfold in a hundred years. Ammonia, a typical nitrogen compound, is used as fertilizer, feedstock for chemical products, and so forth. When ammonia is discharged as exhaust gas or in wastewater, it causes various environmental problems such as bad smells, PM2.5 particles, eutrophication, and nitric acid pollution. Accordingly, the European Union (EU) has set nitrogen waste reduction targets and the United Nations Environment Programme (UNEP) has also called for reductions. Although Japan does not currently have strict regulations, there is no reason to think we will stand idle. Looking 20 or 30 years ahead, the establishment of innovative nitrogen cycle technologies is an urgent matter."

The goal is technologies that, rather than greatly reducing the quantities of ammonia used by humans, can protect the global environment while sustaining current industrial activity.

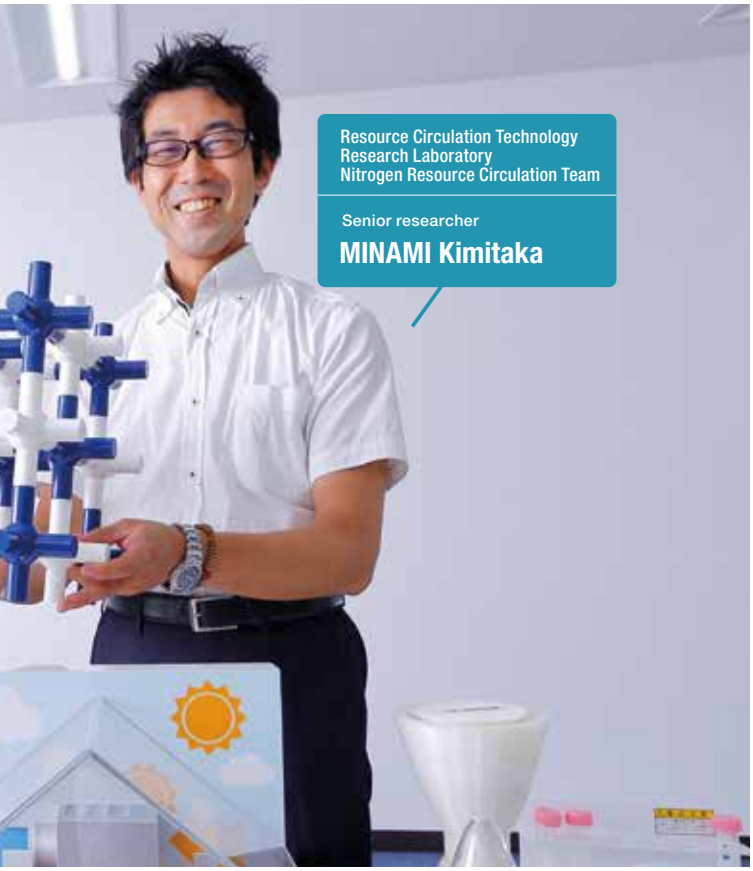
Adsorption by Prussian blue for recovery and reuse of ammonia

The team is working to provide a novel nitrogen cycle system by putting together a cycle of converting harmful nitrogen compounds discharged by industrial activity to ammonia, separating, and recovering the ammonia, and using it again in industrial activity. The core technology, developed in 2016, is adsorption of ammonia by Prussian blue, a blue pigment.

Ammonia is a source of bad smells. The team has conducted demonstration testing using a Prussian blue adsorbent that, as well as adsorbing ammonia at high concentrations, adsorbs ammonia at low concentrations that are difficult for the human nose to detect. The results have shown excellent effects in a pig rearing facility beyond a reduction in smells, such as an improvement in fattening conditions.

Now the research is moving onto the next stage and proceeding along two main paths. Minami Kimitaka describes one of them, a project to convert exhaust gases to resources.

"We started demonstration testing at a composting facility on a pig farm in 2019. This new research theme is scrubbing and recovering ammonia adsorbed from exhaust gas to enable reuse. We have conducted diverse investigations into durability of the adsorption material, scrubbing methods, recovery methods and so forth. The livestock farmer who assisted us in this series of demonstration tests was most concerned about reducing smells in the pig rearing facility at first, but is now interested in the environmental issues and has started to talk about his wish to produce fertilizer with high nitrogen content."



Because ammonia can be produced cheaply by industry, reuse will not expand unless it has some advantage over buying ammonia. One form of the nitrogen cycle system may be "local production for local consumption," reusing required amounts of nitrogen at locations close to a nitrogen recovery site. Technological development to meet a variety of local needs such as fertilizer, fuel, and other applications is being hastened.

The pig farm that hosted demonstration testing

Recovering resources from sewer water and industrial effluent

Development of technology to recover ammonia from wastewater in parallel with exhaust gas is also proceeding. It has reached the stage of demonstration testing with industrial effluent.

"By modifying the composition of Prussian blue at the atomic level, we can produce versions for exhaust gas and for wastewater. Sewer water and industrial effluent contain various ions alongside ammonium ions but, using the material we have developed, ammonia can be selectively recovered even when concentrations of other ions are high. If we install ammonia adsorption equipment in existing wastewater processing facilities, we should also be able to reduce the workload of activated sludge tanks."

The team is now working on producing materials suitable for reuse processes after recovery, developing equipment that is stable and effective in water, and other projects.

Drawing a complete picture of nitrogen resource circulation

A nitrogen resource cycle cannot be achieved by separation and recovery alone. Research must also be conducted on the technologies needed for a novel nitrogen cycle system, such as technology for converting nitrogen compounds such as NOx to ammonia, technology for decomposing and detoxifying N_2O, and combustion technology for using ammonia as fuel, feedstock and so forth.

Kawamoto says, "Through integrated research project, our research has become known to everyone in the Institute, not only the researchers close to us, and we can draw a more complete picture of the nitrogen cycle than before. In particular, fuel ammonia is a carbon-free fuel that does not emit CO_2, which is one scenario that is highly desired by society. I think having more colleagues to help us will be valuable."

Minami, who has been shuttling between the lab and the demonstration testing site, says "My goal as a researcher is to bring basic research to social implementation. Now, research to link the interesting materials AIST has developed to wide-ranging solutions for problems—from difficulties at production sites to global environmental problems—is possible and is progressing well." Kawamoto adds "Research into the nitrogen cycle involves a huge number of tasks and there are currently not enough of us. While we still have few competitors, this seems to be an interesting time in which we can discover many methods to solve social problems. Nitrogen cycle technology will definitely become progressively more important in the future. Concerning nitrogen compounds, many people have stories about current specific difficulties. I would like to accumulate more technologies to be able to propose solutions for those problems and ultimately make the cycle complete."

AIST is determinedly using the power of science and technology for the important goal of protecting the Earth from environmental pollution with nitrogen compounds.

Technology to watch over daily life without effort

～ Personal optimization for longer healthy lives ～

We want to stay healthy as long as possible. To achieve this goal, we have to keep up activities that we understand but find hard to actually do, such as suitable exercise and dietary habits. Working to add value to data obtained from everyday life and provide healthcare services that suit individuals, AIST is expanding leading-edge cross-domain research that makes use of data analysis and simulations in cyberspace.

What is the real challenge in extending healthy life?

The average lifespans for both men and women in Japan are over 80 years, but it is known to be a leading country facing the issues of declining birthrate and aging population. The greatest problem is that the difference between average lifespan and what is known as healthy lifespan, in which people can freely go out, perform housework, exercise and so on, is up to around ten years. The Advanced Healthcare Service Research Laboratory is pursuing research to satisfy people's wishes to live healthily as long as possible.

Laboratory Director Komine Hidehiko explains: "The major reasons for needing nursing care include dementia, strokes, and frailty due to old age. Everybody knows that exercising and taking care over diet are effective in preventing these problems, but finds them difficult to put into practice. I think this is the challenge in extending healthy life. The challenge has two main issues. One is that a person does not notice problems arising until they can see or feel the effects; early discovery of illnesses is difficult. The other is a lack of motivation to maintain and improve health. We have to use two approaches to conduct interventions and services that are suitable for individuals."

Assessing declining cognitive function from car-driving data

For the first issue, early discovery of illnesses, we are adopting the concept of relating data monitored without effort during daily life to disease discovery and health maintenance, in contrast to activities for detecting disease and maintaining health in the form of annual health checks. The idea is to provide added value to simple data measured during daily life by relating it to precise data measured in laboratories and data from clinical information, and hence use the data for early diagnosis of diseases.

Taking the example of dementia, it is an irreversible disease. Although there are drugs that can halt its progress, there are no drugs that can cause improvement. It is very important to discover dementia as early as possible. In AIST, by relating driving data of people whose cognitive function is declining with clinical diagnostic data such as brain scans and cognitive function tests, we are developing an algorithm that may assess a decline in cognitive function from operations in day-to-day driving such as steering and braking.

Meanwhile, in research to evaluate falling risks, by relating sophisticated laboratory-level walking analysis data to simple acceleration sensors like those used in pedometers, we can assess falling risks from data on habitual walking styles.

Adapting to individual psychological characteristics to raise motivation

For the second issue, maintaining and improving motivation, we are taking a different approach

incorporating psychological techniques.

A problem in healthcare is that even when we know about activities that are good for health, it is difficult to sustain them. To some extent, this is natural for the human animal. If we simply pursue the desires to eat until we are full and rest when our bodies are tired, these habits turn out to be bad for health. Komine explains that habits that are good for health, such as eating until 80% full and performing exercise every day, constrain our desires and are accompanied by some level of discomfort.

"Nobody wants to experience discomfort and if there was no way to counter that logic, we would not adopt habits that are good for health. Accordingly, AIST is conducting research into support and interventions for individuals that take account of individual attributes, environmental factors, and psychological characteristics such as personality type, person by person."

Concealing personal information during data analysis in cyberspace

The Advanced Healthcare Service Research Laboratory is not limited to developing disparate underlying technologies. End-to-end research from device development to data analysis, support, and interventions is a major feature. They are pursuing research across numerous specialisms including AI, physiology, psychology, and sensor technologies.

"Handling personal information is always a problem for healthcare research. Therefore, we are working to build a platform that will put personal information into incomprehensible states to perform data analyses. More specifically, we are transferring healthcare data obtained in physical space (the real world) to cyberspace (the virtual world) in states from which personal information cannot be retrieved, to perform data analyses and simulations."

We are now making progress in research to build a database from around 30,000 sets of health and clinical data gathered in collaboration with universities and local governments, perform analyses in cyberspace, and provide intervention techniques that are adapted to disease prognoses and individuals in a "health web service app."

Great hopes for integrated research project to produce impacts across fields

Often we encounter things that are not possible within our own specialisms but can be achieved for the first time through collaboration with other fields. Komine describes the changes that come from healthcare questions being clearly repositioned as integrated research questions:

"The technology required by healthcare has many branches, such as sensors, AI, medicine, and psychology. It is difficult for universities and companies to tackle these alone and I believe AIST can demonstrate the advantages of its collective strength. Even in AIST, I think there have previously been walls between domains and organizations to some extent. Now the message is going out that these organizations should conduct integrated research and it seems that these walls are getting lower. I see potential to produce research outcomes with impacts that extend beyond previous research domains."

The problems of healthcare are social problems that are very personal and are easier for the individual to perceive. However, because they are personal, they are complex in requiring a variety of approaches that can be trusted. These problems are an opportunity for the power of AIST working through its collective strength to flourish. In seeking to realize a society in which daily life can be supported in a lowkey way and people can be healthy without special efforts, we will continue to help extend healthy lives.

Infrastructure inspection evolving with size and weight reductions and AI technology

～ A high-accuracy, low-cost, non-destructive X-ray inspection system ～

The social infrastructure that was built in Japan's period of high economic growth is deteriorating. There are dangers that deterioration in places that are not visible may progress and lead to serious accidents. Accordingly, AIST has developed non-destructive X-ray inspection technology for more efficient infrastructure inspection. As well as reducing size and weight of an X-ray source and developing an innovative X-ray detector, our goal is to upgrade inspection technology in general to make infrastructure inspection more efficient and more automated.

How can rapidly deteriorating infrastructure be inspected efficiently?

Japan surged through high economic growth from around 1955 to 1970. There was a rush to construct expressways, railroads, bridges, dams and more. Much of the infrastructure that was created so quickly has now stood for more than half a century. Managing the maintenance of deteriorating infrastructure is a major social problem.

The Infrastructure Inspection Technology Research Team is developing a variety of non-destructive inspection technologies that use X-rays, near-infrared light, geophysical surveys, ultrasound probes, microwaves, and so forth. Kato Hidetoshi and Fujiwara Takeshi are working on non-destructive X-ray inspection technology.

Kato says "Because the quantity of infrastructure built in the period of high economic growth is huge, it cannot all be inspected regularly. There is a desire to minimize the effort and cost of maintenance by inspecting more efficiently and replacing or servicing only where necessary. When we use X-rays, we can check for degradation of steel rods embedded in concrete, thinning of pipes due to corrosion and wear, and so forth. However, conventional X-ray sources were large and heavy and needed to be connected to electricity supplies; they were limited in where they could be used. In addition, they caused high costs and inconvenience in inspection. Our goal is to solve these problems."

An X-ray source with drastically reduced size and weight that can be carried by a robot

For several years, AIST has worked hard on R&D of non-destructive X-ray inspection technologies dedicated to infrastructure inspection. Kato succeeded in drastically reducing the size and weight of an X-ray source in 2014. He used a carbon nanostructure cathode for X-ray tube, and succeed in developing X-ray source with an output of 120 kV tube voltage, a weight less than 2.5 kg, a size similar to a large CD case with a thickness less than 70 mm, a long lifespan, and able to operate with a USB power supply or battery. In 2016, he raised the output tube voltage performance to 200 kV. At the same time, Fujiwara was developing a high-sensitive X-ray detector for high energy X-ray source. As a result, they created a compact, lightweight, high-power X-ray inspection device that can be carried by a robot.

Kato won a commendation for this research from the Minister of Education, Culture, Sports, Science and Technology in 2019. He is now working on further improvements to the X-ray source and on the development of detection techniques that can be employed for various infrastructure inspections.

"Many infrastructure constructions are very large, and the greater the thickness, the harder they are for X-rays to penetrate. Therefore, it is necessary to increase tube voltage and tube current even further. Moreover, in order to mount the system to robots, it is necessary to reduce size and weight of an X-ray source and simplifying the structure of the device is also important."

In chemical plants, high-temperature and hazardous substances pass through piping. Therefore, any malfunction in the piping or other parts of the plant could lead to a serious accident. Therefore, technologies for periodic inspections using robots

are required for safe and efficient inspections. The X-ray inspection system developed by Kato and his team can autonomously travel and inspect such

A portable compact X-ray source

piping, enabling a significant reduction in costs and manpower.

Innovative backscattering X-ray inspection technology widens the range of infrastructure inspections

X-ray nondestructive inspection is usually the observation of the inside of an object sandwiched between an X-ray source and an X-ray detector. In practice, however, there are a great many infrastructure facilities that cannot be sandwiched by the X-ray devices. For example, railroad tracks at railroad crossings are surrounded by wood or rubber, tunnels that are covered with fireproof covering, and large bridges spanning rivers. Those infrastructure cannot be observed by conventional X-ray inspection system. To solve this problem, Fujiwara is developing a novel non-destructive X-ray inspection technique using backscatter X-rays.

"This technique uses X-rays scattered in backward instead of transmitted X-rays. X-rays are irradiated onto a certain region of a target object like a flashlight and X-rays that are scattered in backward are detected by an ultrahigh-sensitive X-ray sensor. We used the fabrication process of LCD televisions (feeding electronic signals to control timings of control lines that extend in a lattice pattern, which illuminates pixels at intersections of the lattice lines to display text and images) to develop an ultrahigh-sensitivity X-ray sensor that visualizes the backscattered X-rays. Maintenance of rails at 33,000 level crossings across Japan has become an urgent problem. In response, we have developed a backscattering X-ray inspection device in the form of a vehicle that moves on the rails. Combining this with AI technology, we are proceeding with development of an image interpretation device. When AI is employed, accurate judgments can be made even with fuzzy images that are barely visible to the human eye."

Fujiwara is thinking of applying this technology to tunnel inspection. In tunnel inspection, the speed would become an issue. Currently, inspecting a 10 cm square takes about two seconds, examining a long tunnel would require too much time. The ideal is to mount equipment on an inspection vehicle and just drive it through a tunnel. Fujiwara is working towards a huge increase in inspection speed.

Ambitious integrated fields project aiming at social implementation

The Infrastructure Inspection Technology Research Team brings together experts from a wide range of fields such as non-destructive inspection, sensors, IT, materials development, structural design, and physical properties evaluation.

"AIST has declared infrastructure inspection technology to be a topic for the whole Institute and collaboration with other research fields has become much easier. In particular, there is great benefit in working together with top-rank AI researchers. Moreover, new materials are necessary to raise the sensitivity of sensors, which has led to new collaborations with materials development researchers. Because this ambitious R&D is now possible, we anticipate wider-ranging opportunities for cooperative research and demonstration testing with interested companies." Fujiwara said.

Kato describes the prospects for social implementation: "For social implementation of the new technology, it is necessary that the companies doing actual inspection decide to adopt the technology. However, given that changing inspection procedures quickly is difficult, I think an institute such as AIST has an important role to play in making prototypes and testing them in the field."

Damage to social infrastructure leads to serious accidents and has profound effects on society. Through R&D of infrastructure inspection that prevents the occurrence of accidents, AIST is strongly supporting the foundations of a safe and peaceful society.

Enjoying Normal Life Without Fear

～ Evaluating and preventing infection risks at mass gathering events with technology ～

As we pass through the waves of COVID-19 infections, restrictions on holding events such as sports and entertainment are being relaxed in stages. Anticipating a return to normal life and a time we can safely enjoy these events, AIST is deploying advanced measurement technology and AI analysis technology to perform on-site surveys and evaluate infection risks in stadiums, arenas and the like. Trustworthy evidence is important for making policies for infection suppression.

Seeking to relax restrictions with an evidence base

Yasutaka Tetsuo recalls, "When the COVID-19 epidemic arrived in February 2020, we thought, this problem is a job for infectious disease specialists and there is nothing we can do." Since then, with Naito Wataru, he has been considering evaluation of infection risks at large scale gatherings as a member of a large committee (MARCO), a volunteer research team formed of diverse experts from universities, business, medicine, and so forth. When Japan's professional soccer league (the J. League) asked in October 2020 whether infection risks in stadiums could be surveyed, Yasutaka decided that linking up AIST's various technologies could surely solve this social problem and immediately jumped into action.

"The J. League thought it needed evidence for discussions of the risks to spectators in stadiums, what measures to apply, and the effects of restrictions" says Yasutaka. To form quantitative arguments of the form "what restrictions in what areas will lower risks by how much?", we had to model counter-infection measures and their effects and we had to collect data observed in the real world.

Naito adds, "We immediately decided that we would conduct field studies. In discussions of what other kinds of data we should collect, we realized that Onishi Masaki, who we had not previously been in contact with, is a researcher who conducts crowd flow analysis and we decided to consult with him."

Onishi readily agreed to take part in empirical surveys, considering them part of AIST's job as a public research institution. In November 2020, the first on-site survey was conducted at the home ground of FC Imabari in the J3 League. Thus, integrated research project was launched in a bottom-up style by a team focusing on the problem in front of them.

Monitoring movements of people and CO_2 concentrations to "visualize" infection risks

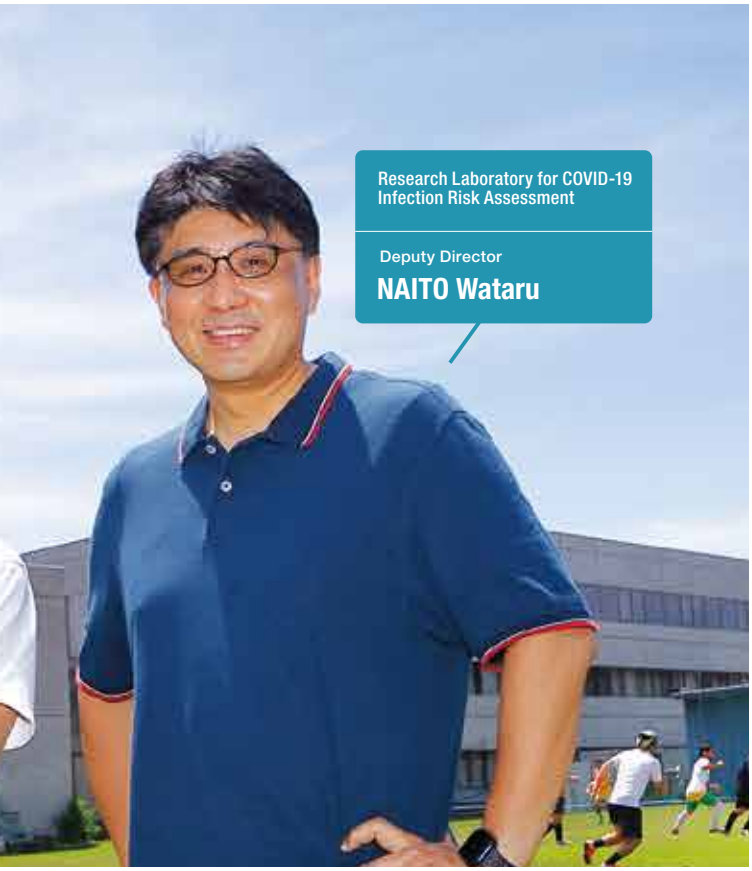
The field studis progressed using strong points of each member. The group led by Naito previously had been using CO_2 concentrations to measure ventilation conditions for evaluating danger from chemical substances and the like. By using this concept and measuring CO_2 concentrations, it is possible to estimate mixing and activity levels of people and to understand ventilation conditions. Onishi's research was on measuring movements of people (crowd flows) with laser radars, enabling evaluation of how close people are to each other in reality. We measured degrees of mixing and evaluated infection risks from droplets and the like.

One member of the lab, Bando Yoshiaki, conducted audio surveys using microphone arrays and AI. These surveys can evaluate periods of spontaneous cheering from spectators and periods of applause etc. This important data quantitatively showed that supporters were expressing support without using their voices at the time, which is important for a later return to the "normality" of vocal support in stadiums. Onishi

and his colleagues developed a new technology using video cameras and AI to assess rates of mask-wearing and employed this technology first in surveys of mass gathering events in Japan.

Thus, by creating a system bringing together the advanced metrology technologies of AIST with a view to infection risk evaluation, they were able to present data leading to solutions to the social problem in front of them.

They continued the surveys; surveys were conducted at two matches in April 2021 as government technological testing. The result was that when measures such as assuring seats were spaced apart, wearing of masks, disinfection and hand washing were applied, they evaluated that infection risks were cut by 94% compared to these measures not being applied.



What conditions should be put in place to allow vocal support?

We concluded a cooperation agreement with the Japan Football Association and continued on-site surveys with varying event conditions: the Emperor's Cup competition and the final Asian qualifier for the FIFA World Cup in December 2021 were held with 100% spectator occupancy; and vocal support at matches in the J. League started to be allowed in stages from June 2022.

Regarding vocal support, they evaluated risks in advance before matches. Compared with conditions for matches in June 2022 of 100% spectator occupancy and no vocal support, they assessed that infection risk would be suppressed by about half if certain conditions were put in place, such as cutting spectator numbers by half, spacing seats, and mask-wearing. In surveys at actual matches, they found that spectators were consistently observing the rules, with mask-wearing rates of 99.7–99.8% in areas allowing vocal support and proportions respecting spaced seat arrangements of 94.5–97.0%.

Onishi says, "In the J. League, tickets go on sale about a month before match day; so, on-site surveys and evaluations need to be quick. We took measures such as pursuing automation of AI analyses. When results need to be quick, we inform the J. League of mask-wearing rates among vocal supporters the following day and publish the survey results after about a week. We have attained speeds unimaginable in usual research."

By the end of July 2022, AIST's on-site surveys had reached a total of 77 varied sports and entertainment events, including soccer, baseball, basketball, and concerts. We will go on to expand the scope of survey subjects.

Researchers provide data and assessments; operators and government bodies make decisions

The most difficult part of evaluating infection risks is presenting the results to society without misunderstandings, as Yasutaka explains: "Even when the same evaluation results are presented, people will interpret them as high risks or as low risks depending on the person, and interpretations vary depending on the current infection situation and the mood in society. Japan is currently gradually relaxing restrictions on an evidence basis, but movement is said to be slow compared to Europe and North America. Of course we want to return to normal life as quickly as possible, but AIST's role is ultimately to produce evidence and turn it into resources for decision-making. It is governments and business operators that decide how evidence is interpreted and what measures are applied. As researchers, our survey results and evaluation results have been promptly applied to guideline revisions and decision-making by operators such as the J. League. As we go into the next stage, a rapid shift to working on different problems is very exciting."

AIST will move on to deeper research into measurement and evaluation of infection risks and will contribute to society by gathering and publishing evidence.

AIST and Environmental Problems

To build a sustainable society, AIST brings the results of research and development to society. To incorporate environmental considerations into the research and development process, AIST has set an Environment and Safety Policy and complies with laws and regulations in its business activities.

See pages 54-57 for more details▶

Environmental Policy

To build a sustainable society, AIST has the Charter of Environment and Safety in place. Its aim is to bring the results of research and development to society, as well as to incorporate environmental considerations into the research and development process. Under the Charter of Environment and Safety, we have set an Environment and Safety Policy to proactively work with a keen awareness of the importance of ensuring global and local environmental conservation, and the health and safety of everyone working at AIST. This is done keeping in mind AIST's characteristic as a research institute that handles a wide variety of chemical substances.

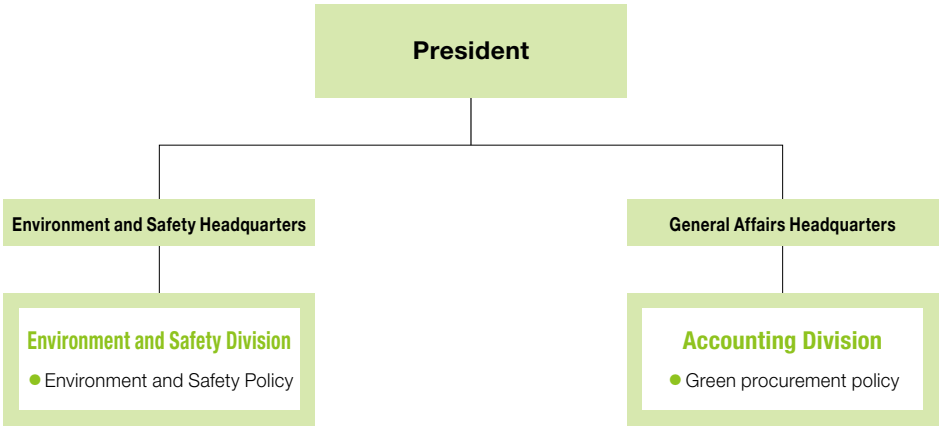
Environment and Safety Policy

1. We proactively conduct research that contributes to conservation of the environment and the development of a healthy and safe society.
2. We comply with laws, regulations, ordinances, and agreements on the environment, safety and health, set our own management standards, and seek to further improve environmental conservation, health and safety.
3. We seek to reduce the consumption of energy and resources and the generation of waste, and thus aim to reduce loads on the environment
4. We seek to prevent pollution and work-related accidents, to take prompt and appropriate actions in the event of an emergency, and to prevent the spread of damage.
5. We are developing a management system for effectively and efficiently conducting activities to ensure environmental conservation, safety and health with the participation of all members of AIST; we seek continuous improvement.
6. We actively disclose environmental, safety and health information by publishing environmental reports and disclosing information to promote communication with society.

We also set a policy for promoting the procurement of eco-friendly goods and services in accordance with the Act on Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities, Green Purchasing Act, and the Act on Green Procurement.

Implementation Structure of Policies Related to Environment and Safety

AIST's headquarters organizations and operating units work together closely to implement our environmental initiatives covering the whole of AIST.



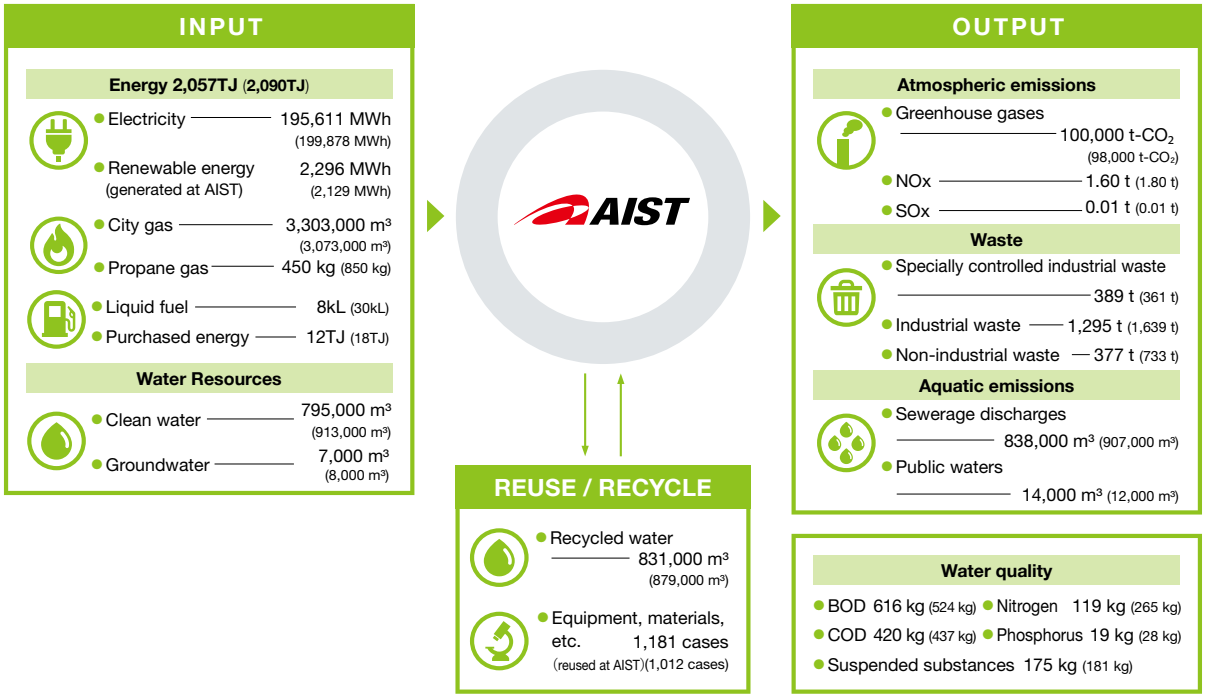
Environmental and Safety Management System

AIST has its own environmental and safety management system (ESMS) in place which is eco-friendly and appropriate for a research institute. It combines two subsystems: an environmental management system and an occupational safety and health management system.

PDCA (Plan-Do-Check-Act) cycle is implemented, and know-how for occupational safety and health is carried on as we strive to reduce potential danger and prevent accidents

Overview of Environmental Burdens

( ): FY 2021 results



Appropriate Management of Chemical Substances

AIST has introduced the Chemical and Gas Management System that enables management of possessed and used quantities of chemicals and gases in order to appropriately manage the wide range of chemicals used in research activities. Through this system, the kinds and quantity of chemicals possessed are grasped, and proper management of the amounts possessed and appropriate calling for attention to the laws and regulations are conducted.

●Response to PRTR system

Based on the PRTR system and ordinances and guidelines of the Tokyo Metropolitan Government, the Osaka Prefectural Government, the Fukushima Prefecture, AIST grasps the amounts of chemicals discharged to the atmosphere and moved as sewage water or waste material. For FY 2021, we report the amounts of chloroform, methylene chloride, n-hexane, hydrogen fluoride and its water-soluble salts, ferric chloride, N,N-dimethylacetamide subjected to the PRTR system, chloroform, ethyl acetate, methanol subjected to the ordinance of Tokyo, volatile organic compounds subjected to the ordinance of Osaka, and ammonia, propylene glycol subjected to the guidelines of Fukushima.

Consideration for Biological Diversity

To comply with the Cartagena Act* for the conservation of biological diversity, AIST requires employees involved with recombinant DNA experiments to undergo education and training (e-learning), and a total of 956 persons took the course in FY 2021. We also review the experiments based on the opinions of the committee of external experts. Moreover, we conduct once a year in principle on-site inspections of laboratories conducting recombinant DNA experiments to verify all is managed correctly according to the law.

When experiments on animals are conducted at AIST, the experimental design is reviewed for the 3R principles (Replacement, Reduction and Refinement) outlined in the Act on Welfare and Management of Animals, and the results of self-assessments are posted on our public website. We have been subject to external inspections and certification by the Center for Accreditation of Laboratory Animal Care and Use of the Japan Pharmaceutical Information Center.

* The Cartagena Act: In Japan, the Act on the Conservation and Sustainable Use of Biological Diversity through Regulations on the Use of Living Modified Organisms came into effect in 2004. It aims to ensure safe handling of living modified organisms that could have adverse effects on the conservation and sustainable use of biodiversity.

Consideration for Water Resources

●Prevention of water pollution

Wastewater from laboratories is sent to wastewater treatment plants and processed to abide by the Water Pollution Prevention Act and to meet municipal effluent standards. It is then discharged into the public sewerage system. To prevent water containing hazardous substances from leaking into groundwater, AIST builds dikes and conducts periodic inspections of buried research wastewater pipes and groundwater quality to check for abnormalities.

Wastewater treatment plant at AIST Tsukuba

●Use of reclaimed water

For the efficient use of water resources at Tsukuba Central and AIST Tokyo Waterfront, research wastewater is neutralized, treated with reducing agents, and reused as recycled water. It is used for cooling laboratory equipment and flushing toilets. In FY 2021, 51% of the total water use was recycled water.

Water reuse plant at AIST Tsukuba

Consideration for Atmospheric Emission

Reduction of fluorocarbon emissions

In accordance with the Act on Rational Use and Appropriate Management of Fluorocarbons, AIST requires periodic inspections and spot checks of refrigeration and air conditioning equipment that uses fluorocarbons as refrigerants, to restrict emissions of fluorocarbons into the atmosphere. In FY 2021, a total of about 612 t-CO_2 was released, and it was less than the amount (over 1,000 t-CO_2) required to report under the Act.

Prevention of air pollution

Regarding boilers for air conditioning that are major sources of NOx and SOx, we measure the effluent gases twice a year so that they do not exceed the emission standards under the Air Pollution Control Act. Regarding NOx, in FY 2021, the measurement results were all within the limits. Of SOx, there has been little emission since 2017, and the results fall far below the emission standard. In addition, when replacing equipment, we choose chiller units with high energy-saving effects and downsized units to reduce emissions.

Energy-saving Efforts

We work to reduce energy consumption per unit to an annual average of over 1%* in the medium to long term, an amount required under the Act on Rationalizing Energy Use. To achieve the target, we actively install devices with high energy-saving effect when renovating facilities, in addition to taking energy conservation measures by appropriate temperature settings of air-conditioners. Our existing solar power systems are being used effectively, and renewable energy systems have been installed in our new buildings. Presently solar power systems are installed at AIST Tsukuba, AIST Tohoku, Fukushima Renewable Energy Institute (FREA), AIST Tokyo Waterfront, AIST Kashiwa, AIST Chubu, and AIST Kansai. Wind power generation is installed at FREA.

* Energy consumption per unit average of FY 2017–2021: 98.1% (98.2% compared to the previous year)
Amount of renewable energy generation: 2,296,017 kWh (about 1% of total electricity consumption of AIST)

Green Procurement Efforts

Each year AIST discloses its policy for promoting the procurement of eco-friendly goods and services, in accordance with the Act on Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities (Green Purchasing Act), and the Green Contract Law. Moreover, in accordance with the Green Purchasing Act, automobiles were leased in a comprehensive evaluation bidding method from the best company after prices and environmental performance (fuel consumption) were evaluated, and the bottom-cut method was adopted for power supply and waste contracts with companies that cleared the standard after evaluating their reduction efforts for global warming gas emission and compatibility to the certification system for excellence and that placed the lowest bid.

FY 2021 procurement goal attainment status of designated procurement items defined in the Green Purchasing Act: 241 items out of 282

Applying the 3R principles

AIST seeks to reduce waste by applying the 3R (Reduce, Reuse and Recycle) principles and thus reduce environmental loads. We are focusing particularly on the reuse of research equipment, because this reuse can also contribute to cost savings.

An AIST intranet-based article recycling system has been in place for items no longer necessary, including research equipment, office electrical equipment, furniture and consumables, to promote reuse within AIST.

Cases of reuse for FY 2021: 1,181

Response to Environmental Accidents

AIST conducts contact, communication, and an emergency action drill at all research bases once a year to minimize damage in the event of an environmental accident such as a leakage of oil or a chemical. We have a communication system that once the Environment and Safety Headquarters is contacted can immediately deal with an accident if it occurs. After expeditious measures, related organizations are notified. The Environment and Safety Headquarters analyzes the cause of the accident and takes measures to prevent a recurrence of such an incident.

Accident case in FY 2021: leakage of freezer refrigerant (134a fluorocarbon)

This leakage was discovered by a leak tester during monthly inspection of a non-working out-of-order freezer. It seems that the compressor joint and pipe had corroded. As a measure against further corrosion, the refrigerant was collected, and the machine was sealed with nitrogen.

Environmental accident drills of FY 2021: 19 accident drills across all research bases (supposing damage of research wastewater pipes, leakage of oil while refueling)

Emergency accident drill supposing light oil* had leaked while refueling in the room for a house power generator for emergency and flowed outside (*water used for the drill)

Environmental Education

We provide e-learning training throughout the year on issues with significant environmental impacts such as how to treat liquid wastes and vented gases from research and how to sort and remove waste.

Equipping a quantum device development base (the Superconducting Quantum Circuit Fabrication Facility)

In response to the "Quantum Technology Innovation Strategy" (Now called "Quantum Future Society Vision") prepared by the Cabinet Office in 2020, we established the Superconducting Quantum Circuit Fabrication Facility ("Qufab") to be an R&D base for the quantum devices that next-generation computing will need.

As preparation of the base for research activities, building 2-12 at AIST Tsukuba Central 2 was refitted in FY 2021.

Quantum technology means technologies that apply the peculiar physical laws known as quantum dynamics. Prominent in quantum technology, quantum computers can far surpass the calculation capabilities of supercomputers and are predicted to have disruptive effects in fields of industry such as materials development, AI, and finance. There are hopes that social implementation of quantum technology will enable economic growth and carbon neutrality. AIST has an important role to play in the creation of the quantum technology innovation base that the government has set and in advancing quantum technology.

The newly established Qufab is a research facility dedicated to fabricating superconducting quantum circuitry. It brings cutting-edge processing equipment for fabricating semiconductor devices together with the foremost superconducting device processing technologies and expertise in Japan. In addition, an improved air conditioning system is expected to make energy use more efficient (by about 30% compared to the previous system).

The exterior of building 2-12 at AIST Tsukuba Central 2, which houses the Superconducting Quantum Circuit Fabrication Facility (Qufab)

Industry–Academia–Government Collaboration and AIST

Data of Research Activities (FY 2021)

See pages 48–49 for more details ▶

Research presentations (in journals) **4,171** cases	Innovation coordinators **58** people
Research presentations (oral) **5,916** cases	Technology consulting **692** cases
Number of joint research **1,063** cases	Technical advice **2,132** cases
Joint research revenue **86** million yen	Number of AIST staff contributing in international standardization activities **498** people
Number of commissioned research projects **89** cases	Number of proposed standards **67** cases
Fund received for commissioned research **8.9** million yen	Number of MOUs concluded with overseas organizations **21** institutes
Acceptance number of external researchers for joint research **1,991** people	Number of foreign researchers **429** people

Data of Personnel Training and Use (FY 2021)

Number of users of the cross-appointment program **48** people	Number of students who finished courses at AIST Innovation School **49** people
Number of employees as AIST Research Assistant **432** people	Number of students who finished courses at AIST Design School **130** people
Number of technical trainees **1,317** cases	

Technology bridging

AIST conducts cooperative research, contract research, technology consulting, technical advising, contract testing, provision of research samples and so forth, and contributes to R&D and product development by businesses. At hubs such as the Cooperative Research Laboratories and Open Innovation Laboratories, AIST collaborates with companies and universities to investigate possible applications of technology and promotes open innovation.

TOPICS

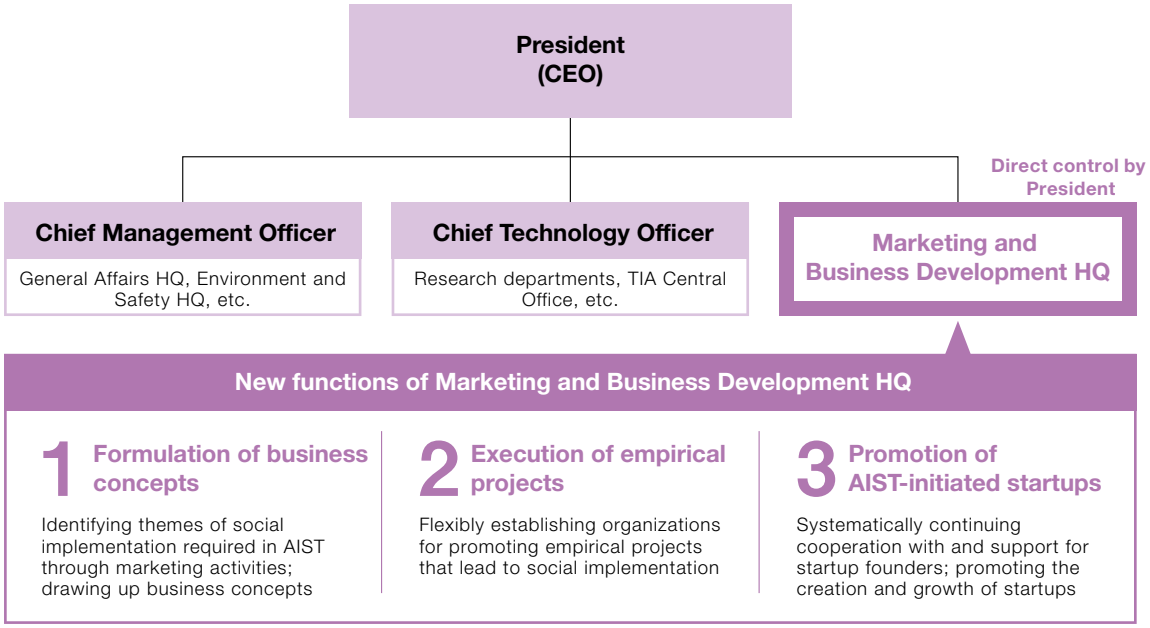
Accelerating social implementation

The Marketing and Business Development Headquarters, an office directly controlled by the President, has been set up to be the core of the national innovation ecosystem given high priority AIST's Fifth Medium- to Long-term Plan. The Marketing and Business Development Headquarters, together with industry, will create new value in linking solutions for social problems with stronger industrial competitiveness, which is AIST's mission.

The Marketing and Business Development Headquarters has three functions that are new to AIST: formulation of business concepts; execution of empirical projects; and promotion of AIST-initiated startups.

With these new functions, it will put in place structures for systematic unified promotion from R&D to commercialization, for our mission of solving social problems and strengthening industrial competitiveness, and it will accelerate social implementation of research outcomes through activities such as commercialization in collaboration with business and the creation of startups.

●Functions of the Marketing and Business Development HQ



Provide a Platform for Industry–Academia–Government Collaboration and Promote Acceptance of Researchers

See pages 48–49 for more details ▶

●Active invitation of external researchers

• Number of external researchers for joint research accepted in FY 2021: 1,991

AIST provides researchers from our joint research partner institutions with an access to AIST's state-of-the-art facilities to conduct effective joint research.

●A platform for industry–academia–government collaboration

AIST recruits members from, and collaborates with, various companies and organizations to organize thematic meeting structures (AIST Consortiums). We explore potential application of cutting-edge technologies and aim at promoting R&D and creating new markets.

●Joint and commissioned research projects conducted in past years

Our joint research is R&D projects between AIST and our cooperative partners—companies, universities, or public research institutions with common objectives and goals—with the aim of creating innovative results that cannot be achieved by individual research. Commissioned research is a type of R&D project conducted solely by AIST under contract with a company or other organization. Through this research, companies can use AIST's research potential to offset their lack of necessary technology to proceed with their own R&D project. Technology consulting is a system by which AIST—a multidisciplinary group of professionals—provides solutions based on its cutting-edge research capability and abundant knowledge to overcome challenges that companies cannot solve by themselves. In FY 2021, 692 cases were conducted.

Marketing Activities toward Creation of Innovation

At AIST, innovation coordinators (IC) are responsible for liaising with external bodies such as companies and universities. As of March 2022, 58 ICs focus on transferring technology to society. The Research and Innovation Promotion Headquarters, research domains, and research units are working together to promote collaboration with partners by improving the framework of cross-sector marketing activities spanning different domains and regional research bases in order to quickly and accurately understand diverse needs according to the characteristics of different industries.

AIST supports setting up new business and creating new products and services in companies starting from coordinated menus made with various companies using its technology consulting system. Through technology consulting based on analysis of company needs, we propose research themes that span across a number of research domains based on company-wide business plans of partners. We also conduct "co-creation consulting" with companies to consider search of new business seeds and setting of coordinated themes from the concept stage.

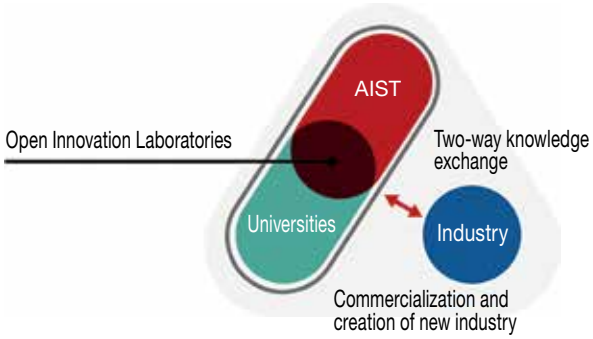
These comprehensive, cross-sector marketing activities are contributing to the creation of innovation through new business and connections between different fields.

Cooperative Research Laboratories

In order to conduct R&D that more closely relates to the strategies of companies, we are collaborating with partner companies and have set up Cooperative Research Laboratories in AIST bearing the names of these partner companies. The partner companies provide researchers and research funding, and AIST provides research resources including researchers, research facilities and intellectual property. The researchers loaned from the companies and AIST's researchers work on R&D in cooperation. As of March 2022, we were operating 18 Cooperative Research Laboratories. We hope they continue to make an impression as platforms for collaboration and synergy involving companies, universities and other research institutes. In FY 2021, we established the JX Metals–AIST Advanced Material and Technology for Future Society Cooperative Research Laboratory, the Future Core Digital Technology Cooperative Research Laboratory.

Open Innovation Laboratories

AIST has set up Open Innovation Laboratories ("OILs"), which are industry–academia–government collaborative research bases sited on university campuses. As of April 2022, 7 OILs were in operation. By sharing research bases, they seamlessly conduct basic research, application research, development and testing. They focus on faster research and active mobility of human resources using the Cross-appointment Program, and also on practical training of doctoral students and postdoctoral researchers through the Research Assistant Program. This initiative synergizes the basic research conducted at universities with AIST's goal-oriented basic research and application technology development aimed at solving social issues, facilitating transfers of technology to industry. In FY 2021, we continued the bridging function through cooperation with universities as seen in acquisition of public funds for the establishment of a place for co-creation with universities. Using OILs as hubs, we will continue to promote interdisciplinary fusion and put our efforts into strengthening the platforms for collaboration and synergy.



Participation in Technology Research Associations

AIST has become a member of Technology Research Associations, the member of which jointly carry out research and development of technologies used in industry by sharing their resources such as researchers, funds, and equipment. AIST contributes to the associations' projects from planning and performing research to utilizing research outcomes.

Particularly by sharing our "personnel" and "premises" with the associations, we aim to serve as a field where various people from different organizations can share their knowledge toward co-creation. We thus aim to help promote open innovation.

Specifically, AIST staff members participate in the associations' projects as researchers, project leaders or board members. We also give access to our facilities to researchers from industries and universities participating in the associations for carrying out intensive research.

●Technology Research Associations in which AIST participated (FY 2021)

	名称		
1	Photovoltaic Power Generation Technology Research Association (PVTEC)	9	International Research Institute for Nuclear Decommissioning (IRID)
2	Consortium for Lithium Ion Battery Technology and Evaluation Center (LIBTEC)	10	Manufacturing Technology Association of Biologics (MAB)
3	Fuel Cell Cutting-Edge Research Center Technology Research Association (FC-Cubic)	11	Thermal Management Materials and Technology Research Association (TherMAT)
4	Photonics Electronics Technology Research Association (PETRA)	12	Innovative Structural Materials Association (ISMA)
5	Technology Research Association for Next Generation Natural Products Chemistry	13	The Research Association of Automotive Internal Combustion Engines (AICE)
6	NMEMS Technology Research Organization (NMEMS)	14	Technology Research Association for Future Additive Manufacturing (TRAFAM)
7	Control System Security Center (CSSC)	15	Geological Carbon dioxide Storage Technology Research Association (CCS)
8	Technology Research Association of Magnetic Materials for High- Efficiency Motors (MagHEM)	16	Technology Research Association of Secure IoT Edge application based on RISC-V Open architecture (TRASIO)

TIA Collaborative Research Program (“Kakehashi”)

“Kakehashi” (a Japanese word for a “linking bridge”) is a funding program designed to strengthen collaborative relationships within TIA through support for investigative research projects conducted by TIA member organizations (AIST, National Institute for Materials Science, University of Tsukuba, High Energy Accelerator Research Organization, the University of Tokyo, and Tohoku University). The program aims to find “seeds” and “sprouts” of research and technology at various stages, nurture “buds” through collaboration and transfer “fruits” to industry. Its activities involve not only the 6 member organizations of TIA but also external organizations including companies as the program addresses challenges that are difficult for a single organization to tackle. Integrating people, technology, knowledge, and information of each organization through “Kakehashi” leads to planning of large-scale joint research and development projects, formation of joint research and acquisition of external research funds.

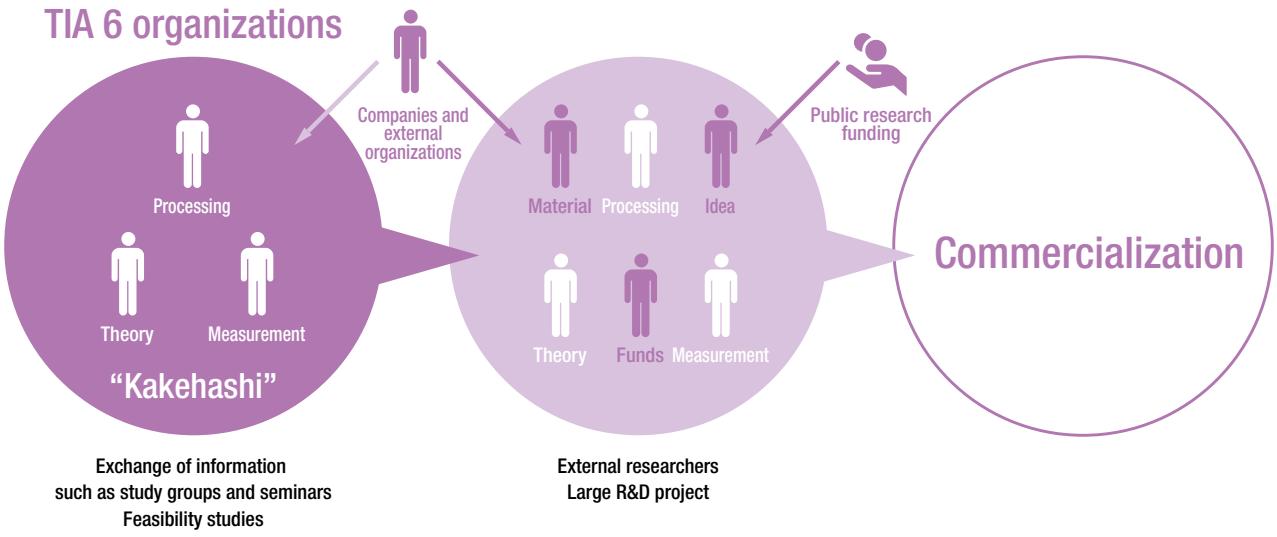
●Activities in FY 2021

51 investigative studies were chosen as “Kakehashi” themes in FY 2021 covering 6 areas such as healthcare, biotechnology, and electronic devices, of which 17 were from AIST. TIA provided not only financial support but also promoted public relations, holding on-line events and releasing related content on its website, depending on the research theme at various stages.

●Company-proposed themes

As part of collaboration with industry, “Kakehashi” has introduced research themes proposed by companies and has provided support for team formation since FY 2018. In FY 2021, there were a total of 6 company-proposed themes (of which 3 were led by AIST), including 2 themes of electronic devices, 2 themes of green sector, 1 theme of material processing, and 1 theme of basic research.

●Image of “Kakehashi”



Promotion of International Standardization

See pages 48 for more details.▶

Standardization themes that crossover a number of industries are increasing such as for various connected products with the advancement of digital technology. Under such circumstances, AIST, with the Standardization Promotion Center and research domains coming together, is further promoting cross sectoral standardization activities that span over industry and research based on political and industrial needs.

At international organizations such as International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), 69 AIST researchers are actively serving as chairs, committee managers, or convenors while 429 in total are participating as experts with specialized knowledge contributing to the development of standards.

In FY 2021, we proposed a total of 67 domestic and international standards, including the ISO standard for general requirements of moving signs, “dynamic signs,” and the ISO standard for accelerated aging tests of adhesion durability between metal and resin.

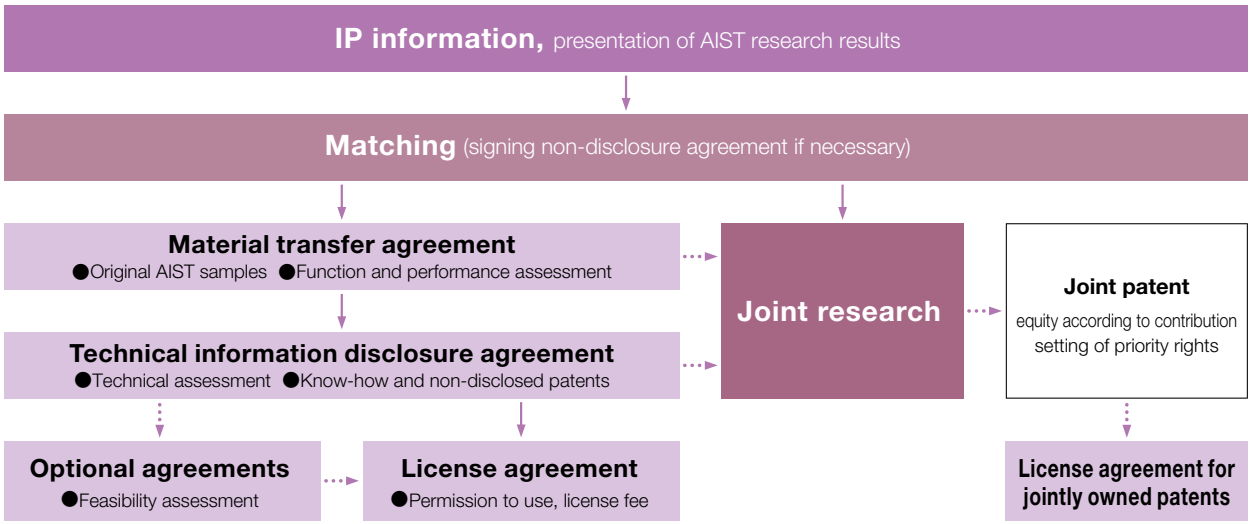
In October 2021, we established the Standardization Consortium of Marine Biodegradable Plastic (19 corporate members as of March 2022). It responds to the need for standardization in new industrial areas crossing over production, biotechnology, and environmental impact assessment. It provides information to share and a place for discussion for various private companies that focus on production of biodegradable plastics and its assessment method.

Technology Transfer Activities

It is AIST’s mission to contribute to the development of the economy and industry by disseminating its research achievements in society. To achieve this mission, AIST develops a strategic approach to obtain intellectual property (IP) rights, and appropriately maintain and manage such IP rights so that the research achievements lead to technology transfer.

Specifically, based on the needs of the partner in cooperation for AIST’s intellectual property, we perform the necessary procedures (signing of a non-disclosure agreement, a material transfer agreement, a technical information disclosure agreement, a license agreement and such), and promote wide dissemination of AIST’s research outcomes in society.

●Technology transfer process



Deploying and developing human resources

AIST promotes staff exchanges to facilitate the development and utilization of personnel who will produce innovation. AIST's efforts to develop training activities include AIST Innovation School and AIST Design School.

Cross-appointment Program

See page 48 for more details ▶

To create a cross-institutional research system, in November 2014 AIST established a cross-appointment program. This program allows a researcher to enter into employment contracts with multiple institutions and he/she can work in research, development, and education according to his/her role in each institution.

Interchange of researchers between AIST and the other institutions increases mobility of human resources among academic, industrial, and governmental sectors. As a core institution for transfer of technology, AIST is expected to adopt superior technology seeds produced by fundamental research by universities and to promote transfer of technology for practical application of research outcomes and creation of new industries.

We accept 32 researchers from 13 universities, 1 private company, and 2 institutions, and send 11 researchers to 7 universities and 3 private companies and 1 institution. (As of April 2022.)

AIST Research Assistant Program

AIST established AIST Research Assistant Program designed for graduate students with remarkable competencies. It aims to develop human resources of world-class, high-level expertise with practical abilities that can be applied in diverse environments. This program allows talented graduate students to develop their abilities to plan and proceed with advanced research by participating in AIST's R&D activities that respond to social needs, while focusing on research for their degrees without financial insecurity.

In FY 2021, 432 students in graduate programs engaged in R&D at AIST.

Employment requirements for AIST Research Assistants

(as of May 2022)

Candidate	Graduate students in master's programs	Graduate students in PhD programs
Requirements	R&D abilities that may help to promote AIST's R&D projects and capability to work independently under staff guidance.	Superb R&D and paper-writing abilities that contribute highly to the promotion of AIST R&D projects and capability to work independently under staff guidance.
Days of employment	Avg. 4-14 days/month	Avg. 10-14 days/month
Salary	1,500 yen/hour (approx. 80,000 yen/month for 7 working days)	1,900 yen/hour (approx. 200,000 yen/month for 14 working days)
Number of graduate students employed in FY 2021	432	

Technical Training

See page 49 for more details ▶

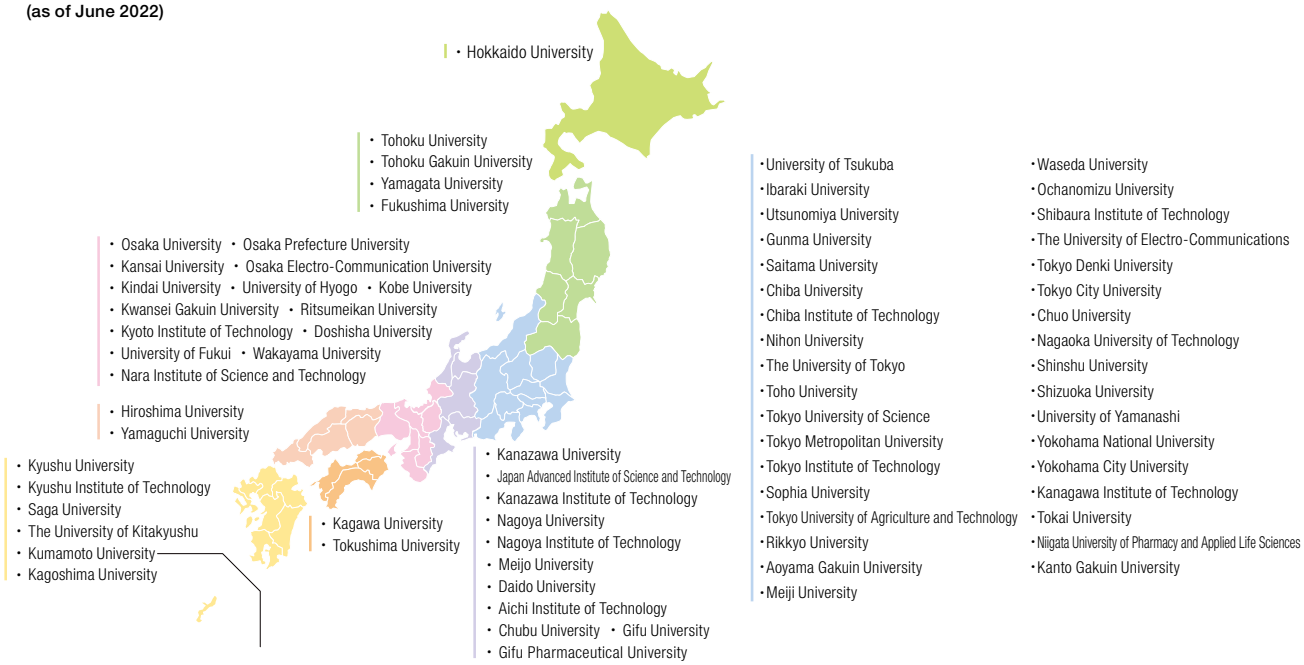
The technical training is a program in which AIST accepts researchers, engineers, and students from companies, universities, and public research organizations for defined periods and provides them with an opportunity to acquire skills under the instruction of AIST researchers. The program may also be used for the purposes of short-term technical training (internships) and educational programs for academic credits, which are both designed mainly for university students.

●Partner Graduate School Program

Using the knowledge and experience gained at AIST, AIST researchers teach as guest professors at graduate schools that have cooperation agreements with AIST. Within this program, AIST also provides technical training to the graduate students on the site of AIST. This program is deemed to be part of the students' academic degree programs.

●75 universities with partner graduate school agreements

(as of June 2022)



Innovation School

AIST Innovation School aims to train human resources able to contribute to innovation.

To address increasingly complicated social issues, we need to develop innovative technologies by integrating the ideas and technologies of AIST and external organizations. For this we need personnel who can play a central role in collaboration. AIST actively accepts postdoctoral researchers and graduate students, and provides lectures and training to learn and develop 3 skills: “research skills” that are learned through scientific and technological knowledge in specific areas of expertise, “cooperation skills” acquired through working with experts in different fields, and “resourcefulness” nurtured through communication, the ability to develop one’s own career.

In FY 2021, we conducted lectures, seminars, and long-term business training as part of the training course of “human resources for innovation,” and 14 postdoctoral researchers completed the course. We ran a half-year course online on “basic research skills” as an education program for graduate students in response to social conditions, and 35 students completed the program of lectures, seminars, and technical training conducted at AIST.

Online lecture/seminar

●Curriculum of the Innovation School

1 Lectures and exercise at AIST

Topics

- Postdoctoral human resources expected by companies
- Intellectual property training
- Research ethics
- Companies and industries
- Research example cases at AIST (technology bridging research, goal-oriented research, integrated research, standardization etc.)
- How to create an innovative project
- Exercise on skills in presenting research in ways that can be understood by people from different fields
- Business manners, communication skills
- Exercise on how to develop one's career
- Coaching for collaboration between different fields (interdisciplinary collaboration)
- Data science

2 Training at AIST

- Working on research topics in laboratories
- Experiencing research at AIST

3 On-the-job training with companies

(2 months or more, part of the training course of "human resources for innovation")

- Research development activities, productization, speed of technology development, importance of cost awareness at companies
- Experiencing teamwork, importance of collaboration with other departments

●Expanding the vision of young researchers

Through the lectures and interactive communication among students of the school they commented that it broadened their perspectives: "It was meaningful that I was able to deepen exchanges with students of various backgrounds," "I was able to broaden the perspective of my research activities by deepening my understanding of research at companies through the training." Through training at companies, "I was able to learn approaches other than research regarding social issues," "I became aware of effectively structuring work taking into account my ability, work environment, and time, and this will help me greatly in the future." Companies that have accepted trainees say that "the students inspired the employees, and the opportunity was effective in finding good talent," and "the students' attitude toward work was serious, and the project leaders generously cooperated with them." The companies rate the trainees' research capabilities and work attitudes highly.

Since the school started, over 600 students have completed the two training courses. They have discovered their new potential and are working in a variety of areas at companies, universities, and public research institutions.

AIST Design School

This is said to be the age of VUCA (volatility, uncertainty, complexity and ambiguity), an age of rapid change in which it is unclear what issues should be addressed. In particular, there has been a huge change in lifestyles since the beginning of 2020 because of the COVID-19 pandemic, and there are great expectations of science and technology, and technologies such as AI and robotics are progressing at speeds beyond the capacity of humans to adapt to change. Business too is moving from "what things should we make?" to "why do we make things?" and it has become more difficult to launch new ventures.

In these times, speed through agile development (smart development), which is different from a traditional linear process from original idea to R&D, field testing, and then commercialization, is needed in an organization for innovation. Moreover, the purpose, values, culture of the organization, and its members' purpose, and values need to be clarified, and it needs to fit with the society's values, and new values need to be presented and co-created.

To respond to the requirements of society described above, we opened the AIST Design School in 2018 as a forum for AIST researchers and participants from business to cultivate the capabilities (competencies) needed for co-creation and marketing and business.

In FY 2021, 130 students completed courses at the school (14 students taking a standard course, 22 a short course, and 94 single-session courses).

In FY 2021, with preventing COVID-19 infections and benefits of face-to-face learning in mind, the school designed and employed a hybrid online and face-to-face curriculum. As a result, 100% of the students said that they would recommend the course to colleagues, thus expressing their satisfaction.

Competencies being cultivated

- Have a firm point of view and deep understanding of self (introspective, axial strength)
- Aware of cognitive limits, and able to explore the world from a new view point (bird's eye viewing ability, exploratory strength)
- Through rich dialogue, able to deeply empathize and understand others and society (dialogue skills, empathy)
- Able to co-create new values for society and lead the world (ability to co-create, ability to execute)
- Able to endure a situation with no solution (negative capability)

Curriculum

- Experiential learning of dialogue that approaches essential values
- Creative leadership training in collaboration (concluded in December 2019) with KAOSPILOT in Denmark, which is considered the most radical business school
- Future insight with a professor from Hitotsubashi University
- Idea generation and prototyping with a professor from the University of Tokyo who taught for years at Britain's Royal College of Art (RCA)
- Project design by formation and execution of team projects

Face-to-face learning

TOPICS

AIST technology transfer ventures (AIST Start-ups)

Financial investments in AIST technology transfer ventures, through which AIST applies the outcomes of R&D to business, were enabled by the Act on the Vitalization of Science, Technology and Innovation of December 2018 (a revision of the Research and Development Enhancement Act, Act No. 63 of 2008). The relevant system was established in 2019.

AIST made its first investments in two AIST technology transfer venture companies, SOCIUM, Inc. and ProteoBridge Corporation, in June and December 2021.

The purpose of an investment from AIST is pump-priming for private investment in an AIST technology transfer venture at the founding and early stages, in principle to complement private venture capital and the like in accordance with "Guidelines on Investment by Designated National Research and Development Institutes" (from the Cabinet Office and MEXT).

With these investments triggering faster private fundraising, we hope that commercialization applying research outcomes from AIST will lead to the growth of related industries.

Strengthening international collaboration

AIST is building a global network with prominent research institutes around the world and is promoting efficient and effective research cooperation through international collaborative research, workshops and seminars, and personnel exchanges which include dispatching and inviting researchers.

Increasing Global Presence

AIST has been raising its international profile not only by conducting world-leading research but also by strengthening collaboration with overseas research institutes and through inter-organizational personnel exchanges. As an effort to enhance collaborative relations with overseas institutes, AIST, together with RIKEN, organized the Tenth Global Summit of Research Institute Leaders in October 2021. The purpose of this summit was to bring together the heads of the world's leading research institutes to discuss the future of science and technology, the role of each institute, and collaboration among research institutes. The tenth summit was attended by leaders representing 25 research institutes from 17 countries, who engaged in vigorous online discussion on the theme "Contribution to resilient society through science and technology." President Ishimura in his opening remarks spoke of the importance of research institutes around the world to cooperate to create innovation in order to face big challenges such as worldwide spread of infectious diseases and natural disasters of recent years.

During the conference, the importance was confirmed of “research being conducted beyond research fields and national boundaries during the Covid 19 crisis” and “the need for each to fulfill a major role in order for research institutes to pursue a resilient society through science and technology.”

Accepting Foreign Researchers

See page 49 for more details ▶

To enhance cooperation with overseas research institutes and to develop an international network of researchers, AIST welcomes foreign researchers from universities and research institutes around the world. In FY 2021, a total of 429 foreign researchers engaged in research at AIST.

By region, researchers from Asia accounted for more than 70% of the total, followed by Europe.

Strengthening International Collaboration to Address Global Issues

AIST has concluded Memoranda of Understanding (MOUs) on comprehensive research collaboration with 21 leading institutes representing various countries/regions worldwide and is engaged in the development of international research networks. In accordance with these MOUs, we aim to tackle global issues through joint research and personnel exchanges with overseas research institutes.

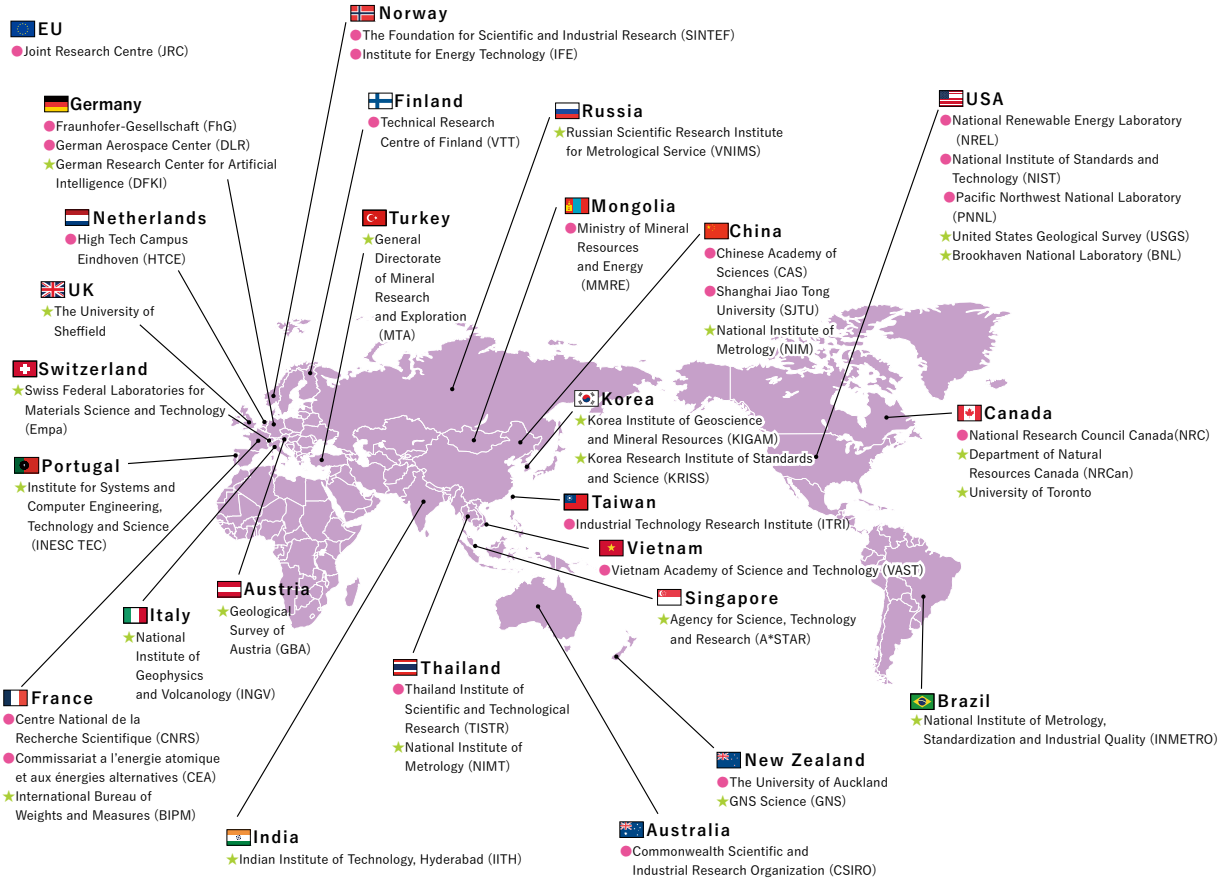
At the same time, through international collaborative research, workshops and seminars, and international conferences, AIST is forming a global network with influential research institutes in countries around the world and is promoting efficient and effective research cooperation. In 2021, the ITRI-AIST Joint Symposium 2021 was held online between the Industrial Technology Research Institute (ITRI) of Taiwan. In his opening remarks, President Ishimura noted that, since concluding a comprehensive Memorandum of Understanding (MOU) in 2005, AIST and ITRI have deepened collaborative relations and produced results in a wide range of fields. He also presented ITRI as an important partner in solving various social problems

facing the world, such as global warming, frequent natural disasters, and pandemics. The opening remarks were followed by keynote speeches on ITRI's technology development strategy including venture development, and AIST's research strategy for the 5th Medium- to Long-term Plan, presentations on the research collaboration achievements by the two institutes, technical sessions and online lab tours, and there were lively discussions among the participants.

ITRI-AIST Joint Symposium 2021

●LIST of MOUs

● : Comprehensive MOUs ★ : Specific MOUs (excerpts)



as of March 2022

AIST and It's Staff

Human rights

A wide variety of people work at AIST in addition to executives, permanent employees and contract employees, including temporary employees, visiting researchers, technical trainees, contractors, visitors participating in industry–academia–government programs, and visitors participating in international programs. Everyone performs their duties with the awareness that it is important to have an attitude of respect and support for each other, regardless of title or position.

Protecting Human Rights in Research

AIST conducts ergonomic research involving human subjects, and medical research carried out in compliance with our Ethical Guidelines for Life Science and Medical and Health Research Involving Human Subjects.

In FY 2021, we implemented 173 research projects involving ergonomic experiments and 113 medical research cases.

Regarding an ergonomic experiment, the experimental protocol is reviewed based on opinions of the Committee on Ergonomic Experiments, which consists of external members, in accordance with the Declaration of Helsinki* to ensure the safety and scientific validity of the experiment. Likewise, a medical research experiment is reviewed in accordance with ethical guidelines based on the opinions of the Bioethics Committee consisting of external members.

When an experiment is performed, its participants are given thorough oral and written explanations of the details of the experiment and of their right to revoke consent. In this way, we ensure that their human rights and dignity are protected.

* Subtitled "Ethical Principles for Medical Research Involving Human Subjects," this is a code of conduct regarding human subjects adopted by the 18th World Medical Association General Assembly in Helsinki. Medical researchers have established this rule to regulate themselves with regard to medical research involving human subjects.

Harassment Prevention

Harassment stains a person's personality and hurts the dignity of the person being harassed and causes emotional distress and disadvantage. Not only the person harassed but also those who learn of the presence of harassment may suffer from reduced motivation to work, and the loss such as adverse effects on the results of research and resignation of talented people can be immeasurable. AIST has internal rules in place and provides training to make the workplace free of harassment.

●Harassment prevention measures

- AIST has in place rules for handling harassment and has defined procedures for the prevention of harassment.
- AIST provides counselors placed at AIST work sites with training on how to prevent harassment and provide counseling for harassment victims. We also hold a seminar on harassment targeting all employees to enhance awareness.

●Counseling system

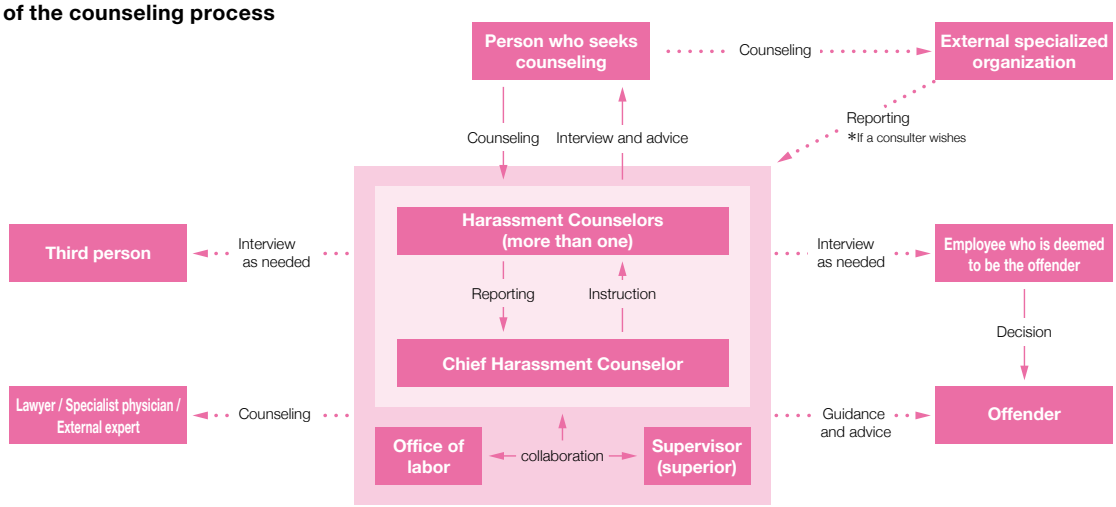
Each site has workplace harassment counselors. The counselors work to counsel, investigate, and mediate so that harassment victims are not distressed and suffer alone as a result of their experience. If the line of management or a counselor cannot address a harassment issue, it is possible to file to the Compliance Promotion Committee for the recovery from the disadvantages suffered. The committee reviews the issue and recommends the appropriate actions, which are then taken.

In addition, we have established an external counseling organization and made counseling by email or telephone possible to make it easier to seek counsel and to protect privacy.

Training programs provided on harassment in FY 2021

Training program	Trainees	Objectives	Number of traineesin FY 2021
New Employee Training	New AIST employees	As part of training in the attitudes, basic knowledge, and skills required to perform their work, participants learn the basics of harassment issues and harassment prevention.	118
e-learning training for employees *including e-learning training for foreign researchers in English	Permanent employees, contract employees	As part of their learning of the basic organizational ethics and rules of AIST, participants learn the basics of harassment issues and harassment prevention.	6,881
Harassment Counselor and Sexual Harassment Counselor Training (online training and e-learning)	Harassment counselors	Participants learn the harassment prevention knowledge and skills required by counselors. These include face-to-face counseling techniques based on lectures.	40 113(viewing number)
Harassment Prevention Seminar (e-learning)	AIST employees who wish to attend the seminar	Participants learn the basics of harassment issues and harassment prevention.	221 (viewing number)

Flow of the counseling process



* Those who seek counseling can include people other than the employees involved (i.e. they can be the employee who is deemed to be the offender, the employee who is deemed to be the victim, or someone else, such as a colleague or a supervisor).
* Counseling can be sought by means of a face-to-face meeting, telephone call, email, letter, or fax. (contact by email or telephone with external specialized organizations)
* Seeking counseling causes no disadvantage.
* Adequate consideration is given to the protection of privacy, and any information acquired in the course of counseling is kept strictly confidential.

Harassment counseling cases

(Persons)

	FY 2020	FY 2021
Sexual harassment	2	2
Power harassment	17	18
Total	19	20

Hiring Fixed-term Employees through Open Recruitment at AIST

The work conducted by AIST's headquarters organizations and operating units includes routine work such as purchasing, asset management, and employee benefit management which can be done more efficiently by engaging highly experienced employees.

A skilled contract employee and a temporary employee who have been working at AIST for a certain period of time can be candidates for employment by AIST under the fixed-term regional employment system (i.e. employing administrative staff who are not transferred from one region to another). AIST has hired 67 people in total, and these employees have been working at the headquarters organizations and operating units. We receive dozens of applications each year, and in FY 2022, we hired 14 people.

The employees can work for up to 2 years, yet they have a chance to be hired as permanent employees based on evaluations of their work performance. 57 employees have been rehired as permanent employees so far. AIST will continue to hire fixed-term regional employees to support research and development, innovation, and other activities.

Diversity

AIST aims to provide a working environment that embraces the values and ideas of employees with diverse attributes, including gender, age and nationality.

Activities of Intellectually or Developmentally Challenged Teams

AIST has set up Challenged Teams, made up of people with intellectual challenges and developmental challenges, at AIST Tsukuba, AIST Chubu and AIST Kansai. Each year, with reference to regional minimum wages, these people are employed on contracts at wages above the minimum wage for the region. They perform clerical support work, environment improvement work and the like with the support of instructors.

●AIST Tsukuba

The AIST Tsukuba Challenged Team, made up of 13 members and four instructors, assists with clerical work and improves the working environment. In FY 2022, a new team was set up at AIST West of 3 members and 1 instructor, and they assist in improving the environment.

A week's schedule is set, and upon request from departments, the members carry documents between offices, pick up and shred discarded printouts, clean and redeliver binders, and clean lecture rooms and sidewalks. As dexterity training they make eco-friendly bags from old newspapers and small eco-friendly envelopes and bags from geological maps and distribute them. This year they engaged in gardening and flower growing. The team hopes to expand its activities and will try new tasks.

AIST West team

Enclosing papers

●AIST Chubu

The AIST Chubu Challenged Team currently has five members and one instructor. The team assists clerical work and engages in beautifying the environment. It regularly conducts cleaning and weeding the premises outdoors, activities indoors such as cleaning meeting rooms, collecting, sorting, and recycling used paper and cardboard and setting up meeting rooms. The team, upon request from departments, also do unscheduled work.

Team members working

●AIST Kansai

The AIST Kansai Challenged Team presently comprises two members and one instructor, mainly working to beautify the premises. It contributes to maintaining trees and vegetation there by clearing weeds with a weeder, cutting high dead branches with a tree trimmer, and doing other tasks using various machinery and tools.

Weeding the premises

Measures to promote diversity in the Fifth Medium- to Long-term Plan

See pages 50–51 for more details ▶

Measures to promote diversity in the Fifth Medium- to Long-term Plan (April 2020 to March 2025) were stipulated in March 2020. Activities in FY 2021 are shown in the table below.

Measure	Goals	Main outcomes in FY 2021
Achieving work–life balance	To promote measures to support work–life balance and create a work environment so that everyone working in AIST can work in a way that balances work with life and that mitigates career interruptions resulting from life events	• We are continuing to provide a teleworking system for working at home to support childcare, which was used by 12 employees (6 men and 6 women). • In parallel with the working at home system to support childcare, we are implementing special measures for working at home as a COVID-19 countermeasure. We are planning to introduce an expanded teleworking system for new styles of working in the future.
	To embed attitudes unconstrained by established ideas of gender roles, to promote the provision of workplace environments that enable both men and women to conduct their childcare, and to widely adopt measures that support work–life balance	• We held online work–life balance (WLB) lunch meetings (3 on childcare, 1 on the support system for hiring supplemental staff, 1 on careers). • We worked on providing information and spreading awareness in the Institute of systems of childcare leave etc.
	To spread awareness in the Institute and improve the childcare and nursing care support systems as required to meet the needs of employees during maternity leave, during childcare leave, during nursing care leave, and after returning to work	• We held online WLB seminars on remote care balancing work with nursing care (91 participants). • Twenty people were supported by the support system for hiring supplemental staff (18 for childcare support, 2 for additional childcare support). • We conducted a diversity promotion survey and learned that many staff want to know more about the childcare and nursing care support systems.
Promoting the activities of female employees and expanding the employment of female research staff	To support the promotion of female managers, to step up measures to improve staff motivation, spread acceptance, and improve the workplace environment; to aim for the proportion of female managers to be 12% at the end of the period	• The proportion of female managers was 8.6% (35/406) at the end of March 2022. • We held a cross-industry event as part of MEXT's development support program for science personnel, "Initiative for realizing diverse research environments (collaboration type)."One female researcher gave a presentation and was awarded a special prize.
	Actively advertise employment opportunities for female research staff and to step up measures in accordance with the situation in each research domain	• We arranged informal meetings and lab tours with female researchers at AIST for female postgraduates and postdocs (36 participants from universities around Japan), and held online events for female middle and high school students. • We participated in ten events at the invitation of universities and academic societies, giving introductions to research jobs and AIST. • 91 women applied for research posts in response to advertisements in FY 2021.
	To maintain the proportion of women in research posts at or above 18% over the five-year period; Hiring of administrative staff with the aim of achieving similar proportions of women and men in administrative posts.	• The proportion of women appointed to research posts (new entrants) in FY 2021 was 17.6% (15/85). • The proportion of women appointed to administrative posts (new entrants) in FY 2021 was 48.1% (13/27).
Recruiting and support for onboarding and work of foreign researchers	To raise foreign researchers' awareness of AIST by providing information to foreign researchers on a public English website in order to support the recruitment and integration of excellent foreign researchers	• Information provided on the public English website was updated. • The proportion of foreign employees (foreign nationalities) recruited to research posts in FY 2021 was 12.9% (11/85).
	With AIST International Center (AIC) focusing on residence and living support services for foreign researchers, to understand the needs of regional research bases and, in cooperation with the appropriate departments, hold seminars in English on work in the Institute etc.	• We gave explanations and prepared guidebooks on internal systems such as childcare support in both Japanese and English. • AIC collaborated with relevant departments to give foreign researchers and onboarding mentors seminars in English (two), courses in Japanese, and information announcements for foreign staff (12 monthly newsletters). • We handled 111 consultations on various subjects and 21 enquiries about the Ministry of Justice's points-based preferential immigration system for highly skilled foreign professionals.
Career development	To provide career counseling and lectures by experts, a mentor system, and consistent support from career path design to career development so that each researcher can take a positive approach to their career	• Lectures on diversity were included in internal training at various levels (induction training and unit manager training). • One person took mentor system training overseen by Ibaraki Prefecture. • Career development support training was given online (two sessions). In response to the establishment of the personnel management policy, useful communication skills were included in the training curriculum. • Career counseling (150 consultations): due to the effects of COVID-19, a mix of face-to-face counseling and online counseling was provided.
Comprehensive promotion of diversity	To prepare suitable workplace environments for people with disabilities, to promote the hiring of people with disabilities and comply with statutory employment rates, and to support people with disabilities to be active members of society	• The number of employees with disabilities was 137 out of 5281.5, achieving the statutory rate at 2.6%. • We presented the work of the barrier-free promotion group at the Tsukuba assistive products exhibition (online). • We installed walking guidance mats for visually impaired people and reclining chairs (in break rooms) for people with physical disabilities. • We switched from regular mobile phones to smartphones that can be operated with voice commands for visually impaired staff.
	To nurture awareness of diversity throughout the Institute to promote acceptance and understanding of people with diverse genders, ages, nationalities, etc.	• We held seminars focusing on diversity and inclusion, enhanced understanding of diverse characteristics such as disabilities and LGBTQ identities, and studied how to create suitable workplace environments. • We are considering signage for facilities provided for diverse characteristics, such as universal toilets.
	Guided by the Diversity Promotion Committee, to apply the PDCA cycle to promotion measures, consider necessary policies, and promote diversity throughout the Institute.	• A survey on diversity promotion was conducted (adding new sections on teleworking and a married couples leave-matching system). Awareness of appointments of female managers and familiarity and satisfaction with work–life balance support systems were compared with the previous year to ascertain the current situation.
	To contribute to the Diversity Support Office (DSO) as a key member organization; to sustain cooperation with other organizations and contribute to society	• Together with the University of Tsukuba and IBM Japan, we continued activities in line with MEXT's "initiative for realizing diverse research environments (collaboration type)." • We continued to coordinate the activities of a diversity support network of 20 research and education institutions in Japan (the DSO), exchanging information such as case studies, and improving internal systems.

TOPICS

Informal meetings and lab tours for postgraduates and postdocs

In 2015, AIST began holding events for female graduate students, including lectures by female researchers who serve as role models, informal meetings with female researchers, and lab tours introducing female graduate students to understand AIST and their career image in research positions. Every year, the contents of the program have been devised from time to time, and events that are easy to participate in have been held.

From 2020, from the perspective of preventing the spread of COVID-19 infections, we have changed the event to online and have held it without canceling it. In particular, in the video production for the lab tour, we have gotten the cooperation of many employees and filmed the clean room and the interior of the experimental equipment, which are normally not accessible. In addition, we edited and adjusted the audio output to make it easier to understand, and we were able to deliver a video that reminds us of a virtual lab tour. In March 2022, we were able to introduce more labs than usual years by distributing an archived lab tour video and holding informal meetings.

Participant surveys showed a high degree of satisfaction with the lab tour etc. in the events, so we will continue to actively advertise them to increase the number of students who are interested in AIST and research positions.

Safety and health

As would be expected in laboratories, AIST uses substances and equipment that may affect the human health and the environment, such as various chemical substances, high-pressure gases, radioisotopes, genetically modified organisms, nanomaterials, laser equipment, and various experimental equipment. Accordingly, AIST creates a work environment in which all people working there can do so in a safe and healthy manner.

Occupational Safety and Health

See pages 52 for more details ▶

●Safety and Health Committee and webcasting of “the summary of incidents and safety and health management” videos

The Safety and Health Committee meetings attended by labor and management representatives are held monthly to discuss safety and health issues. Each month, the incidents and safety and health management information are summarized and streamed on the intranet to inform and reconfirm safety and health management rules. By making it mandatory for all employees to view the video, we work on increasing safety awareness.

●Establishment of Safety and Health Guidelines

Safety and Health Guidelines set out precautions on handling hazardous chemicals and high-pressure gas cylinders, disposal of research wastewater, fire and disaster prevention.

Serving as the basis for employee safety education and for laboratory work, these guidelines are reviewed and revised as needed. In FY 2021, major revisions including chapter alterations were made to make it easier for employees to attain desired information on safety management.

●Emergency preparedness

AIST conducts disaster, fire, and other security drills so that we can promptly respond to emergencies such as disasters and accidents, thereby minimizing damage. We also perform safety confirmation drills using our safety confirmation system* for quick and smooth grasping of the safety of employees.

To ensure a means of communication with our regional research bases nationwide in the event of a disaster, we also conduct emergency communication drills using emergency radiotelephones installed at those bases. As part of preparedness for disasters such as large-scale earthquakes, we stockpile food, rescue equipment, and other emergency supplies, which are inspected and refreshed on a regular basis.

* In the event of a disaster, the safety confirmation system automatically sends bulk safety confirmation emails to executives and employees. It automatically collects the results and displays them on the web.

Preventing occupational accidents

In the event of a occupational accident, an investigation and analyses are conducted to determine the cause, and recurrence-prevention measures are implemented. The information on the accident is communicated to all employees to prevent similar accidents.

AIST holds a Safety Management Report Meeting every morning connecting Environment and Safety Headquarters with each research base using a web conference system to share information on accidents and near-miss incidents. The aim is to share details of recurrence prevention measures and thus improve safety and health.

FY 2021 saw one case increase in the number of total cases compared to FY 2020, however, there were no serious accidents. To address this situation, we provide safety education to make sure that appropriate protective equipment is worn, prepare work procedure manuals and risk assessment for high-risk tasks, and enhance sensibility by conducting risk prediction activities to foster safety culture.

Safety education and support for license acquisition

AIST accepts many researchers, engineers and students from businesses, universities and the like for cooperative research, technical training and so forth. With a view to preventing accidents, AIST runs a number of safety training programs and classes, both for employees and for visitors from other organizations. Safety education provided when employees are hired and when there is a change in work details is managed by an internal safety education management system, which allows participation history and program contents to be checked as needed.

Health Management and Mental Health

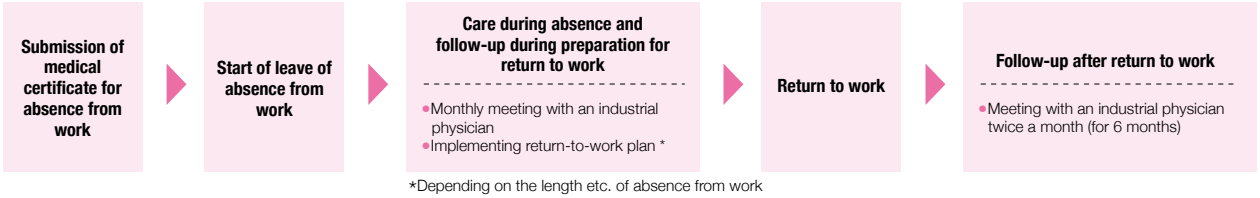
See pages 53 for more details ▶

General and special medical examinations are performed in spring and autumn every year. We strive to increase the percentage of employees who undergo medical examinations by raising awareness that they are required to take these examinations, including health screening. As follow-up care after medical examinations, an industrial physician and industrial health staff provide health advice for the prevention and detection in the early stages of health disorders and illnesses. In response to employees' diverse needs, we also provide health information through health support seminars to raise health awareness, and thus provide support to improve the performance of individual employees and AIST as a whole.

To address mental health issues, we have developed a unified Mental Fitness Program in accordance with the directives and guidelines of the Ministry of Health, Labor, and Welfare. Four programs based on the Mental Fitness Program are implemented in a continuous and planned way. They focus on (1) self-care; (2) line care through implementation of education and training and seminars; (3) care by in-house industrial health staff and others through face-to-face counseling with an industrial physician and industrial health staff and support in returning to work; and (4) care by external resources through the use of external mental health organizations.

We use a stress check system (once a year) to encourage awareness of stress situations of staff and to promote workplace improvement to create a comfortable workplace. By doing this, we are making efforts to strengthen measures to prevent staff from suffering mental health disorder. For the entire AIST, the average stress score has been lower than the national average since the stress check was introduced.

Outline of return to work program



*Depending on the length etc. of absence from work

Community Involvement

Establishing the Material Process Innovation (MPI) Platform

What is the MPI Platform?

The materials industry in Japan is at a high level internationally and is expected to continue leading the world. The Integrated Innovation Strategy Promotion Council of the Cabinet Office has discussed strengthening of materials innovation and declared that strong industry–academia–government collaborations and the construction of development infrastructure are important. The Department of Materials and Chemistry is working to build the Materials Process Innovation (MPI) Platform as a hub for leading-edge research equipment, to nurture materials development personnel, and prepare infrastructure for data-driven materials R&D.

1 Equipping and deploying a social implementation support base

Supporting industry in rapid social implementation of developed technologies by preparing production and evaluation equipment at the base to be used for R&D and personnel development

2 Preparing infrastructure for data-driven materials R&D

Preparing infrastructure (equipment and networks) to collect and use production process data; creating basic technologies relating to process informatics that will use data to improve production processes

Specifically, the MPI Platform covers these three fields: advanced catalysts (at AIST Tsukuba); ceramics and alloys (at AIST Chubu); and organic and biomaterials (at AIST Chugoku). By leveraging AIST's production process potential and collecting end-to-end, high-throughput process data from feedstocks to finished products, we are building the MPI Platform to be capable of analyzing and improving fabrication processes.

MPI Platform bases
https://unit.aist.go.jp/dmc/platform/MPI/index.html

Equipping a ceramics and alloys base at AIST Chubu

Product material industries that utilize ceramics and alloy materials have high international market shares. This base is being prepared to enable development of new materials and support for trial developments of component materials for these product material industries. The base is being equipped to create R&D infrastructure that enables trial production of the raw materials required for product development and collection of the data required for component materials development. In particular, ceramics, alloys and such are used in the next-generation electrical components necessary for an advanced digital society; in the mobility field for the electrification of automobiles, aerospace equipment and so forth; and in fields such as decarbonization, environment, and energy. The base is being provided with trial production equipment and analytical evaluation functions to enable processing of these materials from feedstock powder compositions to component materials—including molding, machining, sintering and film formation—and materials evaluations of ceramics and such on the same site.

Equipment is being installed for collecting various kinds of data suitable in, for example, improving new functions and structural characteristics; using electromagnetic waves to synthesize novel powders; using 3D additive printing technology to develop ceramic members with complex shapes; using low-temperature ceramic sintering technology for device development; evaluating the reliability and integrity of ceramic members for electrical components, healthcare, structural materials and so forth; and employing process informatics with a focus on magnetic materials for development. This equipment will provide support with the aim of shortening development lead times.

Ceramics and alloys base (AIST Chubu)

Connecting with local communities online: FREA, Tsukuba and Kashiwa

Two-way communication with all stakeholders is important for AIST. In FY 2021, Fukushima Renewable Energy Institute (FREA), AIST Tsukuba, and AIST Kashiwa held online events to cultivate deeper conversations with their local communities.

FREA: Online open house

Developing renewable energy has become more and more important in recent years as a measure to address global energy and environmental constraints, as well as a valuable domestic energy source for Japan, which is poor in natural resources. In September 2021, FREA organized an online open house event on the theme of "wind turbine secret: Why is everyone interested in renewable energy now?" The main target audience was children, especially elementary school students. A variety of contents were provided to inspire interest in renewable energy, such as 360° views from the top of a wind turbine over 40 m high, quizzes to learn about energy systems, videos of crafts to make at home, including how to make paper cup windmills, chemical batteries, etc. Very many participants enjoyed it, making comments such as "The view from the windmill was great" and "It was easy to take part even at home."

AIST Tsukuba: Sansoken Saturday

AIST Tsukuba put on five live streaming events using YouTube. The events went into laboratories that the public are not normally allowed in and described the research being done there. They included a demonstration of a robot checking for problems in pipes and an experiment to produce silica from incineration ash in real time. At the studio, researchers introduced research on ants and bees, research using X-ray computer tomography (CT) and a detonation experiment testing the strength of an explosives store, with videos and diagrams to aid understanding. Many people took part in an online viewer participation quiz. During the streams, reactions and questions came from viewers in real time and two-way communication was achieved. Comments provided by the viewers included "I thought it would be for children but it was fun for adults to watch too" and "I was pleased that we could ask questions."

AIST Kashiwa: Open house 2021 (online)

Sansoken Saturday archive
https://www.aist.go.jp/science_town/live/

AIST Kashiwa applies IT and robotics to pursue research centered on human augmentation technologies that are put in close proximity with people to enhance their human capabilities. Local people, other research institutions, and businesses in the Kashiwanoha area, where AIST Kashiwa is located, have helped us with social implementation research of this new technology. In October 2021, AIST Kashiwa held an online open house to inform local people about its research activities and ask for their continuing help. With the theme "AIST at home! Remote experience tour," it provided opportunities for people to see lectures, virtually move around inside the facilities, and talk to researchers. They rode on avatar robots and visited laboratories, danced with researchers, and experienced human augmentation technologies within the online event.

Conducting a live streaming event (AIST Tsukuba)

Basic Information about AIST

Future Outlook

Under the vision "Create the Future, Collaborate Together," AIST is pursuing research activities to give the world technologies that can enable a sustainable society, address social problems, and generate economic development.

Aiming to Fulfill the AIST Mission

Basic policy for the Fifth Medium- to Long-term Plan

In the Fifth Plan, AIST has taken up the mission of producing world-beating innovation that solves social problems and contributes to stronger economic growth and industrial competitiveness. We will make particular efforts focused on the three themes described below. To maximize the outcomes of these efforts, we are working on pioneering laboratory management as a Designated National Research and Development Institute, enhancing and accumulating technological intelligence, and contributing to national strategies.

Ⅰ. R&D that spearheads innovation for solutions to social problems

(see the Opening Article starting on page 4 for more details)

Ⅱ. Strengthening the innovation ecosystem through improved bridging

1 Promoting focused development that leads to stronger industrial competitiveness: To further enhance the bridging function that was improved during the Fourth Plan, AIST will conduct research that facilitates more connections with business in cooperative research and that matches industry needs precisely at advanced levels.

2 Stronger functioning as a platform for collaboration and synergies: Using the Collaborative Research Laboratories and Open Innovation Laboratories as enhanced hubs for the bridging function linking AIST's technological seeds to commercialization, we will strengthen and expand our function as a platform between organizations, encouraging collaborations and synergies between many organizations, including collaborations with ministries and government agencies.

3 Promoting regional innovation: AIST will work to understand the needs of major regional businesses and small and medium enterprises, and to promote innovation that invigorates regional economic activity by closely collaborating with local bureaus of economy, trade and industry, public testing and research institutions, and universities.

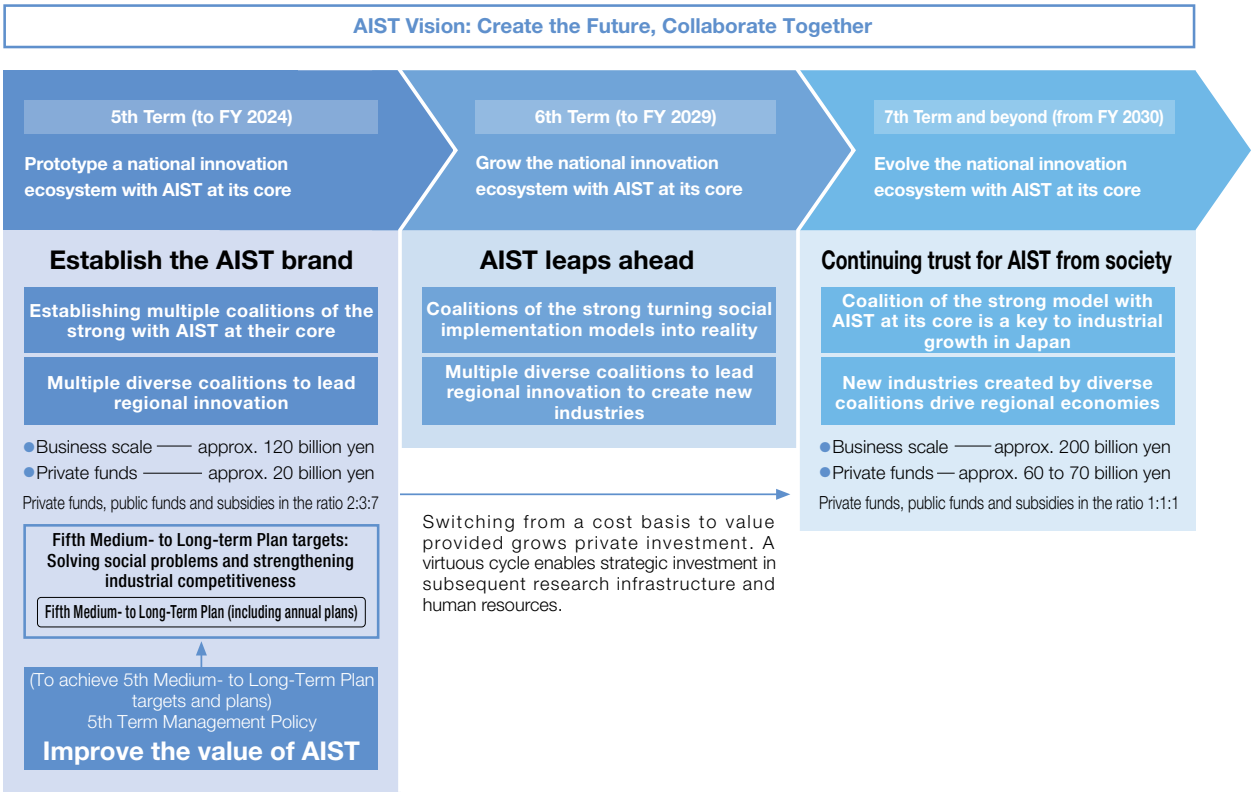
Ⅲ. Developing infrastructure to support the innovation ecosystem

1 Creating even more technology seeds with a long-term perspective: To create more key technology seeds and breakthrough technology seeds, AIST will strive to focus even more on long-term, challenging research that is unlikely to produce results in the short term.

2 Further improvement of standardization activities: AIST will proactively work on cross-disciplinary standardization activities that go beyond the conventional scopes of industrial fields and will improve standardization activities as a whole across AIST.

3 Nurturing personnel who can contribute to improved technology management: To create innovation in private companies, it is important to nurture innovation personnel—staff who will contribute to improved technology management in those companies—and to enhance their talents and encourage their activities. Therefore, AIST intends to continuously improve and expand personnel development projects, such as the AIST Innovation School and AIST Design School, and deliver their graduates to society.

Map of the Fifth Term Management Policy



AIST Management Policy

AIST adopted the 5th Term Management Policy in September 2021. Backcasting from a future vision in which AIST continues to be at the core of the innovation ecosystem for the whole of Japan in the 7th Term and beyond, this management policy sets goals of the 7th Term being a period of evolution, the 6th Term being a period of growth, and the 5th Term being a period for building a prototype of the innovation ecosystem. To realize this future vision, we will maximize the value of AIST while accelerating social implementation.

1. Mapping the 5th Term Management Policy with a view to the long-term prospects of AIST

1 Maximizing the value of AIST

By switching from a cost accumulation basis to a value provided basis for cooperative research with private businesses and the like, we will produce a virtuous cycle in which capital investments in AIST increase, enabling strategic investment in subsequent research infrastructure and human resources.

2 Business scale in the 7th Term and beyond

To accelerate social implementation, we aim to double the scale of business of AIST Group, which includes external corporations, from the current business scale (about 100 billion yen) to 200 billion yen. We are aiming for private funds to then be of the order of 60 to 70 billion yen (bringing the ratio of private funds, public funds, and subsidies close to 1:1:1).

3 7th Term and beyond (from FY 2030)

Mapped as a period to "evolve the national innovation ecosystem with AIST at its core" with the tagline "continuing trust for AIST from society," the aims are for "the coalition of the strong model with AIST at its core to be a key for industrial growth in Japan" and that "new industries created by diverse coalitions drive regional economies."

4 6th Term (FY 2025 to FY 2029)

Mapped as a period to "grow the national innovation ecosystem with AIST at its core" with the tagline "AIST leaps ahead," the aims are "coalitions of the strong turning social implementation models into reality" and that "multiple diverse coalitions to lead regional innovation to create new industries."

5 5th Term (FY 2020 to FY 2024)

Mapped as a period to "prototype a national innovation ecosystem with AIST at its core" with the tagline "establish the AIST brand," the aims are "coalitions of the strong with AIST at the core" and that "multiple diverse coalitions to lead regional innovation."

2. Overview of the 5th Term Management Policy

In the 5th Term, we aim to increase the value of AIST by strengthening the core functions of a national innovation ecosystem and improving the team strength of AIST. In this way, we aim to build a prototype of the national innovation ecosystem and establish the AIST brand.

Realizing the building of this prototype starts with switching from the cost basis to value provided. Consequent to strategic investment in research infrastructure and human resources, the aim in the 5th Term is for the business scale of the whole AIST Group including external corporations to reach around 120 billion yen, about 20 billion yen of that being private capital.

(1) Strengthening the core functions of the national innovation ecosystem

We will further enhance AIST's strengths by selecting and concentrating management resources, creating value through system design, and promoting unique research base equipment.

We will improve social implementation of research outcomes by using the Dejima approach (setting up external corporations and the like) to accelerate social implementation, strengthening AIST-initiated startups (helping to create unicorns), and improving the one-stop system.

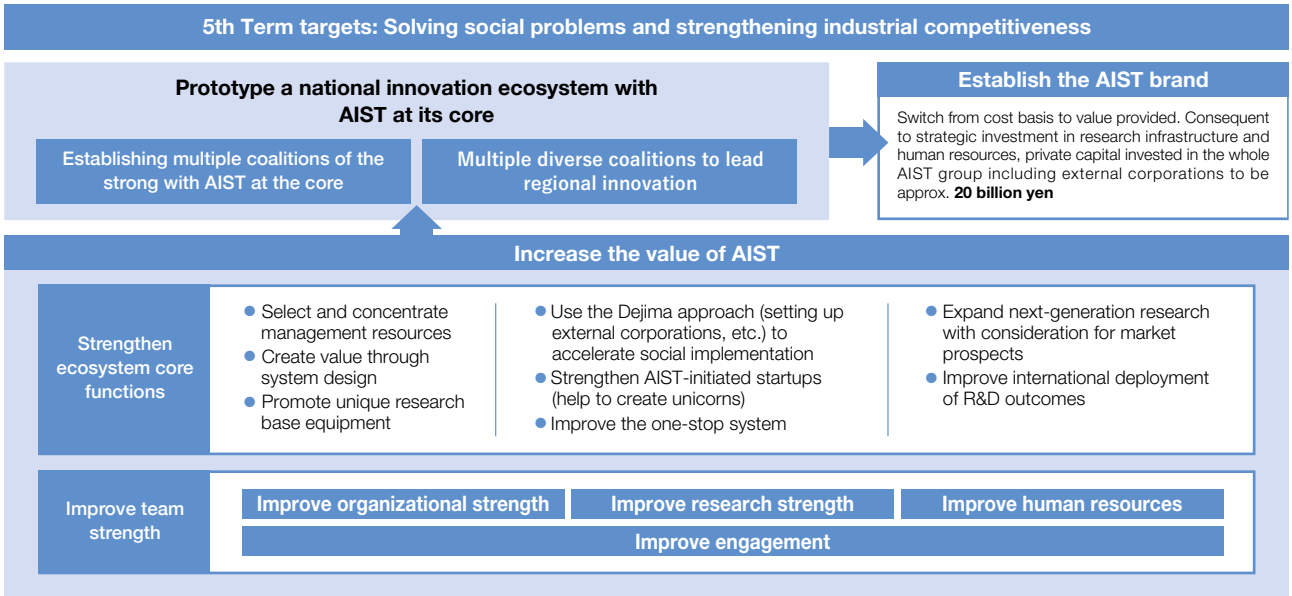
We will enhance AIST's potential by expanding next-generation research with consideration for market prospects and improving international deployment of R&D outcomes.

(2) Improving the team strength of AIST

Manifesting AIST's team strength to the greatest extent is important for increasing the value of AIST. We will improve each of the elements that make up AIST's team strength: 1) research strength, 2) organizational strength and 3) human resources.

Improving engagement based on two-way trust and assistance between staff and the organization is also important as a foundation for the three elements of AIST's team strength. As key points in improving engagement, we will work on (1) building relationships of trust, (2) sharing a vision, (3) providing fulfillment, (4) preparing suitable workplaces, and (5) supporting personal development.

●Overview of the 5th Term Management Policy



Appropriate and trustworthy organizational governance

AIST ensures appropriate management of all operations to make full use of AIST's capabilities and achieve AIST's missions.

Promotion of Compliance

To raise employee awareness of compliance and take our organizational culture to the next level, AIST undertakes the following measures to strengthen compliance:

Compliance initiatives

1. Every week, a Compliance Promotion Committee meeting is held to gather risk information and determine how to address it. Risk information is also shared at regular in-house meetings to prevent recurrence.
2. Continuing from last year, AIST has set December as the Compliance Promotion Month to strongly raise awareness of compliance of each executive and staff and reliability of AIST. In particular, the President's message was issued, special training for executives and management officials as well as stratified training were provided, a slogan was set, posters and notices were displayed, and we proactively engaged in activities based on action plans drawn by each research domain.
3. In addition to e-learning courses for all staff, we provide compliance education as part of training for newly hired employees and management training for unit directors and research group leaders, with content adjusted to each group of participants.
4. In an effort to instill compliance, we post monthly compliance posters titled "Compladayori," created under a different theme for each month. This is aimed at increasing employee awareness of compliance and urging them to be vigilant at work.

Addressing research misconduct

1. In the event that research misconduct is alleged to have occurred, AIST handles the allegations rigorously in accordance with the Research Misconduct Rules and other guidelines.

2. In order to become a research and development organization trusted by society, a Handbook on the Code of Conduct for Researchers was made and distributed to all the staff that succinctly summarizes into "5 minds" the ethics and points of attention needed in conducting research.

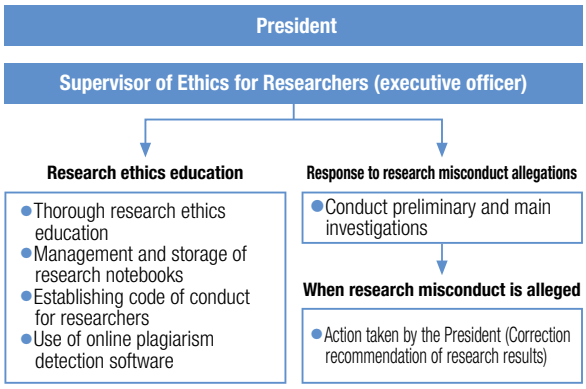
3. We encourage employees to use the online plagiarism detection tool, which was introduced to help prevent inadvertent self-plagiarism and other forms of research misconduct. The number of times used was 483 in FY 2015, the first year it was introduced, and in FY 2021, the number increased about 3 times to1,430.

Compliance partnerships with other entities

1. The Expert Committee on Compliance was established in December 2017 in the Association for National Research and Development Agencies with the primary aim of enhancing the risk management of agencies and now there are 27 member agencies. AIST played a central role as its chair and secretariat until December 2021, and handed the role over to the National Agriculture and Food Research Organization.

2. AIST, as the secretariat, held the Expert Committee on Compliance meeting in July, where the member agencies shared compliance information and discussed challenges and other matters. Furthermore, a Compliance Promotion Month was set by all members of the expert committee, a slogan was decided, identical posters were posted, and executive and official training was conducted.

Response to research misconduct at AIST



Research information management

As an institution conducting scientific and technological R&D financed by public research funds, AIST has been strongly called upon to take steps to prevent research misconduct—such as fabrication, falsification, and plagiarism—by the guidelines issued by the Ministry of Education, Culture, Sports, Science and Technology and the Ministry of Economy, Trade and Industry.

Accordingly, AIST has set rules of records management as a concrete measure and has made it obligatory to record research information. Regarding research information that needs storing such as research notebooks, we have made it obligatory to register the information on the research notebook recording system and be validated by superiors. In addition, for thorough management of research information, we have restricted taking out research notebooks and copies when resigning, and have set guidelines for handling research information other than research notebooks.

AIST will continue doing its utmost to ensure the integrity and transparency in research and will make effort to prevent research misconduct.

Disclosure of Information and Protection of Personal Information

Disclosure of information

To increase the transparency of AIST's activities and fulfil its accountability requirements, AIST proactively discloses information on its website and by other means in accordance with the Act on Access to Information Held by Incorporated Administrative Agencies (implemented October 1, 2002).

Information disclosure desk and personal information protection desk

Requests for information disclosure in accordance with the Act on Access to Information Held by Administrative Organs and the Act on the Protection of Personal Information Held by Administrative Organs can be made through these desks and the website of AIST Tsukuba and other regional research bases. Each desk also provides help on the procedures for disclosure and personal information protection. Only requests for information disclosure can be made through the website.

Protection of personal information

In accordance with the Act on the Protection of Personal Information enforced on April 1, 2022 which integrated three acts, the Act on the Protection of Personal Information, the Act on the Protection of Personal Information Held by Administrative Organs, and the Act on the Protection of Personal Information Held by Incorporated Administrative Agencies, AIST has established a privacy policy and Rules on the Protection of Personal Information at AIST, to protect the individual's rights and interests while ensuring that activities at AIST are conducted properly and smoothly.

Every year, self-inspections by e-learning for personal information protection and information security are conducted, to raise awareness of the proper management of personal information relating to executives and staff and of information security compliance.

Internal Audits

At AIST, the Audit Office is deemed an independent organ that reports directly to the president. In collaboration with the auditor and the accounting auditor, the office endeavors to achieve (1) effective and efficient work, (2) observance of laws and ordinances governing AIST operations, (3) preservation of assets, and (4) reliable financial and other reports. Toward these ends, the office monitors whether individual operations function properly and efficiently and based on the findings, recommends improvements and other corrective actions. These internal audits are performed to support the auditees, not only by detecting and pointing out problems in work processes (i.e., problem finding), but also by suggesting effective improvements based on mutual understanding that is built through thorough discussion on the problems (i.e., problem solving).

In FY 2021, audits were performed concerning the following topics:

- As specific themes that urgently need auditing as well as cross-sectional themes, for administrative headquarters, and research units, audits of research operations in general were conducted. While the audits confirmed that these operations were generally being carried out properly, issues in terms of compliance, effectiveness, and efficiency of some of the operations were identified. The auditees concerned were advised to swiftly make suggested improvements and the improvements were confirmed.
- As information security audit and personal information management audit, audits were conducted on implementation status of various rules, and the audits confirmed that these matters were generally being handled properly.

●Collaboration in audits

	Internal audit ← Collaboration →	Auditor audit ← Collaboration →	Accounting auditor audit
Scope of audit	●Operational audit ●Accounting audit ●Compliance audit	●Operational audit ●Accounting audit	●Accounting audit
Points of audit	●Activities as a whole ●Appropriateness of risk management and development and operation of internal control systems ●Improvement of work process efficiency	●Activities as a whole ●Decision-making by the President ●Creation and operation of internal control systems ●Appropriateness of financial statements	●Appropriateness of financial statements (effectiveness of internal control systems)

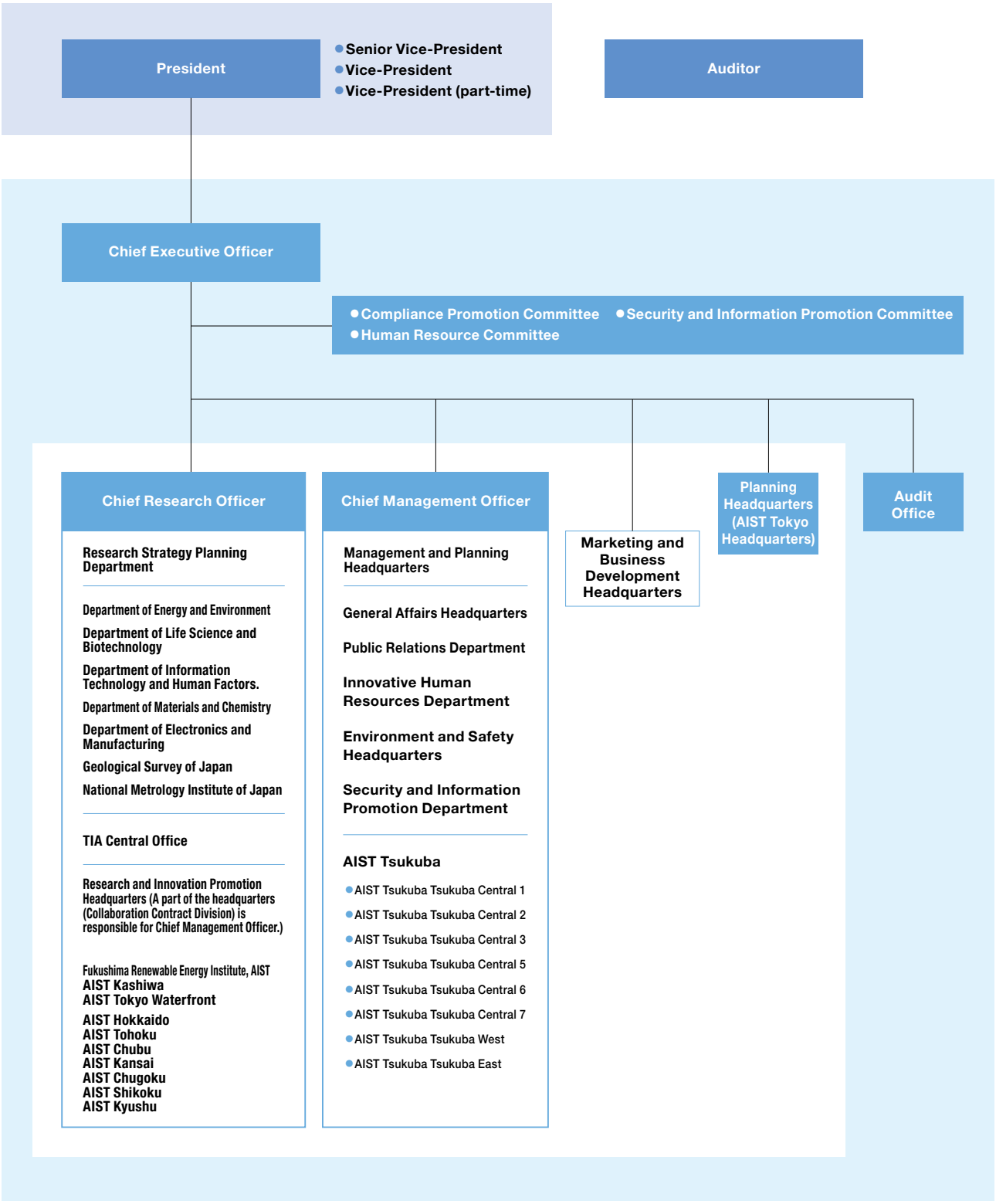
Fair Operating Practices

We conduct appropriate work management based on the law.

Item	Purpose	Action in FY 2021
Management of Conflict-of-Interest	In order not to give the impression to society that individual profits from other parties in industry–academia–government collaborations are put before duty by executives or research responsibility, a conflict-of-interest management system is in place.	•3,438 executives and employees who needed to declare their own status of conflict-of-interest all submitted their self-assessments. •3 employees who had particular concern for conflict-of-interest were interviewed by outside counselors to look into their activities. Additionally, after the Conflict-of-Interest Management Committee consisting of outside experts deliberated, they were notified of points of attention regarding promotion of industry–academia–government collaborations. •In order not to give the impression that we are putting profits before public responsibility, from FY 2020, we operate a management system for conflict-of-interest on a full scale. 44 corporate bodies with which we have close collaborative relations were targeted, and the Committee deliberated on our collaborative activities and procurement records. No problem was found.
Information Security	In order to ensure information security regarding information systems and important information, AIST implements measures that comply with the Common Standards for Cybersecurity Measures for Government Agencies and Related Agencies.	●Information security measures •Providing a new network zone to respond to confidentiality levels and required access restrictions •Introduction of software that detects and conducts measures against malicious programs •Response to information security incidents by the Computer Security Incident Response Team (CSIRT) •Conducting business continuity plan training ●Information security training •Improving information security awareness by information security training ●Information security audit •Conducting information security audits for all departments
Implementation of Security Export Control	To maintain peace and security within the international community, AIST has tight security export controls in place in accordance with AIST's Rules on Security Export Control (internal rules and regulations), formulated based on the Foreign Exchange and Foreign Trade Act, thereby preventing AIST's technology from being used for the development of weapons of mass destruction.	Through (1) dissemination of the latest information on legislative amendments within AIST; (2) export control training for AIST staff; (3) export control instruction to individual staff members; (4) classification and transaction screening; and (5) internal audits, efforts are being made to raise awareness of security export control at staff level, and by maintenance of departmental systems, we are implementing appropriate export controls.
Promotion of Rational Procurement	We promote autonomous, continuous rational procurement with its operational attributes in mind while keeping its fairness, and transparency through the PDCA cycle, based on the Promotion of Rational Procurement in Incorporated Administrative Agencies (decided by the Minister for Internal Affairs and Communication on May 25, 2015).	Each year, we formulate an AIST Rational Procurement Policy, and conduct ex-post facto inspections of individual contracts by a Contract Oversight Committee, whose members include outside experts. We answered to questions from members and obtained their agreement. Once a fiscal year ends, we conduct a self-assessment of how our rational procurement policy for the fiscal year has been implemented using the set indicators, and the results are publicized. As part of the CSR procurement and pursuant to the Act on Promotion of Government's Procurement of Goods Supplied by Facilities for Persons with Disabilities to Work, every year AIST also discloses its policy for promoting the procurement of goods from those facilities and its procurement results. As outcome of efforts in line with the policy, we were able to achieve a goal that exceeded the results of the previous year. Furthermore, AIST has introduced a procurement method that evaluates suppliers based on how they promote work–life balance, with the aim of realizing public procurement contributing to women' s active participation in the workforce. (To see how the rational procurement plan is conducted, list of documents of the Contract Oversight Committee, AIST policy of Goods Supplied by Facilities for Persons with Disabilities to Work, and procurement records, please look up announcements on the following website: aist.go.jp/aist_j/procure/)
Implementing Market Testing	In accordance with the Basic Policies on Public Service Reform, AIST Tsukuba conducts facility management.	Continuing from FY 2020, operational administrative tasks and support of the information network system were conducted, and continuous, stable services were smoothly provided to the users. (To be continued up to FY 2022)

Basic Information about AIST

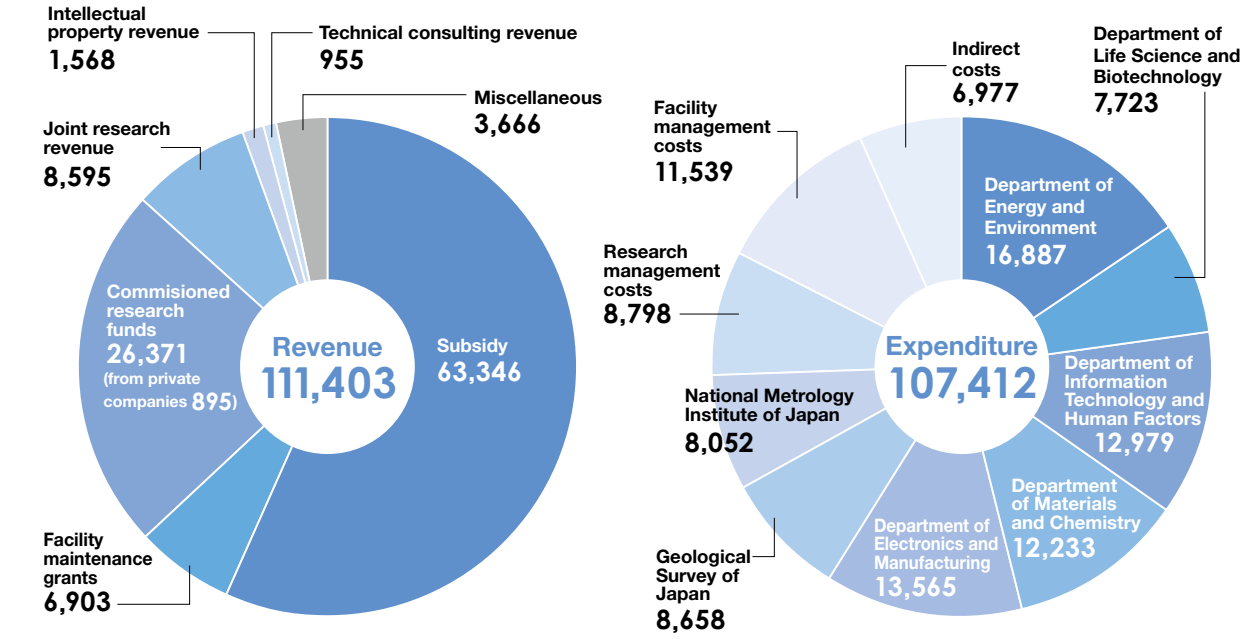
Organization Profile



As of September 2022

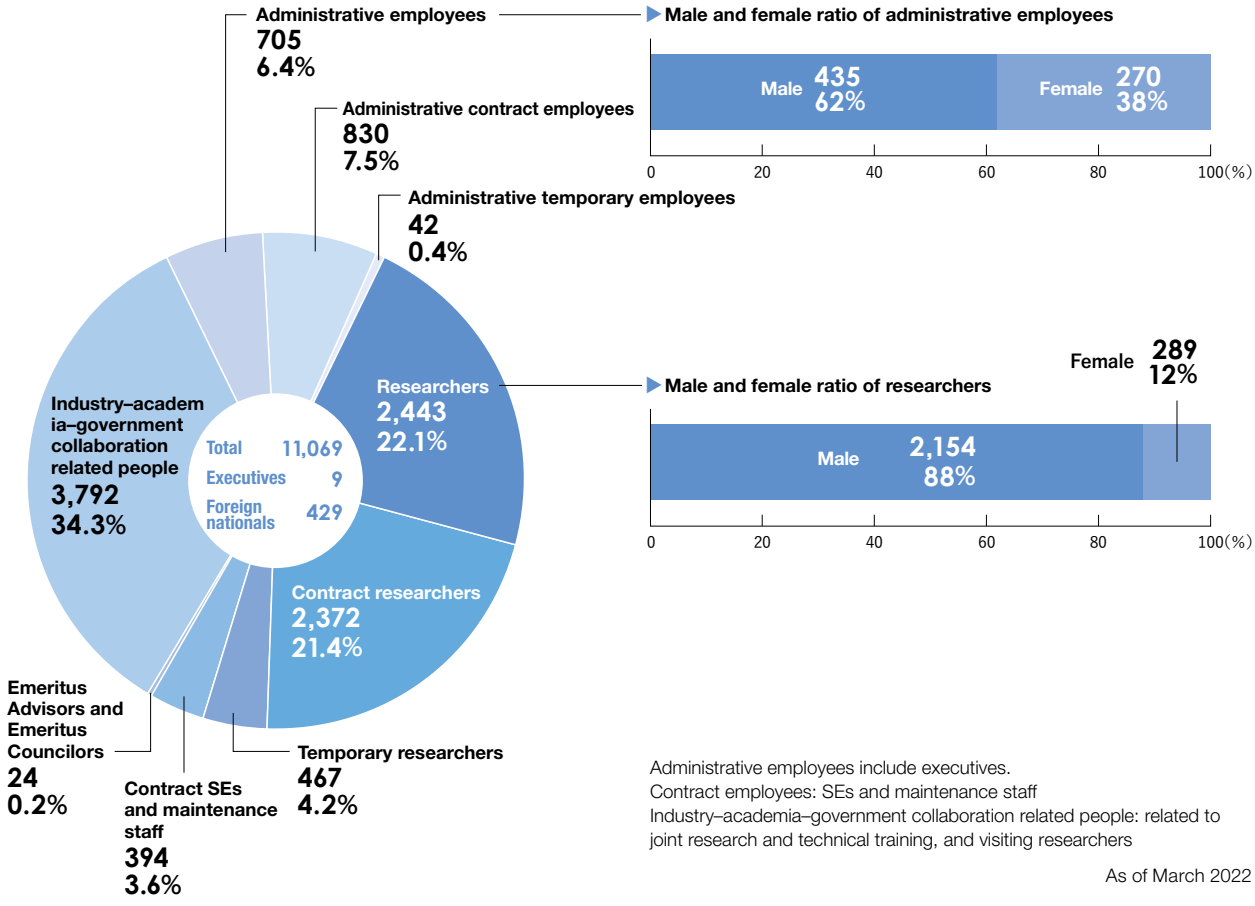
Revenue and Expenditure

Financial results for FY 2021 (unit: million yen)



Notes1 : Total may not become 100% due to rounding off.
Notes2 : The amounts of revenue and expenditure are adapted from the "Financial Statement" prescribed in Article 38 of the Act on General Rules for Incorporated Administrative Agencies.

Staff



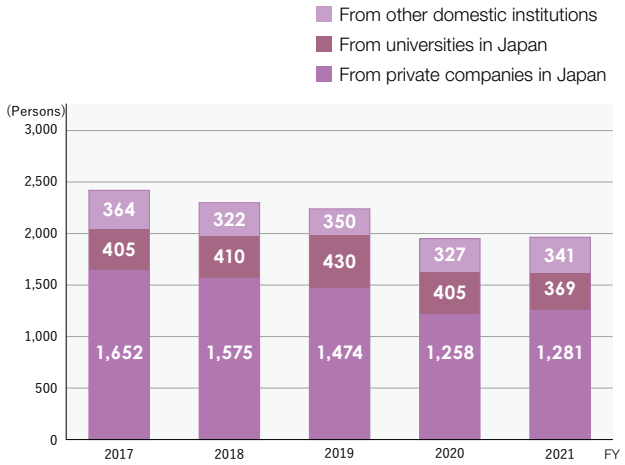
Administrative employees include executives.
Contract employees: SEs and maintenance staff
Industry–academia–government collaboration related people: related to joint research and technical training, and visiting researchers

As of March 2022

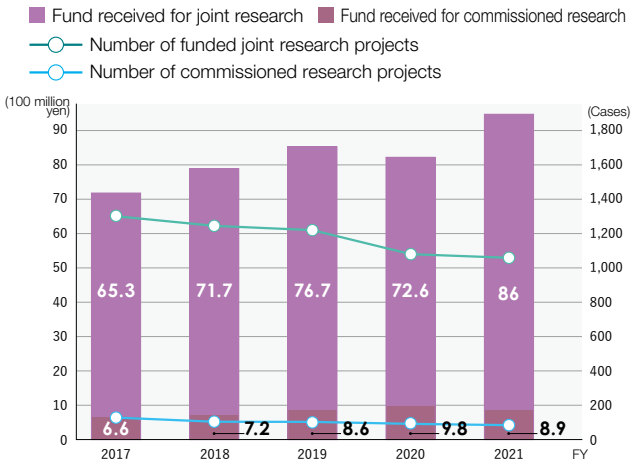
Reference Data

Data about promotion of research and development

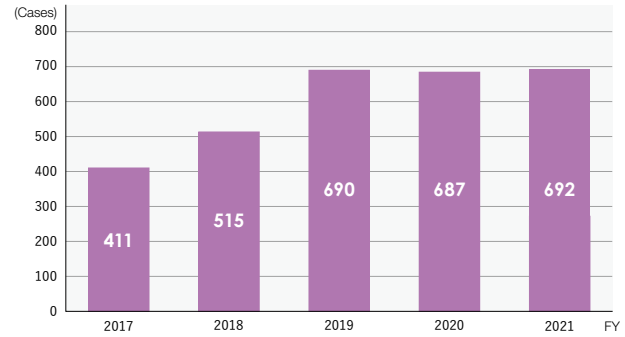
Acceptance of external researchers for joint research



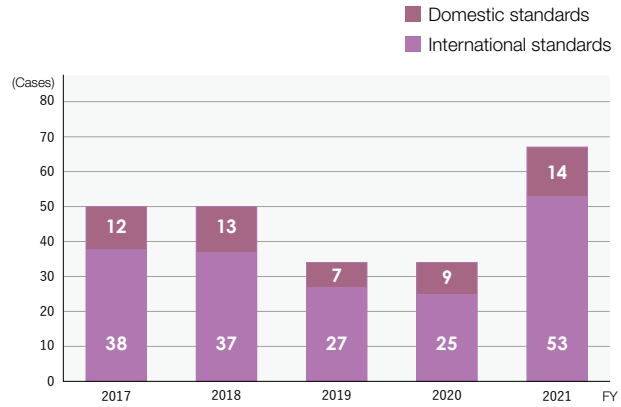
Joint and commissioned research with companies



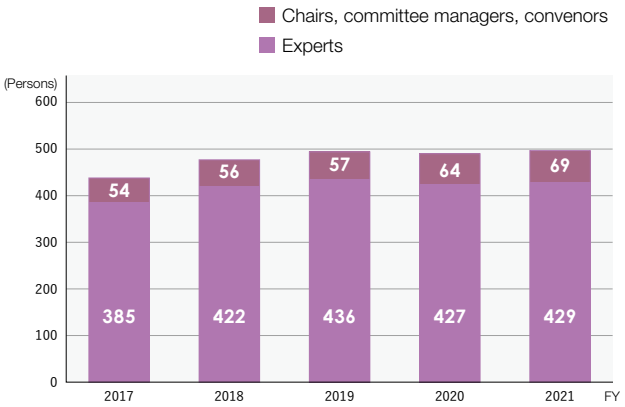
Number of technical consulting



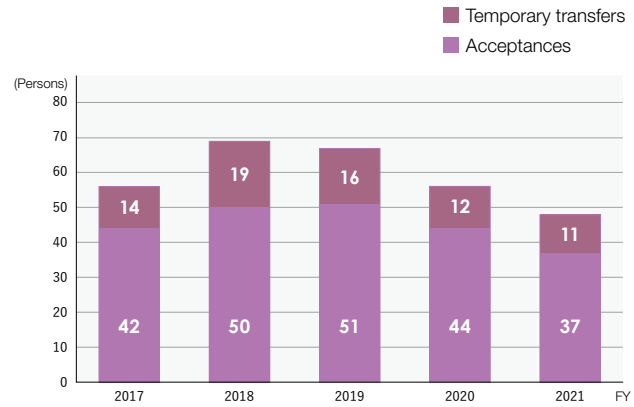
Number of proposed standards



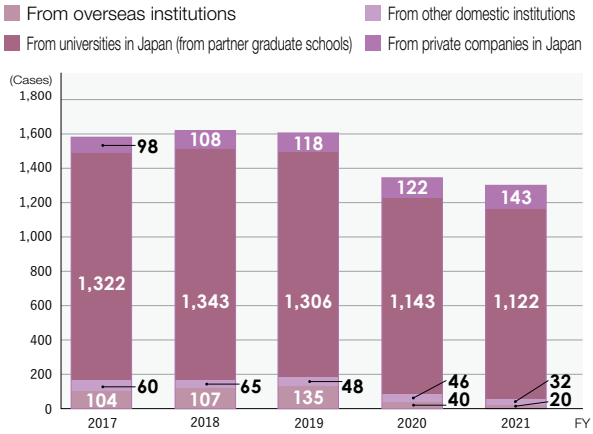
Contribution of AIST staff to international standardization activities



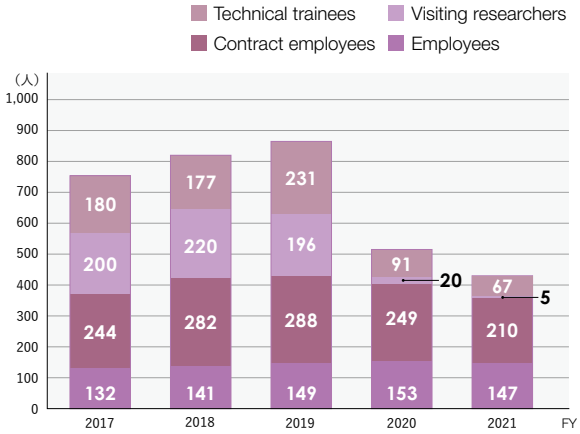
Number of cross-appointment program users



Number of trainees on technical training

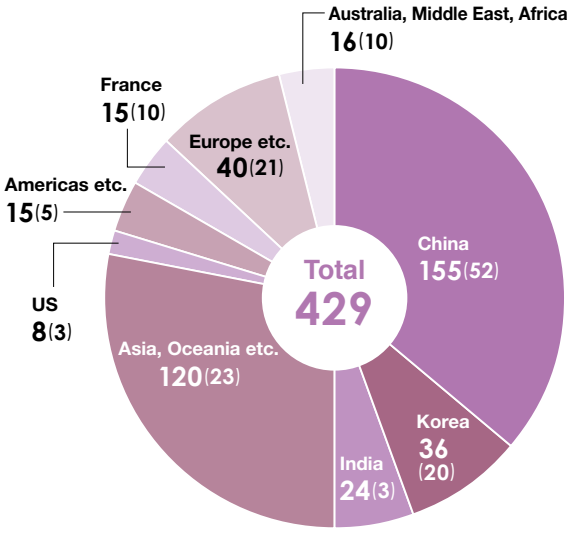


Number of foreign researchers



*Revised the number adding the number of foreigners accepted from other domestic institutions.

Number of foreign researchers by country and region in FY 2021



*Numbers in parentheses are those with employee status.

Data relating to human resources

Number of people who used the various leave programs

(Persons)

	FY2017		FY2018		FY2019		FY2020		FY2021	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Leave to care for sick children	124	224	139	217	122	219	89	147	98	153
Special childcare leave	27	14	42	22	39	21	30	13	30	15
Extended childcare leave*	2	44	11	37	15	48	12	35	21	30
Nursing care leave	69	45	72	57	75	59	48	40	48	46
Extended nursing care leave*	2	7	0	5	0	1	1	2	1	2

* Number of employees starting the leave within the fiscal year
* Because the counting method has been changed since FY 2021 to exclude those who extended their leave, published numbers of past data have been revised according to the new method.

Number of employees who used child daycare services

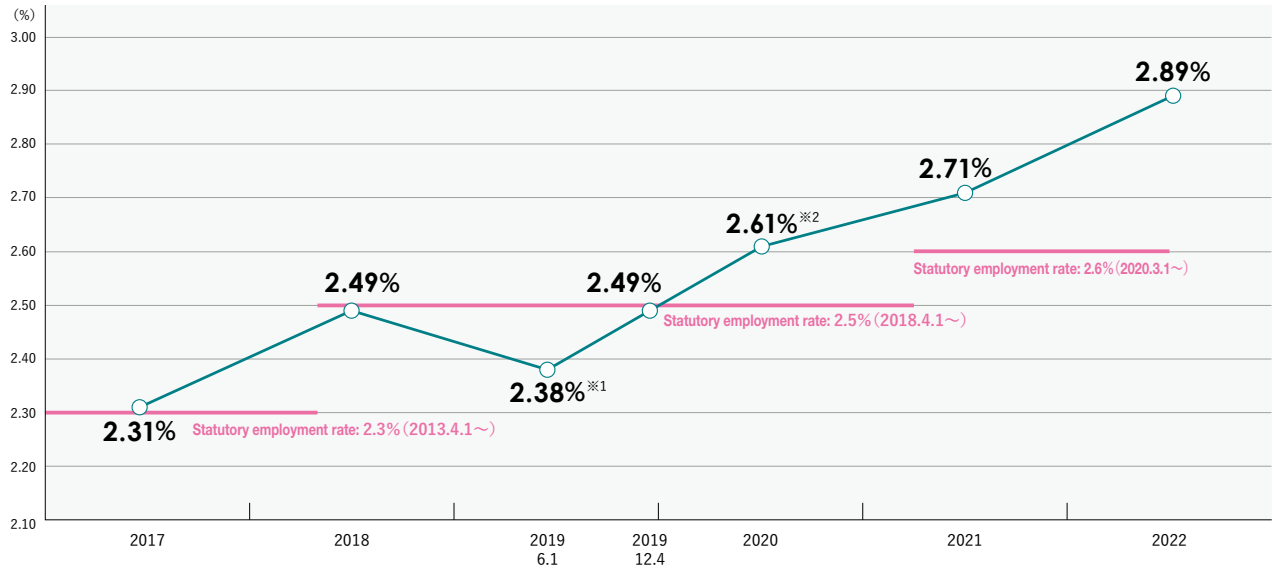
(Persons)

	FY2017		FY2018		FY2019		FY2020		FY2021	
	Permanent employees	Contract employees	Permanent employees	Contract employees	Permanent employees	Contract employees	Permanent employees	Contract employees	Permanent employees	Contract employees
AIST Tsukuba	1,872	1,069	1,681	897	834	1,047	473	73	534	241
AIST Chubu	5	112	15	87	93	59	18	11	15	27
AIST Kansai	229	5	136	21	134	45	4	1	38	0
Private child daycare facilities and babysitters	32	26	41	12	43	4	24	0	44	0

* total number

Change in employment rates for people with disabilities

% of June 1 of each year

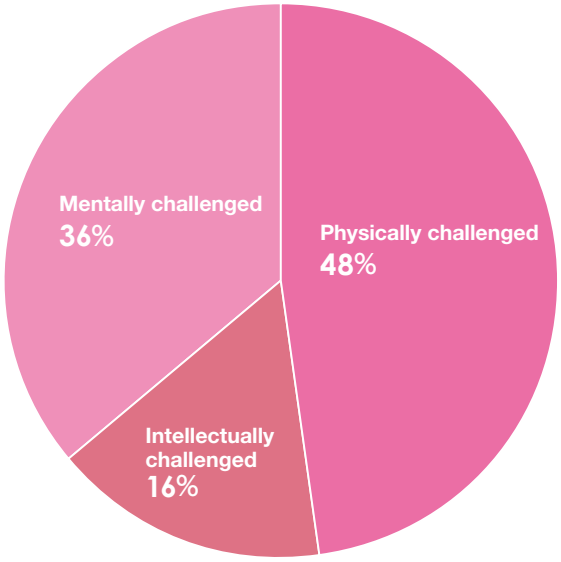


*1 Corrections were made after reinvestigation.
*2 As of December 4, 2019, the actual employment rate was 2.49%, but the number of legally employed persons (136 persons) calculated from the legally mandated employment rate of 2.50% has been met. Therefore, the statutory employment rate has been achieved.

Percentage of people with disabilities remaining at work

	FY2017	FY2018	FY2019	FY2020	FY2021
Number of people at the beginning of the fiscal year	88	105	111	110	115
Number of people who left AIST within the fiscal year	11	8	9	4	11
Employee turnover rate	12.50%	7.62%	8.11%	3.64%	9.57%
Employee retention rate	87.50%	92.38%	91.89%	96.36%	90.43%

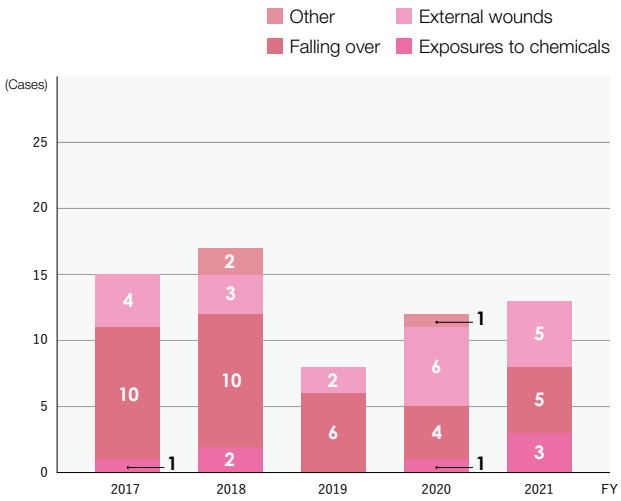
Employment rate by disability type



as of June 1, 2022

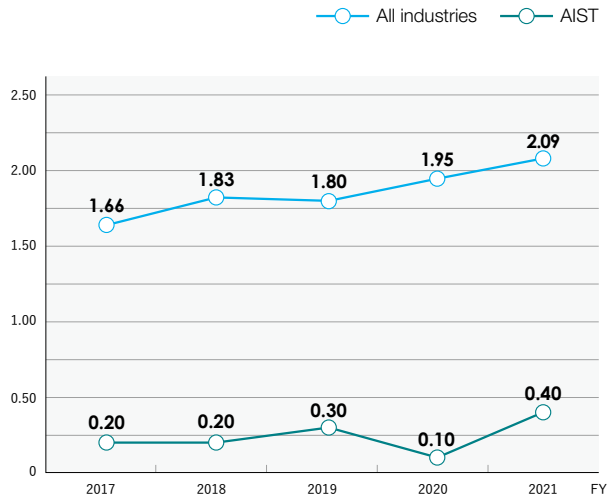
Health and safety data + Health management data

Trends in the number of occupational accidents



*The definition of accidents was reviewed and set as cases that required medical examination at medical institutions or that had serious effect on the environment, and the counting method has been changed since FY 2021 to not include minor cases.

Frequency rate of accidents resulting in absences from work



Calculation method
AIST: (number of applications for compensation for absence from work due to industrial accidents/total number of working hours) x 10^6
All industries: (number of deaths and injuries due to occupational accidents/total number of working hours) x 10^6

Main education and training programs and workshops held in FY 2021

Program	No. of sessions	No. of participants
Course on skills required for a Health Officer's License	0	0
Course on skills required for a Chief Technician's License for Using Organic Solvents	0	0
Course on skills required for a Chief Technician's License for Using Specified Chemical Substances	0	0
Courses on specialized safety (waste)	1	3,031
Education and training for recombinant DNA experiments	1	956
Education and training for animal experiments	1	412
Education and training on human ethics in life science experiments	1	196
Education and training for ergonomic experiments	1	447
Specific safety training course (radiation)	22	355
Specific safety training course (X-ray) (for new X-ray researchers)	62	211
Course on compliance with laws and regulations on radioactive materials (for managers)	0	0

Number and percentage of permanent and contract employees who underwent periodic medical examinations (including health screening), 2017-2021

Top: percentage of examinees Bottom: no. of examinees/ total no. of eligible employees

	2017	2018	2019	2020	2021
(1) Employees (excluding (2)) *1	99.8%	99.9%	99.8%	99.7%	99.7%
	3,061／3,067	3,065／3,068	2,986／2,992	3,021／3,030	2,975／2,984
(2) Contract employees *2	99.8%	99.9%	99.7%	99.9%	99.9%
	2,436／2,440	2,455／2,456	2,569／2,577	2,399／2,401	2,409／2,411

*1 Excluding those on extended childcare leave and sick leave and those on long leave due to overseas relocation
*2 Social insurance policy holders only

Number of permanent and contract employees (including temporary employees) who underwent special medical examinations in FY 2021

	Spring			Autumn		
Special medical examination	Permanent employees	Contract employees	Total	Permanent employees	Contract employees	Total
Medical examination for organic solvent poisoning prevention	744／744	695／695	1,439／1,439	720／720	711／711	1,431／1,431
Medical examination for specified-chemical poisoning	454／454	374／374	828／828	446／446	382／382	828／828
Medical examination for ionizing radiation exposure	342／342	97／97	439／439	335／335	99／99	434／434
Medical examination for lead poisoning	17／17	16／16	33／33	19／19	28／28	47／47
Medical examination for laser injury	341／341	137／137	478／478	37／37	34／34	71／71
Medical examination for pneumoconiosis	4／4	22／22	26／26	2／2	1／1	3／3
Medical examination for asbestos exposure	2／2	2／2	4／4	3／3	3／3	6／6

*no. of examinees/ total no. of applicable employees

Number of employees with significant findings from AIST's medical examinations, and number of employees who received face-to-face counseling

(1) Number of employees with significant findings, and their percentages of the total

FY	2017	2018	2019	2020	2021
With significant findings (D-diagnosis)	134	152	140	159	157
	2.2%	3.5%	3.1%	3.7%	3.8%
With significant findings (E-diagnosis)	907	822	817	872	857
	14.6%	19.1%	18.3%	20.6%	20.7%

(2) Number of employees who received counseling, and their percentages to employees with significant findings

FY	2017	2018	2019	2020	2021
With significant findings (D-diagnosis)	110	123	121	130	129
	82.0%	80.9%	86.4%	81.8%	82.1%
With significant findings (E-diagnosis)	791	718	726	779	789
	87.2%	87.3%	88.9%	89.3%	92.1%

Definition of criteria: A: no anomalies; B: mild abnormalities but no interference with daily life; C: follow-up examination required; D: health advice required; E: treatment required; F: counseling required (applicable only to special medical examinations)

Number of face-to-face health consultations in FY 2017–2021

(Cases)

FY		2017	2018	2019	2020	2021
Industrial physician	Physical	1,451	1,573	1,439	921	736*2
	Mental	540	551	573	525	777*2
Industrial health staff		3,356	3,850	5,496*1	5,599	5,414
Total		5,347	5,974	7,508	7,045	6,927

*1 From FY 2019, the number includes consultations for employees who received health screening at outside medical facilities and overworked employees (based on reform of working practices).
*2 Classification has been readjusted.

Flu shots (at AIST)

(Persons)

FY	2017	2018	2019	2020	2021
AIST Tsukuba/Tokyo	1,876	1,201	2,000	1,962	0
Regional research bases	664	566	578	640	0
Grand total	2,540	1,767	2,578	2,602	0

Other activities of health management

(Persons)

FY	2017	2018	2019	2020	2021
Exercises to refresh	246	192	198	video streaming	video streaming
Walking lessons	377	175	82	*	video streaming
Emergency first-aid workshops	80	138	145	*	video streaming
Mental health seminars	79	115	55	146	video streaming

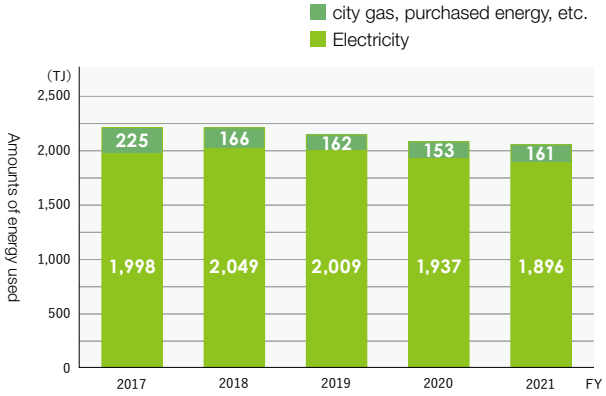
	2017	2018	2019	2020	2021
Workshops (training)	187	227	183	239	214
Anger management workshops	-	-	119	43	50
dental health	-	-	-	-	video streaming

*Due to Covid-19, the event was not held. (Exercises to refresh were conducted via video streaming.)

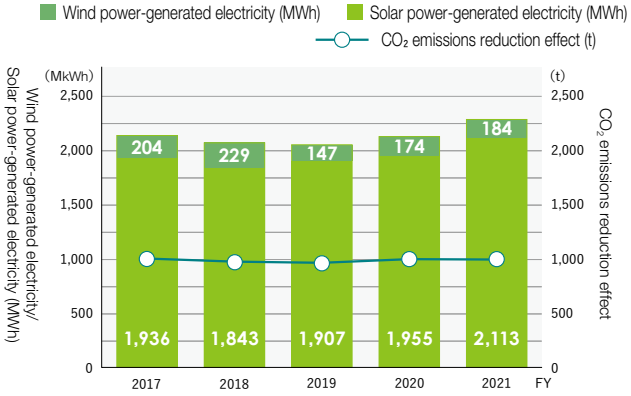
Environmental Reporting Data

Energy

Changes in amounts of energy used



Progress in renewable energy generation and CO_2 emissions reduction



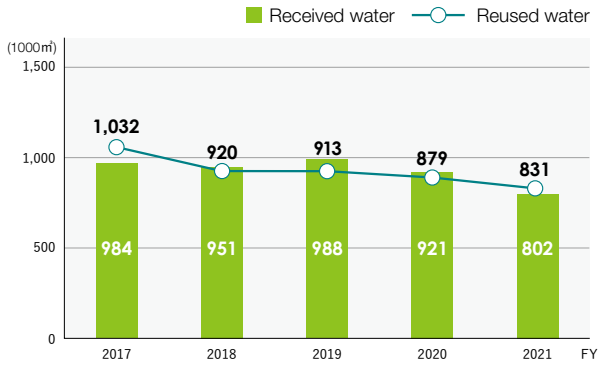
Water resources

Breakdown of water received

Unit: 1000㎥

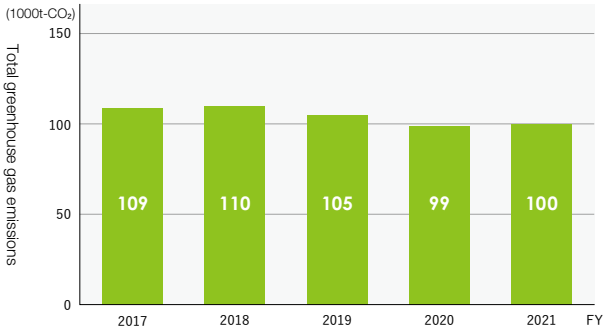
	2017	2018	2019	2020	2021
Potable water	968	937	974	913	795
Groundwater	16	14	14	8	7
Industrial water	0	0	0	0	0
Received water	984	951	988	921	802
Reused water	1,032	920	913	879	831

Changes in amounts of water received and reused



Atmospheric emissions

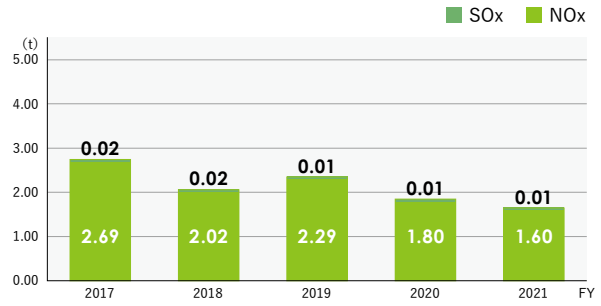
Changes in CO_2 emissions by year



Estimated leakage of CFCs (FY 2021)

Type	R-number	Estimated t-CO_2e released by R-number	Estimated t -CO_2 released by type
HCFC	R22	0	0
HFC	R32	2.2	612.4
	R134a	54.5	
	R407C	526.1	
	R410A	29.6	
Mixed	Mixed refrigerant	0	0
Total			612.4

Changes in atmospheric environmental loads

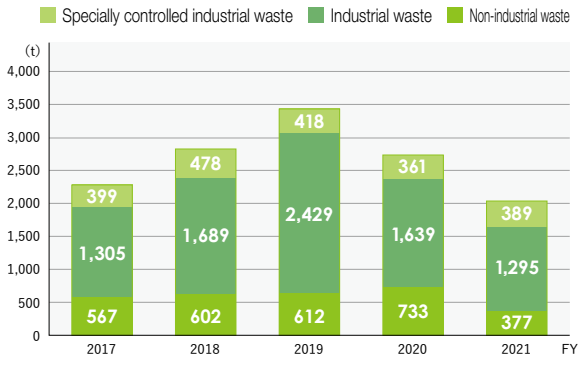


Waste

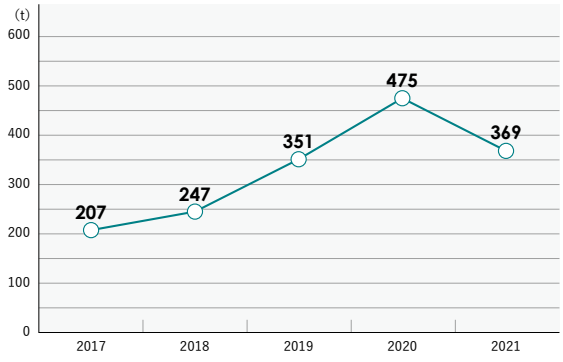
Breakdown of generated waste (FY 2021)

Waste type	Amount disposed of (t)	Amount landfilled (t)	Percentage of waste landfilled (%)
Non-industrial waste	376.77	73.79	19.6
Industrial waste	1,294.92	277.60	21.4
Plastic waste	484.17	21.96	4.5
Metal scrap	247.20	28.66	11.6
Sludge	270.27	196.16	72.6
Glass/concrete/ceramic waste	44.09	10.40	23.6
Slag	15.44	0.00	0.0
Other	233.75	20.43	8.7
Specially controlled industrial waste	389.30	17.48	4.5
Flammable waste oil	26.13	2.19	8.4
Strong acids	284.47	9.04	3.2
Infectious waste	17.48	1.30	7.4
Waste oil (hazardous)	3.51	0.29	8.2
Sludge (hazardous)	7.87	0.06	0.8
Acid waste (hazardous)	4.59	0.01	0.2
Other	45.25	4.59	10.1
Total	2,061	369	17.9

Changes in amounts of disposed waste



Changes in amounts of landfill waste



Storage and disposal of PCB-containing items and PCB waste

Waste type	Quantity stored at the end of FY 2019	Quantity added in FY 2020	Quantity disposed of in FY 2020	Quantity stored at the end of FY 2020	Quantity added in FY 2021	Quantity disposed of in FY 2021	Quantity stored at the end of FY 2021
Capacitors	1,715	339	466	1,588	9	1,441	156
Electrical ballasts	1,225	2	542	685	0	678	7
Transformers	2	0	0	2	0	0	2
Oils/paints (L)	106ℓ	0ℓ	106ℓ	0ℓ	0ℓ	0ℓ	0ℓ
Other contaminated materials	Stored research chemicals, etc.	—	Disposed waste cloth used for analysis	Stored research chemicals, etc.	Added waste cloth used for analysis	Disposed research chemicals and waste cloth used for analysis	Stored research chemicals, etc.

Water quality

●Monitoring of groundwater at AIST Kansai

Sampling month	Measurement of arsenic and arsenic compounds (standard: ≤ 0.01 mg/L)	Sampling month	Measurement of arsenic and arsenic compounds (standard: ≤ 0.01 mg/L)
April 2021	0.022	October 2021	0.022
May 2021	0.022	November 2021	0.043
June 2021	0.017	December 2021	0.023
July 2021	0.027	January 2022	0.017
August 2021	0.012	February 2022	0.017
September 2021	0.017	March 2022	0.007

Appropriate Management of Chemical Substances (FY 2021)

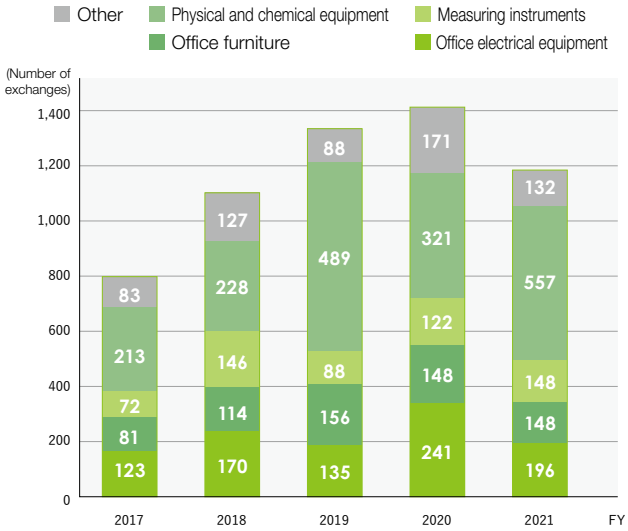
●Amount of chemicals reported under the Chemical Control Program

Research site	Substance	Amount used	Amount released	Amount transferred	
			Air	Sewer	Waste
Fukushima Renewable Energy Institute, AIST	Ammonia (kg)	410	0	0	34
	Propylene glycol (kg)	150	0	0	150
AIST Tsukuba Central 5	Chloroform (kg)	1,300	310	0	1,000
	Dichloromethane (kg)	1,100	170	0	960
	n-hexane (kg)	1,700	370	0	1,300
AIST Tsukuba West	Ferric chloride (kg)	78,000	0	0	0
	N,N-dimethyl acetamide (kg)	1,400	0	0	3,100
	Hydrogrn fluoride and aqueous salts thereof (kg)	3,600	0	390	450
AIST Tokyo Waterfront (Bio-IT integrated technology facility)	Chloroform (kg)	176.9	9.2	0	167.7
	Ethyl acetate (kg)	103.3	7.6	0	95.7
	Methanol (kg)	294.7	3.7	0	291
AIST Kansai	VOC (kg)	1,300	100	0	1,200

*AIST Tsukuba Central 5 and AIST Tsukuba West: PRTR Act, Wastewater including N,N-dimethylacetamide of AIST Tsukuba West has been stored in a waste liquid tank for a multi-year period, and was disposed as industrial waste in FY 2021. (Target substances whose annual quantity handled, released, or transferred is 1 t or more are published.)
AIST Tokyo Waterfront: The ordinance of Tokyo Metropolitan Government (Target substances whose annual quantity handled, released, or transferred is 100 kg or more are published.)
AIST Kansai: The ordinance of Osaka Prefectural Government (Target substances whose annual quantity handled, released, or transferred is 1 t or more are published.)
Fukushima Renewable Energy Institute, AIST (FREA): the guidelines of Fukushima Prefecture (Target substances whose annual quantity handled, released, or transferred is 100 kg or more are published.)

Reuse of equipment etc.

●Reuse within AIST



Environmental accident drills

●Environmental accident drills in FY 2017–2021

FY	2017	2018	2019	2020	2021
Number of drills	17	18	19	19	19

Green Procurement, Etc.

Purchase Results of Eco-friendly Goods and Services

Area	Item		Item	Total quantity purchased	Purchase of specified purchase items	Target attainment
Paper	Photocopier paper		100%	16,102.5kg	16,036.5kg	100%
	Forms		100%	35.0kg	35.0kg	100%
	Coated paper for inkjet color printers		100%	273.2kg	273.0kg	100%
	Toilet rolls		100%	2,016.5kg	2,016.5kg	100%
	Tissue paper		100%	9,766.5kg	9,766.5kg	100%
Stationery	Mechanical pencils		100%	210	210	100%
	Mechanical pencil leads		100%	153	153	100%
	Ballpoint pens		100%	7,309	7,309	100%
	Marker pens		100%	8,354	8,354	100%
	Media cases		100%	278	278	100%
	Glue (including glue sticks and glue pouches)		100%	1,283	1,283	100%
	Adhesive tape		100%	494	494	100%
	Files		100%	61,301	61,301	100%
Office furniture, etc.	Chairs		100%	672	576	86%
	Desks		100%	424	346	82%
Copying devices	Photocopiers, etc. *	Purchased	100%	28	27	96%
		Leased/rented (new)	-	-	-	
		Leased/rented (extension)	-	-	-	-
	Scanners	Purchased	100%	62	60	97%
		Leased/rented (new)	-	-	-	
		Leased/rented (extension)	-	-	-	-
	Toner cartridges		100%	3,757	3,679	98%
	Ink cartridges		100%	1,790	1,781	99%
Office equipment	Paper shredders	Purchased	100%	48	41	85%
		Leased/rented (new)	-	-	-	-
		Leased/rented (extension)	-	-	-	-
Vehicles, etc.	Non-general official vehicles	Purchased	100%	3	1	70%
		Leased/rented (new)		7	6	
		Leased/rented (extension)	-	-	-	-
Fire extinguishers	Fire extinguishers		100%	109	96	88%
Services	Passenger transportation		100%	956	956	100%

*: Photocopiers, combination units, digital photocopiers with expandable functions

Number of green contracts (FY 2021)

Type of green contract	Number of cases
Automobile purchase	6
Contract for power supply	9
Industrial waste	31

AIST REPORT 2022

THIRD PARTY OPINION

As shown by various statistics, Japanese science and technology are in a remarkable decline. As a result, the era of stability and growth of the economy has ended and we are deep into an unstable era in which the future cannot be perceived. In these circumstances, great hopes hang on the combined strength of AIST with its diverse research domains to drive a resurgence of Japanese scientific and technological power. AIST presents various kinds of information, but I have confirmed again that this report is a suitable medium for comprehensively communicating AIST's initiatives. In the process of preparing the report, we went through two rounds of discussions, my opinions were fed back to the Institute, and we worked hard to continuously improve the report. I believe that it better meets the expectations of readers as a result; at the same time, I feel a heavy responsibility.

Reading through the reports from last year and this year, they describe the start of the Fifth Medium- to Long-term Plan in April 2020, the adoption of the 5th Term AIST Management Policy in September 2020, a review of management systems, the adoption of the AIST Vision, shaping of policies and measures to break out of the current circumstances such as the establishment of the Marketing and Business Development Headquarters, and the will for great reform. The perspective on 2030 and beyond deserves special mention. The 5th Term AIST Management Policy has been positioned by backcasting from that future. How to build, grow and evolve the innovation ecosystem, which will be key measures, is clearly mapped out. The switch from cost basis to value provided gives me a sense that this process will be consistently maintained.

Nurturing the human resources that are instrumental in improving technology management can be mentioned as part of the infrastructure that will support the ecosystem. Success particularly in bringing together people who have a strong will for creative technological innovation can be considered key. With increasing calls for more complete information about human capital, the Cabinet Secretariat published a document on "principles of visualizing human capital" in August 2022. There has long been hesitance to disclose personel-related information but, now it is being recast as "human capital" information, there is a switch to active disclosure. Because human resources will affect trends in the ecosystem, I will expect active disclosure in these reports. Such disclosure should not simply be listings of data. Descriptions that draw connections with research management strategies and other issues will be vital.

Workers Club for Eco-harmonic Renewable Society (NPO)

YAMAGUCHI Tamio, Director

AUDITOR'S OPINION

AIST is a Designated National Research and Development Institute (national research and development agency) that advances R&D in industrial technology. It covers a wide range of domains and is among the largest national research and development agencies in terms of researcher numbers and research bases. This huge research organization should be at the heart of solving Japan's social problems and supporting technology for business. Over the last two years, it has drawn up a clear management policy and changed its governance systems. To bring out the potential of its executives and staff to the greatest extent possible, it has created the AIST Vision and worked to improve engagement. It has put in place a system for strengthening business solutions through the Marketing and Business Development Headquarters and has started management based on value provided. These reforms are aimed at manifesting the technology development strength that AIST already had to the greatest extent possible; there are hopes that the result will be accelerated outcomes in the future. Among executives and staff, including researchers, the new frameworks such as the Management Policy are bedding in at speeds beyond my expectations, but there seems to currently be some bewilderment about the shift to management based on value provided. Because this is a research institute, everything starts from research seeds. With sound governance systems, I would like to see cycles of research seeds and desired research outcomes turning dynamically.

Solving social problems and helping business with just a single technology and expertise alone is not feasible. Innovation through synergies of various technologies is necessary. Japan is reputed to be particularly strong in underlying technologies but weak in integration; success in AIST's Integrated Fields Project will signal the start of a fightback. AIST's managers also recognize the importance of improving value by technological synergies, which is confirmed by the significant management resources assigned to the Integrated Fields Project. Researchers also hope to produce results by combining AIST's technologies in various scenarios beyond the Integrated Fields Project, and to create value through further synergies.

Ensuring safety and protecting the environment are obviously issues in research. The lack of serious incidents in recent years is praiseworthy, but this must continue. Maintaining a balance between vigorous research activity and achieving carbon neutrality will be an issue in future. The diversity of human capital now involves all executives and staff. There are hopes for even stronger international collaborations as we come out of the COVID-19 pandemic and for improved global competitiveness. In diversity and international collaboration, a balance must be kept with economic security.

Finally, hopes for contributions to the regions by AIST have risen. While AIST's human capital is limited, how it will respond to the needs of regions is a key question.

Auditor **NAKAZAWA Hiroshi**

On the publication of the AIST Report 2022

AIST publishes its initiatives relating to the environment, workplace health and safety, and corporate social responsibility at AIST Tsukuba and research bases across the country as the AIST Report: Social and Environmental Report, in accordance with ISO 26000.

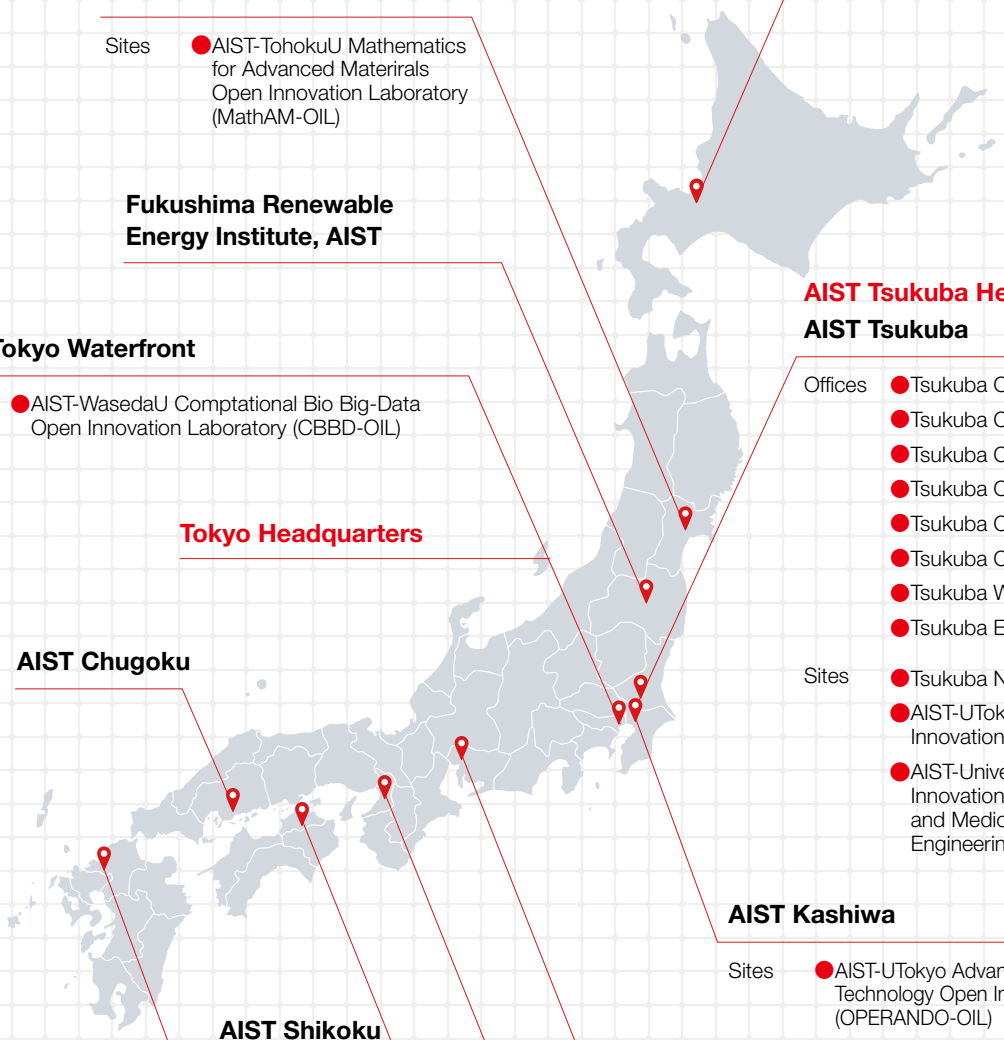
In this year's AIST Report, in the Top Message delivered by President and CEO ISHIMURA Kazuhiko, he describes the new headquarters office, changes in policy foundations and ways of thinking, and the goal of rapidly establishing an ecosystem prototype, to make AIST the core of a national innovation ecosystem, advance technology development seamlessly and quickly link to social implementation. Meanwhile, the external vice-president KOJIMA Keiji, President and CEO of Hitachi, Ltd., expresses high hopes for AIST's reforms and efforts as a public research agency. The Feature Article presents an overview and results of the Integrated Fields Project, the aim of which is to lead the world in solutions to social problems. In the concluding Third Party Opinion, YAMAGUCHI Tamio of the NPO Junkan Workers Club provides invaluable thoughts and guidance. The Auditor NAKAZAWA Hiroshi adds opinions based on a perspective from inside AIST.

As AIST's staff work in unity to solve social problems with "Create the Future, Collaborate Together" (the AIST Vision) in their hearts, we are striving to build relationships of deeper trust with society by presenting AIST's activities working to solve social problems to its many stakeholders through this report.

Vice-President and Director, Public Relations Department **KATO Kazumi**

Research Bases

as of Aug., 2022



AIST Hokkaido

Sites
- AIST Sapporo Odori Site

AIST Tohoku

Sites
- AIST-TohokuU Mathematics for Advanced Materirals Open Innovation Laboratory (MathAM-OIL)

Fukushima Renewable Energy Institute, AIST

AIST Tsukuba Headquarters

AIST Tsukuba

Offices
- Tsukuba Central 1
- Tsukuba Central 2
- Tsukuba Central 3
- Tsukuba Central 5
- Tsukuba Central 6
- Tsukuba Central 7
- Tsukuba West
- Tsukuba East

Sites
- Tsukuba North
- AIST-UTokyo AI Chip Design Open Innovation Laboratory (AIDL)
- AIST-University of Tsukuba Open Innovation Laboratory for Food and Medicinal Resource Engineering (FoodMed-OIL)

AIST Tokyo Waterfront

Sites
- AIST-WasedaU Comptational Bio Big-Data Open Innovation Laboratory (CBBD-OIL)

Tokyo Headquarters

AIST Chugoku

AIST Kashiwa

Sites
- AIST-UTokyo Advanced Operando-Measurement Technology Open Innovation Laboratory (OPERANDO-OIL)

AIST Shikoku

AIST Chubu

Sites
- Nagoya Ekimae Site
- Ishikawa Site
- AIST-NU GaN Advanced Device Open Innovation Laboratory (GaN-OIL)

AIST Kyushu

AIST Kansai

Sites
- Fukui Site
- AIST-Osaka University Advanced Photonics and Biosensing Open Innovation Laboratory (PhotoBIO-OIL)

Public Relations Department

AIST Tsukuba Central1, 1-1-1 Umezono,
Tsukuba, Ibaraki 305-8560, Japan
TEL +81-29-862-6217
E-mail prpub-ml@aist.go.jp

〇Reproduction in whole or in part without written permission is prohibited.

Published in March, 2023

2021年認定 くるみん 子育てサポートしています
仕事と介護の両立支援
女性が活躍しています。
VEGETABLE OIL INK