Driving social change with integrative knowledge

1. Our vision

Having profoundly affected the global economy and society, the coronavirus pandemic is forcing us to rethink and radically change the way in which our socio-economic systems operate. In the face of such an enormous challenge, universities have a significant role to play by bringing together diverse knowledge and people to propel research that forms the basis for the creation of new value and to generate innovation.

As a Designated National University Corporation, Kyushu University will become a **university driving social change with integrative knowledge that fuses the entire spectrum of knowledge from the natural sciences to the humanities and social sciences to contribute to solving social issues and reforming social and economic systems.** In doing so, it will transform itself into an institute of higher education that offers and advances world-class research and education. This reform will enable us to attract superb talent and society's attention and to contribute to **the creation of a society that achieves sustainable social development and diverse realizations of well-being while being rooted in Fukuoka and Kyushu and at the same time closely connected with Japan, Asia, and the world at large**, thereby remaking Kyushu University into a world-leading university.

Bearing in mind the new normal set into motion by the novel coronavirus, we have set the following two major objectives on our path to achieving our vision of becoming a university that drives global social change from Fukuoka and Kyushu with the integrative knowledge it produces under the President's strong leadership.

Objective I: Become a platform for knowledge that drives world-class research and education

Kyushu University will become a world-class platform for knowledge by stimulating international talent circulation through curiosity-driven research using diverse approaches, cutting-edge research these endeavors in turn spur, and education that cultivates inquisitive minds in students who can create the future.

Objective II: Become the core of an innovation ecosystem that forges new social and economic systems

Kyushu University will become the core of an innovation ecosystem powered by a self-sustaining growth cycle that generates new value from the integrative knowledge created by the university, stimulates changes to social and economic systems by developing this newly created value in different regions, and uses these achievements to further expand and develop the university's research and education resources.

In this proposal, we first identify the strengths and unique features of the university in Section 2. Based on those considerations, we then explain in Section 3 two overarching initiatives that we have set as our highest priorities for enacting social reform with integrative knowledge. First is the **resolution of social issues connected to "decarbonization," "medicine and health," and "environment and food**," three areas in which we have already demonstrated world-class achievements. Second is the **advancement of data-driven education, research, and medicine through the Digital Transformation (DX)** to realize Society 5.0, a human-centered society that balances economic development and the resolution of social issues through systems that effectively fuse cyberspace and physical space.

Section 4 details a blueprint for how we will lay the foundation to elevate Kyushu University to compete with the top universities in the world. Central to this plan are initiatives to extend our strengths and unique features and overcome the challenges identified in Section 2 and to create and utilize integrative knowledge as we make significant advances in our three key research areas while at the same time developing new ones that rival or surpass them in achievement.

Through the realization of this vision, we will continuously grow as a university that advances research and education at the highest level, and we aim to have at least ten fields ranked in the top 100 of the QS World University Rankings by Subject within ten years—up from three at present—with several even in the top 50.

2. Self-assessment of our strengths, unique features, and present challenges

Established in 1911, Kyushu University is situated in Fukuoka on the southern Japanese island of Kyushu. For over two thousand years, the area has prospered as a center of cultural and human exchange opening Japan to Asia and the world, and it has been a driving force behind events that radically changed Japan's social structures, including systemic reforms enacted during the Meiji Restoration and Asia's first industrial revolution spurred by coal and iron. The mixture of history, character, climate, and culture that enabled these past innovations are also in the DNA of our university and the backbone of our development. **Kyushu University's Ito Campus**, which was completed in 2018 following over 27 years of planning and construction, provides an ideal environment for the generation of integrative knowledge by assembling research hubs ranging from the humanities and social sciences to the natural sciences, engineering, and agriculture. Moreover, **the campus is one of the largest in Japan** and serves as a zone **for proof-of-concept experiments for advancing research aimed at social implementation**.

Against this background, we analyze in the following sections our strengths and unique features and the challenges that we currently face on our way to realizing our vision of becoming a university driving social change with integrative knowledge.

Education

Strengths and unique features

o Our progressive education systems and their achievements have received high acclaim, with the university being ranked 5th in the *Times Higher Education* Japan University Rankings 2020. Specific examples include **the so-called KIKAN education core undergraduate curriculum**, which was introduced in 2014 and uses active learning classes to develop in students the ability to ask questions themselves and create new knowledge; the **School of Interdisciplinary Science and Innovation**, which was established in 2018 and implements a problem-solving curriculum that integrates the humanities and science; and **our entrepreneurship education**.

o We have established **a six-year integrated bachelor's and master's program** in engineering. As part of the program, we are **working together with nine technical colleges in Kyushu and Okinawa to develop a collaborative education program** that enhances the education by leveraging the educational resources of both parties. Moreover, we have established the **Graduate Program of Mathematics for Innovation** to foster leaders who can work actively across a range of research fields to solve problems.

o We have long been committed to education reforms to accelerate the **development of DX-capable professionals** for the digital society. Related efforts include accumulating, analyzing, and utilizing big data in education through the **Learning Analytics Center** (est. 2016) and coordinating university-wide education in mathematics and data science through the **Education and Research Center for Mathematical and Data Science** (est. 2017).

Challenges

o Only a handful of departments have implemented educational programs specifically designed for developing leaders who can create value and solve problems on a global stage using comprehensive knowledge. The highly regarded problem-solving curriculum integrating humanities and sciences currently used in some of our departments needs to be promptly adopted to programs throughout the university.

o Few opportunities exist for industry and members of the business community to actively participate in postgraduate education programs, and further efforts for producing researchers and managers equipped with business and management skills are necessary.

o For Ph.D. students, we need to provide better financial support in terms of living expenses and research funding, improve support for career-path development, and establish systems to help them acquire real-world skills.

Research

Strengths and unique features

o In the research field of "Molecules, Materials, Energy," we are conducting empirical research in areas connected to the realization of **decarbonization** such as **organic optoelectronics** (organic light-emitting diodes; OLEDs), **hydrogen energy**, and **next-generation fuel cells** through collaboration between industry, academia, and government by focusing on the development of research centers like the International Institute for Carbon-Neutral Energy Research (**I^2CNER; one of six WPI Academies across the country**). Highly ranked areas of research include "organic light-emitting diodes" (7th in number of papers, 2nd in times cited), "electrocatalysts; proton exchange membrane fuel cell (PEMFC); electrooxidation" (1st in number of papers, 2nd in times cited), "heat storage; refrigeration; cooling systems" (2nd in number of papers, 2nd in times cited), "hydrogen embrittlement" (1st in number of papers, 1st in times cited), and "solid oxide fuel cells (SOFC)" (3rd in number of papers).[1]

o In the research field of "Life and Biological Sciences and Future Medical Care," we are conducting **cutting-edge biomedical research** on gene therapy, cellular immunotherapy, regenerative medicine, and transplantation medicine as well as running **a long-term cohort study** with the residents of Hisayama Town known as the Hisayama Study. Areas of particularly strong output include "dectin 1; C-type lectin; glucans" (2nd in number of papers and times cited), "DNA glycosyltransferase; 8-hydroxyguanine; 8-oxodGTPase" (3rd in number of papers, 4th in times cited), and "peroxisomes; peroxisomal targeting signal 2 receptor; microbodies" (4th in number of papers).

o In the research field of "Building a Sustainable Environment," notable contributions related to solving social issues concerning the environment and food include environmental impact assessment using climate models and operation of **a PM2.5 prediction system** (principal investigator selected as a Web-of-Science Highly Cited Researcher for seven consecutive years); studies that provide a scientific basis for **oceanic pollution caused by microplastics** (related paper "Microplastics in the Southern Ocean" is in the top 1% of citations); research technology for biological pest controls; and the development of sustainable production systems using genomic breeding technology.

o In the field of "Arts & Design" (QS World University Rankings by Subject 2020: 24th in Asia and 1st in Japan), we are proposing new social systems built around the effective utilization of technology in daily life led by the **School of Design**, which is the only one of its kind at a comprehensive university in Japan. In the field of "Industrial Mathematics," our efforts are centered around **the Institute of Mathematics for Industry**, one of the world's few industrial

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[1] Based on Kyushu University's search of SciVal (Elsevier) data for 2015–2019 in April 2021.

mathematics research centers and the first in Japan, and our researchers are part of the team that has ranked No. 1 in the world for total of 12 periods between 2014 and 2020 in Graph500, a benchmark of data-intensive loads on supercomputing systems. We are promoting research and development aimed at social implementation through industry-academia collaboration.

Challenges

o We must shift focus from quantity to quality with regards to research output, establish the ability to set research strategy by determining which research fields and issues to prioritize, develop a system to discover and foster world-class research, optimize allocation of budgets and posts based on priorities, and develop governance with the skills to better assess research output.

o Few initiatives are currently driven by integrative knowledge, and there is a lack of progress in transdisciplinary research that incorporates knowledge from the natural sciences, humanities and social sciences, and design or that incorporates ethical, legal, and social issues (ELSI) research to promote socially responsible research and innovation.

o We must improve the research environment in ways that promote diversity to increase the percentage of young, female, and international researchers; that allow researchers to secure time for conducting their own research; and that make trained support staff readily available for researchers.

Social cooperation and international collaboration

Strengths and unique features

o Each of our four campuses serves as an advanced research hub targeting a unique purpose: comprehensive science at Ito Campus, advanced design at Ohashi Campus, life and medical sciences at Hospital Campus, and advanced integrated science at Chikushi Campus. Taken together, these campuses function as an **innovation commons where a wide variety of people**, including those involved in proof-of-concept experiments, **engage in value creation for the future of society**. Through these activities, we have established good partnerships with the local government and business community and with companies in the Kyushu region and beyond, and we have fulfilled our responsibility as the region's leading institute of research and education. In particular, **the "Inclusive Wealth Index,"** which was proposed by one of our researchers and was highly evaluated by the United Nations, is being used by local governments for community development as a means for evaluating the social sustainability. Additionally, a joint effort with Fukuoka City will promote entrepreneurship education and practical application of research results.

o **Kyushu University Hospital** (World's Best Hospitals Ranking 2021 by Newsweek: #62 in the world; #4 in Japan; #1 in revenue from medical fees among national university hospitals in Japan) is making great contributions as a designated **core center for cancer genome medicine** and as **a hub for community medicine**. It has performed the largest number of transplant procedures in the country, including hematopoietic stem cell transplantation, kidney transplantation, and liver transplantation, and it is developing telemedicine programs in collaboration with overseas medical institutions. In response to **the COVID-19 pandemic**, the hospital has made significant contributions to the well-being of the local population by **setting up a PCR center** in cooperation with a private company, **dispatching infectious disease specialists** to hospitals designated for infectious diseases, and providing **intensive treatment for severely ill patients** by establishing hospital beds dedicated to COVID-19. In addition, hospital researchers have succeeded in **identifying existing drugs** that prevent the intracellular invasion of the novel coronavirus and are working with **a university-launched start-up company to develop vaccines** using recombinant protein expression technology.

o To provide international support and cooperation for countries with a focus on Asia, we

provide graduate school education to cultivate future leaders, for example, through **a JICA Development Studies Program**, dispatch faculty members as experts to technical cooperation projects, undertake international joint research (**SATREPS**) that facilitates social implementation of solutions for global issues, and tackle urban problems through **an Urban Thinkers Campus**—the first in Japan of this platform proposed by UN-Habitat.

Challenges

o Most collaboration activities among industry, academia, and government are mainly coordinated by individual faculty members or research groups and not at the level of the university, making them vulnerable in terms of continuity and development. A system to circulate knowledge, information, human resources, and funds from Japan and abroad needs to be established, and the speed of management decisions necessary for external negotiations must be improved.

o While much progress has been made in strengthening international collaboration in individual research fields that are already internationally competitive, the international talent circulation that is essential for the university to function as a platform for knowledge and become a world-class research and education center has only been partially realized.

o The rate of increase in the number of participants in study abroad programs and overseas visits for conducting research, especially by graduate students, has slowed down, so we must expand and strengthen international collaboration to become a center of international talent circulation.

Governance and funding

Strengths and unique features

o The introduction of the **Graduate School and Faculty System** in 2000, which separates the graduate education functions into educational (graduate schools) and research (faculties) organizations, has enabled flexibility in organizational structure and has led to the establishment of the Graduate School of Systems Life Sciences (est. 2003), the Graduate School of Integrated Frontier Sciences (est. 2009), and the School of Interdisciplinary Science and Innovation (est. 2018) and to the implementation of various research and educational reforms across organizational boundaries. Additionally, we have prepared the key infrastructure for the creation and utilization of integrative knowledge through the establishment of the following **platforms that leverage the wide spectrum of knowledge university-wide ranging from natural sciences to humanities**: the **Platform for Inter/ Transdisciplinary Energy Research** (est. 2016), which leverages our strengths in the field of energy research; the **Institute for Asian and Oceanian Studies** (est. 2019), which utilizes human and intellectual assets related to Asian studies to solve current social problems and predict and prevent future ones in the Asia-Oceania region; and the **Collaborative Platform in Research and Education on Humanities and Social Sciences** (est. 2018), which conducts interdisciplinary research that cannot be achieved within the discipline itself through collaboration among various specialized fields in the humanities and social sciences.

o In 2011, we introduced the **University Reform and Revitalization System** to pool together personnel points owned by the departments and reallocate them to enable bold organizational reforms and facilitate outstanding research and education plans for realizing future visions of the university and its departments. Since 2018, the system has been developed into the core of the **Kyushu University Renaissance Project** for sustainable development of excellent human resources and is advancing as an initiative to create a self-sustaining growth cycle for securing and developing human resource through combined personnel reforms led by the President and personnel planning by the departments.

Challenges

- o We must shift focus from university operations to university management with corporate points of view under the strong leadership of the President of Kyushu University. We must develop ways to share visions between leadership and departments and improve faculty member awareness, to promote diversity, and to better reflect the opinions of our diverse stakeholders in university policies.

- o We have not secured the financial resources necessary to enable the rapid advancement of initiatives led by the President. Although we are working to acquire private funds through organization-to-organization industry-academia-government collaboration activities and to increase donations to the Kyushu University Fund, investment is still not as broad as desired.

3. Driving social change with integrative knowledge

Individual researchers working separately in various research areas generally face difficulty addressing and tackling complex social issues alone despite having outstanding academic achievements. Therefore, to robustly address and overcome social issues, we will bring together a broad range of academic disciplines from the natural sciences to the humanities and social sciences under the governance and management of the President while also developing approaches to address ethical and legal aspects of innovations in science. These efforts will thereby form a foundation for promoting the transformation of social and economic systems. To coordinate and propel these efforts at the most fundamental level, we will launch the **Head Office for the Design of Future Society** and the **Promotion Office for Data-Driven Innovation** under the direct control of the President of Kyushu University, and the two offices will work together to develop initiatives that achieve this goal.

The Head Office for the Design of Future Society will oversee the overall management of these efforts. The office will propose social issues to address based on their match to our strengths and unique features through the participation of a diverse range of stakeholders and incorporation of their ideas and will implement innovation gained through research that generates and utilizes integrative knowledge to provide practical solutions to issues faced by society. Furthermore, it will establish the research infrastructure for designing future society (namely, a research unit that integrates social sciences and natural sciences) and will also act as a bridge for the **Kyushu University Regional Collaboration Platform** (details in Section 4E-1), which supports multi-layered regional collaboration and regional and economic growth.

The Promotion Office for Data-Driven Innovation will oversee the formulation of the university's DX initiatives as well as their implementation. Exploring through research what a society that creates new value through the fusion of virtual and physical spaces should look like, the office will put forth and lead initiatives to develop DX-capable professionals, to conduct data-driven education, research, and medical care, and to utilize reliable big data to contribute to solving social issues and the transformation of social and economic systems.

3A. Steps to transform society by solving social issues

In consideration of our strengths and unique features and our curiosity-driven research groups covering a wide range of fields, we have designated **(1) Decarbonization, (2) Medicine and Health, and (3) Environment and Food as our entry points** for solving social issues through innovation. Starting from Fukuoka and Kyushu, we will pursue solutions that will then be extended to other regions in Japan, Asia, and the world that have similar issues. In the area of Decarbonization, we are already conducting joint research with the University of Illinois at Urbana-Champaign via a strategic partnership. In the area of Medicine and Health, we are currently collaborating with more than 75 medical institutions overseas on telemedicine education and training for technicians, and we have substantial experience in the area of Environment and

Food collaborating with researchers in Thailand, Vietnam, and Myanmar to address food security issues.

3A-1. Contribute to decarbonization

Vision and goals

To achieve the government's goals of decarbonizing society by 2050, we cannot simply extend and optimize current research and technologies but rather must create innovative technologies that enable decarbonization of society as a whole and demonstrate a vision and design for an ideal society. The Kyushu University Platform of Inter/ Transdisciplinary Energy Research will play a central role in implementing initiatives for enacting decarbonization of society by uniting research groups such as those in materials and device research, systems research, and urban residential environment research. The university will become a green innovation hub in collaboration with the Kyushu-Fukuoka region, where decarbonization efforts are underway, and will contribute to the creation of innovative technologies, the proposal of policies for regional growth strategies and construction of a decarbonized society model, and the development of highly talented professionals who will drive innovation.

Initiatives

o In the area of **materials and device research**, we will play a role in leading the world in decarbonization research, including research related to **energy conversion technologies** that do not emit carbon dioxide such as fuels cells and electrolysis; **innovative energy-saving technologies** like OLEDs; and even **transportation-related technologies** as represented by next-generation adhesion techniques. We will resolutely develop cutting-edge research and collaborations with industry, government, and academia.

o Centered around the **"Development of Global CO_2 Recycling Technology towards 'Beyond-Zero' Emission" project of the Moonshot Research & Development Program**, we will work toward realizing systems to close **the carbon cycle by establishing energy systems and infrastructure technologies** that recycle carbon to enable circulation loops of carbon and hydrogen, by making advances in wind energy technologies including **offshore wind power generation**, and by creating innovative technologies such as **flying cars**, thereby contribution to the decarbonization of energy use.

o With a goal of assisting the social implementation of technology derived from **the Super Smart Society Service Platform**, we will conduct research on urban living environments in collaboration with UN-Habitat. The research will aim at achieving "zero-energy" urban living through decarbonization and the use of renewable energy, and its achievements will help to arrive at a robust model for urban residential environments oriented toward sustainable development and solving social problems.

o We will cultivate professionals who will contribute to sustainable decarbonization through energy generation and utilization via efforts centered around our Department of Hydrogen Energy Systems, the only one of its kind in the world offering education in science and technology relevant to hydrogen energy.

3A-2. Contribute to medicine and health

Vision and goals

In an aging society with an ultra-low birthrate, we must devise and implement strategies for coping with low birthrates, maintaining good health into old age, improving productivity of the workforce, and preparing for future infectious diseases to realize a society in which for citizens can enjoy physical and mental wellbeing. Such strategies must not be limited to social implementation of research output in the fields of medicine and health but must also incorporate discussions on what kind of social change we should aim for through DX. Under our DX initiative, we will promote

social implementation and commercialization of research achievements with a focus on the three fields of disease prediction and early detection; preservation of healthy physical function and telemedicine; and precision medicine and innovative treatment. Related initiatives include discovering and transferring new research seeds in medicine and conducting high-quality clinical research and clinical trials. We will also work closely with Fukuoka City, leveraging its standing as a National Strategic Special Zone in the area of global start-ups and job creation, to advance the social implementation and commercialization of research achievements.

Initiatives

o As part of our initiatives for **disease prediction and early detection**, we will launch the "**Trans-Omics Cohort Study**," which will be one of the most precise cohort studies in the world. To enable this study, we will develop common protocols for analyzing and cross-analyzing multiple levels of molecular biological information that comprise omics data, from the genome to metabolites. The study will also make use of the medical big data from genome cohort studies, including the Hisayama Study, as well as the largest store of clinical data in Japan held at Kyushu University Hospital. In view of **the social implementation of precision medicine**, through the establishment of the Division of Precision Medicine in the School of Medicine, a first in Japan, and the Clinical Genetics Center, we will systematically conduct studies from prenatal diagnosis to genomic diagnosis and treatment and prognosis tracking using patients' mobile devices. Based on this data, we will be able to conduct integrated, scientific evaluation of molecular-level biological information of each individual's diseases, which will lead to better treatment and prevention. In addition, we will build a mechanism for training general practitioners with advanced expertise in infectious diseases to facilitate and improve countermeasures against infectious diseases such as the novel coronavirus.

o In regard to **preservation of healthy physical function**, we will advance research on body-assisting devices with a view toward social implementation as front-runners to realizing a society in which people can enjoy good health into old age with peace of mind through Society 5.0 and complete **the "Salvitas Device,"** a sensor combining the five senses using technology such as brainwave sensors, audio visualizers, and health meters. Additionally, we will leverage our experience conducting a total of 1,293 education programs in 75 countries, our collaborations with the Japan Surgical Society to establish guidelines for robot-assisted remote surgery, and analytical technology for telepathology developed with a Kyushu University start-up company[2] to contribute to **the social implementation of tele-medicine**.

o In the area of **precision medicine and innovative treatment**, through efforts centered around **the Center for Clinical and Translational Research** and **the Greenpharma Research Center for System Drug Discovery**—two organizations connected to implementing future medical care in society—we will expand our academia drug discovery base by constructing a library of middle molecule compounds, improve and develop technology for synthesizing optimized new lead compounds, and develop **cutting-edge translational research** aimed at creating innovative medicines by 2030. Furthermore, we will promote industrialization in biotechnology and drug discovery to translate our innovative treatments to social implementation by taking advantage of the achievements in start-up[3] originating from our university in the field of regenerative medicine and cell medicine, genome editing technology,

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[2] Medmain Inc., a start-up found by a graduate of Kyushu University's School of Medicine, provides services using PidPort, an AI/digital remote pathology analysis platform.

[3] Kaico Ltd., which designs proteins and antibodies; EditForce Inc., which has proprietary genome manipulation technology; Cyfuse Biomedical K.K., which promotes regenerative medicine with 3D bioprinter technology; GAIA BioMedicine Inc., which develops drug products for proprietary, highly functional designer cells; and other university-launched venture companies that provide services.

and more. As for **COVID-19 countermeasures**, in cooperation with Fukuoka Prefecture and Fukuoka City, we will promote epidemiological investigation of mutant strains in Fukuoka and development of therapeutic drugs and vaccines, and we will establish medium- to long-term pandemic countermeasures for new infectious diseases.

3A-3. Contribute to environment and food

Vision and goals

To intervene in environment and food issues, we will lead the following research, the outcome of which will have practical relevance and could be implemented both in Japan and overseas. Firstly, to tackle environmental problems that are affecting a wide range of regions, such as climate change and air and oceanic pollution, we will lead research on oceanic and atmospheric environments, which draws on ocean dynamics and atmospheric science. Secondly, to tackle food security issues, we will lead agriculture and food research in areas including breeding technologies and the resourceful use of non-edible resources to find a food supply system that is sustainable and safe for consumption.

Initiatives

o The goals of research on **oceanic and atmospheric environments** include **the prediction of the concentration of PM2.5** and the identification of the roles these particles play in climate change such as by studying climate impacts of various short-lived climate forcers (SLCFs) in different regions using hierarchical numerical models and exploring possible mitigation to climate change and environmental damage caused by SLCFs. These studies will lead to a more sophisticated understanding of these particles and their effects on climate change, human health, agricultural produce, and natural disasters. Detailed studies of how the flow of disposed plastics affect the formation and transportation of microplastics in the ocean and how **microplastics in the ocean** affect global environment will also be conducted. These lines of research will contribute to setting international reduction targets for plastic waste by providing concrete numbers and percentages for targets.

o Work ongoing under projects such as the **"Research for the Realization of Green Revolution 2.0" project of the Moonshot Research & Development Programs** will be an important part of our efforts regarding **agriculture and food**. This research will lead to innovations that are essential for a sustainable food supply, including **technology for full life cycle aquaculture and breeding using genome editing technology**. More specifically, it includes both fundamental and applied research on genome information of plants and bioresources. We aim to develop several new, high-value-adding species drawing on strategic breeding through insect genome science, and by mass producing these new species with low cost, will contribute to the formation of a sustainable supply system. In addition, we are pursuing studies on biodiversity with insects as indices and research to develop **edible insects** from non-edible insect resources for animal feed and human consumption.

3B. Steps for DX-driven social reform

Vision and goals

We must become a university that leads DX-driven social reform through the education and fostering of specialized, creative professionals who can lead the development of the digitalized society envisioned by the basic policies outlined in the government's "Basic Reform Policy for the Realization of a Digitalized Society."[4] To realize our goal, we will draw upon integrative

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[4] Basic principles according to the Basic Reform Policy for the Realization of a Digitalized Society (デジタル社会の実現に向けた改革の基本方針): (1) open and transparent, (2) fair and ethical, (3) safe and secure, (4) sustainable, stable, and robust,

knowledge to conceive a new vision of a future society that will bring true prosperity to people and to develop data-driven education, research, and medicine that will "continuously create new value," sharing and utilizing the output of these efforts with the local region to achieve social change.

3B-1. Strengthen the foundation for the realization of Society 5.0

o Central to strengthening the foundation for research and education toward the realization of Society 5.0 will be the to-be-established **Promotion Office for Data-Driven Innovation**. This office will consist of departments including a research division that explores "how future society should be" based on new value propositions that are expected to emerge from the fusion of cyberspace and physical space by DX and a division that promotes data-driven education, research, and medicine. In particular, the research division will be a place for researchers from humanities and social sciences to collaborate with those from information science, and, in cooperation with the Head Office for the Design of Future Society, to share with the public ideas for future society as well as strategies and initiatives to realize them.

3B-2. Develop data management and governance

o To advance data-driven education, research, and medicine, we will establish new strategies, systems, and procedures for **data management (DM)**, addressing issues such as storage, modification, and utilization of data; accumulation and maintenance data; and visualization of data structures. In addition, we will establish clear guidelines and procedures for **data governance (DG)** to regulate and support the execution of DM. These efforts will allow us to develop **new data-driven innovation projects** that can be implemented in society.

o We will **recruit and train a team of specialists** who are well versed in information and communications technology (ICT) and data utilization and create an environment that spurs beneficial exchange between this team, cloud companies, and the IT companies we use for outsourcing. In the future, by circulating these ICT specialists within our university and among outside universities and companies, we will cultivate a new group of skilled ICT personnel (research engineers).

3B-3. Implement data-driven education, research and medicine

o We will further develop and implement **Kyushu University's DX for Education Advancement Initiative**[5]—which was selected by MEXT for the "Plus-DX" program as a plan for achieving a smart-campus at institutes of higher education through Digital Transformation—with the following offices responsible for advancing education reform at Kyushu University at the core of the effort: the Education Innovation Initiative (est. 2017), the Learning Analytics Center, and the Innovation Center for Educational Resource (ICER). We will adopt successes from the initiative university wide, and we will employ **educational data incorporating M2B**—our online learning system—and teaching materials and teaching methods applying digital technology to further improve the quality of education and learning. Furthermore, as **an open education activity**, we will make public to the fullest extent possible big data pertaining to next-generation digital teaching materials and teaching methods gained through the DX for Education Advancement Initiative.

o "Information Science" will be made a required course for all undergraduate students, in which they will learn introductory mathematical modeling and data analysis. For juniors, seniors, and

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(5) solving social issues, (6) quick and flexible, (7) inclusive and diverse, (8) pervasive, (9) creating new value, and (10) rapid and beneficial internationally.

[5] Kyushu University's DX for Education Advancement Initiative includes: (1) learner-centered education through learning analytics, and (2) improvement in the quality of education.

graduate students, we will provide systematic education in data science such as through courses like "Special Lectures on Data Science Practices"—which will enhance students' data literacy and help them incorporate data science in their actual research—and through on-campus internships at research labs specialized in data analysis. These efforts will help us produce **data-literate professionals regardless of their discipline,** be it social sciences or natural sciences.

o The **Pan-Omics Data-Driven Research Innovation Center** (est. 2019), which is jointly operated by the Research Institute for Information Technology and the Institute of Mathematics for Industry among others, will form the center of efforts for equipping young researchers with the high-level skills and ability to collaborate necessary for launching new scientific approaches that integrate the fields of measurement science, data science, computational science, and mathematics by using skills for applying computer simulations and AI in their research. Circulating these young researchers back to their specialized research fields will then further strengthen our data-driven research infrastructure.

o We will deposit, make available to public, and encourage the utilization of research data such as through approaches like green open access led by the **Kyushu University Institutional Repository (QIR)**. One initial pilot project related to this push is our MEXT-funded **"Initiatives for Materials Science Frontier Research" project**, in which we are the hub university for research pertaining to materials data. This initiative will also contribute to the development of a new research community and environment for the DX era.

o In view of the radical transformation that DX will bring forth in healthcare and medical systems in the coming decades, we have started actively pursuing DX in the areas of medicine and health. These efforts will lead to earlier identification of risks and implementation of prevention measures and to enhanced medical and health services through the utilization of medical record data as well as the data that individuals collect in their daily life.

3B-4. Contribute to innovation through DX

o We will launch an initiative that will make use of the big data available from Kyushu University Hospital in tandem with research data from academia to lead to innovation by drawing upon new ideas in medicine and health technology, such as methods for super-early diagnosis. In addition, we will contribute to solving social issues through **initiatives such as support for the introduction of massive, offshore wind farms using big data analysis and AI**, which is proceeding in collaborative with an energy company, and **an initiative to develop an app focusing on coastal fishery resources** to support coastal fishery, which is ongoing through collaboration between our university, the local government, and private businesses.

o The President will be responsible for expediting the social implementation of successful DX-driven initiatives by giving them priority in the allocation of university resources.

4. Becoming a world-class hub for research and education

While our highest priority lies in initiatives for solving the issues faced by society through the three entry points discussed in Section 3 and for achieving social change through DX, we are at the same time determined to **identify new research fields where we have a potential to lead the world and become a world-class research and education hub capable of producing integrative knowledge to bring about change in socio-economic systems**. In what follows, we discuss how we plan to realize these goals through initiatives to strengthen and revitalize our research and teaching by leveraging our university's strengths and unique features and to overcome the challenges we currently face.

4A. Steps to enhance teaching to train professionals who create new value

Securing and fostering excellent students from inside and outside Japan is one of the fundamental goals of our Designated National University proposal. We will cultivate professionals necessary for the realization of Society 5.0 who are equipped with multi-disciplinary knowledge and skills and who can design the future of society and draw on integrative knowledge to create new value. To this end, learning and research will be developed as inseparable of each other, and our doctoral programs will offer education that will broaden future career paths by educating with an awareness toward becoming highly skilled professionals in diverse fields in addition to cutting-edge researchers.

Benchmark universities: University of Groningen; National Taiwan University

The University of Groningen (ranked 128th in the QS World University Rankings 2021) currently offers over 180 degree programs and excels in providing education that is multi-disciplinary and problem-solving oriented. Its doctoral programs offer career training programs, and the university succeeds in maintaining a high quality of education through the Bologna Process

National Taiwan University (NTU) (ranked 66th in the QS World University Rankings 2021) has succeeded in terms of international talent circulation by concluding strategic partnership agreements with a total of seven universities in Europe, the U.S., and Asia. NTU has approximately 5,500 international students (17.1% of its total student body) from about 60 countries across the globe, and close to 80% of its faculty members are either from abroad or obtained their Ph.D. from an overseas institution.

Performance indicators

1. Problem-solving oriented education courses introduced to all department programs.
2. Number of international students increases from the current of 2,422 (about 12 % of the total student body) to over 3,200 (about 17%).
3. Number of the international faculty and the faculty with international experience (including faculty members who obtained their Ph.D. from overseas institutions or who have conducted research abroad for more than one year) increases from the current of 1,000 (about 42% of the total faculty) to over 1,500 (about 63%).

4A-1. Advance education that cultivates the vision and imagination for problem solving and value creation

o We will adapt the **extensive foreign language education** as well as the **problem-solving-oriented education programs** based on problem-based learning and team-based learning implemented by the School of Interdisciplinary Science and Innovation into a campus-wide curriculum by linking them with KIKAN education. In addition, courses on design thinking will be offered in undergraduate and graduate curriculums to develop **STEAM education** that nurtures the skills for creatively identifying and solving actual social issues. Furthermore, the Education Innovation Initiative will lead **curriculum management** to create a platform for cross-disciplinary education at both undergraduate and graduate levels.

o We will provide **systematic entrepreneurship education** aimed at developing professionals who will take on the challenge to create new value. We will do so by enhancing the programs currently offered by the Robert T. Huang Entrepreneurship Center of Kyushu University (QREC) to support students' creative activities and the entrepreneurship courses that are an integral part of KIKAN education, as well as those offered for majors in the School of Engineering, the School of Design, and the Business School.

4A-2. Develop versatile Ph.D. graduates

o   We will enhance and expand **interdisciplinary degree programs that span across schools**, with **the Graduate Program of Mathematics for Innovation**—part of MEXT's WISE Program (Doctoral Program for World-Leading Innovative & Smart Education)—serving as a flagship model. These programs, along with the existing graduate curriculums that aim to develop pioneering researchers and highly skilled professionals, shall produce "advanced knowledge professionals." In addition, international faculty members and experts from outside the university will be actively incorporated into the Ph.D. defense process to make the exam system more objective and international.

o   To broaden career paths for Ph.D. graduates, we propose the following initiatives. First, we will push Ph.D. students to study abroad for conducting research and to participate in internships geared toward career path development at overseas and domestic companies and government institutions. Through these activities, we hope to develop them into researchers, businesspeople, and highly skilled professionals who can open new paths on their own. Second, we will expand **the Doctoral Degree Program for Students in the Workforce**, which allows students who enter the workforce after completion of their master's degree to concurrently work at a company and pursue Ph.D. studies. Lastly, we will enhance opportunities available in the **Joint Research Program to Support Doctoral Students' Research and Career**, which allows Ph.D. students to participate in collaborative research with companies, thereby helping them explore career and entrepreneurship opportunities inside and outside Japan.

o   We plan to recruit excellent Ph.D. students by enhancing comprehensive support through the unification of systems for providing support for living, research, and international travel; for employing students as teaching assistants and research assistants; and for supporting Ph.D. students and post-doctoral fellows in career-path development.

4A-3. Internationalize education and promote a global environment

o   Since the start of Japan in Today's World (est. 1994)—a short-term exchange program for students in partner universities that was the first of its kind in Japan—we have launched about 100 programs. Drawing on this rich experience and the international networks that have been established, we plan to increase diversity and international mobility by enhancing existing international courses and international programs at undergraduate and graduate levels. In addition, we will incorporate **Collaborative Online International Learning (COIL)** in all academic programs on campus. These efforts will effectively strengthen both the inbound and outbound flow of students and provide greater opportunities for interaction between Japanese and international students.

o   Based on university-wide internationalization strategies, we will accelerate the internationalization of education by strengthening cooperation with overseas universities in education at the graduate level, **expanding double-degree programs**, and **establishing new joint-degree programs** (international cooperative education programs).

4B. Steps to boost research capabilities to compete with the world

To compete with the world's top universities, strengthening our research capabilities is of utmost importance, from fundamental research to applied research that could be implemented in society to solve social problems and bring about social change. Through the strengthening of research governance and management, we will boost curiosity-driven research, collaborative and cooperative research, and research in areas in which Kyushu University is particularly strong and has received focused, strategic investment. By doing so, we will promote the creation and utilization of integrative knowledge that advances social change through academic research and the resolution of societal problems. In addition, through the strategic allocation of internal resources (human resources, equipment, money, space, and time), we will further extend our lead

in research areas in which we currently are world leaders as well as those that are distinct to Kyushu University and will recruit and train excellent researchers who will become sources of innovation.

Benchmark university: University of Illinois at Urbana-Champaign (UIUC)

UIUC (ranked 82nd in the QS World University Rankings 2021) is one of our strategic partner universities. At UIUC, the Office of the Vice Chancellor for Research and Innovation (OVCRI) overseas the management of a total of nine, interdisciplinary research institutes. By doing so, UIUC succeeds in strengthening research capabilities and revitalizing interdisciplinary collaborative research, leading to the production of integrative knowledge for tackling global issues. In the past five years, it has published 11,947 articles through international collaboration and 13,121 articles in top ten percent journals, making UIUC's research capabilities on par with other world-class universities.

Performance indicators

1. Articles published with international coauthors in the second half of the next ten years exceeds 10,000 over a period of five years (currently 6,892).
2. Articles published in the top ten percent journals in the second half of the next ten years exceeds 9,000 over a period of five years (currently 6,560).
3. Percentage of young researchers increases to over 30% (currently 24%); the percentage of female researchers increases to over 25% (currently 14%); and the percentage of international scholars increases to over 10% (currently 6%).

4B-1. Enhance implementation of research strategy

o We will establish the **Kyushu University Comprehensive Research Strategy Council**, which will be responsible for setting and managing the university's overall research strategy. The council will work in liaison with the Promotion Office for Data-Driven Innovation, described earlier, and with the Office of Institutional Research to serve as our brain for strengthening research capabilities. They will (1) identify new research areas where data analysis can help create new strengths, (2) identify issues that need to be improved to enhance research capabilities of the university as a whole, (3) strategically allocate financial resource, (4) propose plans for collaborative research projects with strategic partner universities, and (5) study how **integrative knowledge** could be generated by integrating knowledge from the **natural sciences** with knowledge from the **humanities and social sciences**—including research on ethical, legal, and social issues (ELSI)—led by the Collaborative Platform in Research and Education on Humanities and Social Sciences and knowledge from the School of **Design**.

4B-2. Promote the generation and implementation of integrative knowledge

o We will strengthen research capabilities through strategy proposed by the Comprehensive Research Strategy Council to build new foundations to create integrative knowledge through idea exchange, collaboration, and co-creation among researchers. The knowledge thus produced will contribute to the development of research in academia as well as to help solve problems in society. More specifically, at the **Platform of Inter/ Transdisciplinary Energy Research** and at the **Institute for Asian and Oceanian Studies**—the two campus-wide platforms established with faculty acquired through the University Reform and Revitalization System—we will establish a research structure that will realize productive collaboration between natural sciences and humanities and social sciences.

o To enhance the production of integrative knowledge, we will expand **the Collaborative Platform in Research and Education on Humanities and Social Sciences** and prepare

infrastructure required for becoming an Asian hub for research in humanities, archaeology, and history and for conducting research that helps build new socio-economic systems through the examination of ethical, legal, and social issues (ELSI) of emerging innovations in science and technology, which is essential for the implementation of these inventions in society.

4B-3. Strengthen frontier research

o We will establish the **Head Office for the Design of Future Society** to prioritize the allocation of resources to the three research fields selected as entry points: decarbonization, medicine and health, and environment and food. By doing so, we aim to further advance these research areas, to strengthen their peripheries, and to foster research activities producing and utilizing integrative knowledge. This will help strengthen our ability to collaborate at the university level with other institutions and help grow our large-scale research projects and international joint research.

o Large-scale research hubs that are on par with the rest of the world and research that is expected to create new value and innovation that will bring about social change will be recognized as a "**Designated Research Innovation Zone.**" This zone will get priority in the allocation of financial resources and faculty through the University Reform and Revitalization System and from the university management personnel. In addition, researchers and research assistants who demonstrate excellence will be strategically recruited to this zone and given tenure through financial resources gained from large-scale research hub programs to sustain continuous research advancements.

o To enhance research capabilities and expand the scale of collaborative research, the President himself will lead marketing and negotiations with government offices, and coordinators for collaboration with the industry sector and faculty members who are skilled in these areas will assist with the launching of projects. These initiatives will also tie into the **creation of an innovation ecosystem**. Furthermore, research related to these projects will be given a **special status regarding intellectual properties** so that certification of employee inventions, costs pertaining to patent rights application, and transfer of rights to patents can be handled flexibly.

4B-4. Advance research through the recruitment and development of excellent researchers

o We have a substantial pool of know-how and experience regarding the development of excellent young researchers through existing programs at **the Institute for Advanced Study (IAS)** and the INAMORI Frontier Research Center. We will utilize this know-how and experience and related achievements to remake IAS into a hub for strategic recruitment and development of excellent young researchers as well as high-level research activities pursued by senior researchers. Top-class researchers will interact with each other across the boundaries of age and field, and the synergy of these interactions will create a **platform for knowledge that will lead to the development of new academic fields and international talent circulation**, with the effects spreading to the entire university.

o For the recruitment and development of excellent young researchers who have original and ambitious research plans, we will establish the tentatively titled **INAMORI Fellowship Program** at IAS. Through this fellowship scheme, we will recruit about 25 young researchers from overseas in the first five years. These faculty will initially be given term-appointment, but we plan to transition about half of them to tenure-track appointments in their respective departments. They will be co-appointed to the department of a host faculty with related research interests and will be given sufficient workspace and research support and funding to conduct research and advise graduate students. The departments that successfully hired these researchers for tenure-track positions through a thorough examination process will be given incentives, which will lead to strengthening the departments' research capabilities.

o We will appoint promising young faculty members to IAS and provide them with additional research space, research funding, and collaboration opportunities with senior faculty to help them excel further as researchers who can open new research fields. These promising, young faculty members will be chosen from a pool of excellent, young faculty members who got their appointment through **the Fusion Oriented Research for Disruptive Science and Technology (JST-FOREST) program** or who got tenure through **the University Reform and Revitalization System**.

o In addition to developing young researchers at IAS, we aim to acquire a total of **300 young, female, and international researchers by 2030** through the University Reform and Revitalization System and provide funding for conducting fundamental research. Each year they will be given opportunities to participate in a leadership workshop tentatively titled the Foundational Program for International Leadership Development to acquire skills needed to succeed internationally across academia and industry. In addition, we will select about 15 young, female, and international researchers and provide them with opportunities to attend more extensive programs—such as the **Diversity and Super Global Training Program for Female and Young Faculty (SENTAN-Q)** and the **International Research Leader Training Program**—to help them develop management skills and conduct internships in world-class research institutions.

o To attract, develop, and keep excellent researchers, we provide **Joint Spousal Employment for researcher-couples**, hiring them either together or in sequence, so that the couples can stay together; **Support for Long-Term Leave** for faculty who take parental leave or nursing care leave, which is a provision to hire an adjunct faculty up to three years; **Support for the Employment of Research Assistants (short-term)** to help faculty faced with life events carry on research activities; and **Support for Female Faculty Members and Researchers Returning from Maternity and Parental Leave**. Such seamless and continual support contributes to creating an environment where researchers can concentrate, as much as possible, on their research.

4B-5. Promote curiosity-driven research

o To build an environment where the faculty can secure time for research and produce outstanding research output, we will introduce the **Free Quarter for Research (FQR) system**, through which a researcher can secure at least one quarter solely for conducting research. To make this happen, we will reduce the burden of teaching and administrative tasks by introducing a quarter system for educational courses, streamlining and integrating class subjects through the use of digital technology, setting a three-month period during which administrative meetings of the university as well as departments will, in principle, not be held, and reducing the number of participants in and the frequency of such meetings. The FQR will allow for the focus of evaluation of faculty performance to shift from quantity to quality, such as by taking into account citation counts and the number of articles published in top ten percent journals.

o We will introduce the tentatively named **Q-Brain Bank** to create a pool of retired faculty members who will provide the following support to reduce administrative burden and help current faculty secure time for conducting research: (a) teaching support, such as filling in for teaching duties and preparing electronic teaching materials, (b) research support, such as editing research articles and writing application documents for research funding and projects, and (c) outreach support, such as connecting with local municipalities and outside organizations and participating in fundraising. We will also provide sabbaticals for a group of young faculty members to concentrate on research activities inside and outside Japan utilizing FQR and Q-Brain Bank.

o We will **invest up to 3 billion yen in research equipment and facilities over six years**. In addition, we will promote the effective collaborative use of research facilities by encouraging

the use of **ShareAid, a web portal for researchers to share equipment and facilities,** devising a systematic support system for employing technical staff, and installing research equipment that could be operated remotely.

o We will introduce new ways of funding research conducted by young researchers leading ambitious research projects. They will be given funding for several years in a package, and they can utilize the funding flexibly depending on their individual research plan and the progress of the research.

4C. Steps to connect with society

We will strengthen industry, academia, and government collaboration to facilitate the solving of social problems and to accelerate social implementation through the commercialization of research output, thereby creating a self-sustaining growth cycle of research output and social implementation by utilizing the income that is produced. In addition, the university will work to develop the results of research and education into society in various forms.

Benchmark university: University of California at San Diego (UCSD)

UCSD (ranked 54th in the the QS World University Rankings 2021) has a support office that manages research promotion and industry-academia partnerships in an integrated manner and oversees promotion of start-ups, support for grant applications, coordination with private companies, IP management, and technology transfer. Through far-extending outreach campaigns, the office also actively engages with local citizens. Through these efforts, UCSD has, as the latest statistics suggest, generated over 116.1 billion yen worth of revenue (19% of the total annual budget) from industry-academia collaboration and other research activities, showing how active industry-academia collaboration is at the university. Using UCSD as a model, we shall further promote partnerships between industry and academia, double the amount of joint research funds, and multiply the number of university start-ups.

Performance indicators

1. Amount of funding for joint research doubles from the current 2.5 billion yen to 5 billion yen in ten years.
2. Number of university start-ups increases to over 50 in the next ten years from the current 15 in the last five years.

4C-1. Strengthen the university's power to promote open innovation

o We will strengthen the university's capabilities for open innovation by establishing the **Open Innovation Platform (OIP)** as an interface for industry-academia-government collaboration. The cornerstone of OIP is a series of achievements by **the Center of Coevolutionary Research for Sustainable Communities** (est. 2013)—which has been operating as a base for promoting social implementation toward the solution of regional issues—and the services provided by the Academic Research and Industrial Collaboration Management Office (AiRIMaQ) and the Global Innovation Center. OIP will drive the formation of an innovation ecosystem that autonomously generates innovations, including ones influencing the future shape of society. For instance, OIP will, in collaboration with organizations including the Head Office for the Design of Future Society and the Office of Institutional Research, lead social implementation of research output that contributes to solving social issues or to transforming socio-economic systems. OIP will also identify researchers who demonstrate strong leadership in social implementation and form research teams geared toward social implementation.

o We will undertake a radical review of **Kyushu TLO Company**—a fully owned subsidiary of the university that serves as a technology licensing organization to transfer technology generated by our research from the university to industry—in terms of its functions and

structure and launch **a new external corporation**. The new corporation will inherit OIP's support section to ensure the continuity of the services the latter provides. Furthermore, it will be made into a holding company to seamlessly manage anticipated national research and development institutes and venture capital for university start-ups.

o Through OIP's management, we will conduct research projects leveraging strong collaboration with industry, academia, and government as **issue-driven initiatives**. By continuously providing the kind of institutional support commensurate with the scale of such research projects, we will accelerate the development of researchers with an "open innovation" mindset and the pace of social implementation of our research output. Such social implementation will also result in greater IP-related income. By returning the income to the research projects that have contributed to producing it, and by investing heavily in new research projects that will become future strengths, we will create a self-sustaining growth cycle of research that contributes to society.

o As a **science-driven initiative**, OIP will provide seamless support for everything from planning marketing strategies that include considerations for patent applications accompanying commercialization to the launching of university start-ups These services will enable us to quickly discover original research—both basic and applied—performed by our researchers that will generate innovation and to connect these achievements to social implementations without any institutional barriers or delay. In the medical field in particular, the Center for Clinical and Translational Research is expected to play a central role in driving translational research to promptly achieve social implementation of future medicine.

4C-2. Advance social implementation and strengthen the financial base

o We will conclude institutional collaboration agreements with large companies with **the Presidents leading the sales pitch**, win more large-scale joint research projects, and establish a start-up support fund. Taking advantage of Fukuoka City's standing as a National Strategic Special Zone and the support system provided by the Fukuoka Startup Consortium, we will strive to promote social implementation and commercialization of research output in various forms. Through these efforts, we will generate new funding for research through joint research designed to commercialize technologies and know-how (including through the income earned from commercialization of patents, new technologies, and business methods) and increase profits through technology transfer. Consequently, **a self-sustaining growth cycle of research and social implementation** will emerge, thereby **forming a stronger financial base**.

o We will reshape our unique gap fund program into the **Support-and-Nurture the Next-Generation University Start-Up Seeds Program (GAP fund NEXT program)** and more rapidly produce university start-ups by building a scheme that solves shortage of both commercialization verification and candidates for management positions. This program—which will be implemented in cooperation with Fukuoka City, a hub for the start-up ecosystem—is part of **the Social Return Acceleration Program** (SCORE). In implementing the program, a CXO (Chief Experience Officer) candidate or pre-CXO will be appointed. The pre-CXO is responsible for conducting the commercialization verification needed to convert pipeline ideas selected for GAP into full-fledged projects. The pre-CXO, apart from undergoing on-the-job training to get practical experience, will be required to go through systematic entrepreneurship education, making it possible for the candidate to simultaneously acquire practical on-site experience and training required for the job.

4C-3. Encourage citizen science

o The university's Science Communication Promotion Group will act as the hub for spearheading local outreach campaigns, including science cafes, on-site lectures, and campus tours. By making the results of research and education publicly available, raising the awareness of

citizens, and engaging in dialogue with them, we will build a foundation for performing research jointly, which will tie into **the development of responsible research and innovation**. Additionally, we will consolidate our research and education activities with social experimental elements that are closely tied to the local community (*e.g.*, the Kyushu Architecture Students Supporters for Environmental Improvement Project, which is working on improving temporary housing conditions) to form an incubator of social collaboration on- and off-campus. Based on these activities, we will actively make and implement projects that will stimulate **citizen science** and develop activities not only in Fukuoka but also in surrounding areas, Asia, and the world.

4D. Steps to strengthen international collaboration

What sets a world-class university apart in terms of international collaboration is the ability to attract talented students and researchers from all over the world as it produces first-rate achievements in research and education. In other words, the university's ability to act as a hub for international talent circulation. We seek to enhance our functions in this respect by establishing international collaborative relationships with our strategic partners and by building an environment to help promote such relationships.

> The benchmark universities and performance indicators are the same as for "4A. Steps to enhance teaching to train professionals who create new value" and "4B. Steps to enhance research capabilities to compete with the world."

4D-1. Accelerate international talent circulation through strategic global partnerships

o We have recently adopted a new international strategic management system in line with a vision of collaborative co-creation between the university headquarters and the departments, and established the **International Strategy Planning Office**, which is directly under the control of the President. The office will formulate international strategies based on evidence using DX and put them into effect in collaboration with **Departmental International Offices** placed in every academic department. We will also regularly seek advice from the Global Advisory Board, which includes pre-eminent overseas researchers, and use them to formulate and revise our strategies. Furthermore, we will subject the functions of our present overseas offices to a thorough reexamination and use them to recruit talented international students, to strengthen the ties with local education institutions, and to formulate a new model covering all of Europe with the newly established Stockholm Office as the center point.

o We will select universities as focal international collaborators based upon our new international strategies and giving due consideration to factors such as their rankings, locations, and networkability. We will call a handful of such **exclusive universities "strategic partners"** and form with them multidimensional and stable international partnerships in terms of research, education, human resources, and governance. With that end in mind, we will institute overseas matching funds with these partners. (For example, having already come to such an agreement in five fields, including Smart Grid and Sustainable Energy, Data Science/ Data Management, and Curation, with University of Illinois at Urbana-Champain (UIUC), we will attempt similar arrangements with other universities.) We will also use consortiums of the world's leading universities such as MIRAI (Sweden), RENKEI (the U.K.), and APRU (the Pacific Rim) to give new dimensions to our collaborative efforts.

o We will raise the number of international researchers and students coming to Kyushu University to take advantage of **our first-rate research and education facilities** that are match or exceed any in Japan, including the university's hydrogen experiment facility, fuel cell experiment facility, and other state-of-the-art research facilities and equipment, and the **smart farm** that makes use of ICT. This will increase the number of international joint research

projects and lead to further improvement in the quality of education, thereby accelerating the pace of international talent circulation. As for student exchange, we aim to increase the number of inbound and outbound students through measures such as (a) the university-wide promotion of COIL-style education, (b) the establishment of joint degree programs with university-wide support, and (c) the promotion of international exchange programs and the improvement of program contents before, during, and after studying abroad based on the know-how of the School of Interdisciplinary Science and Innovation. Regarding the exchange of researchers, we will actively seek cross-appointments with our strategic partners so that the number of international joint research projects will rise accordingly.

4D-2. Make the campus environment more conducive to international talent circulation

o We will lead other national universities in Kyushu in terms of **implementing bilingualism** (Japanese and English) in the on-campus environment related to education, research, and daily life. We will elevate our ability to handle international duties through training of staff and improve the quality of our counseling services for international students as to improve the quality of services and the living environment for international students and researchers. Around campus, we will build, in cooperation with the private sector, **more dormitories where local and international students can live side by side**, thereby promoting interaction, exchange, and co-learning among international and Japanese researchers and students.

o We will expand networks with our international alumni, seek to organize overseas alumni associations, and create a new fellowship for our overseas alumni that enables them to come back to their alma mater and conduct research with adequate institutional support. In this way, we will establish a long-lasting relationship with our alumni and boost our efforts for international talent circulation. Furthermore, we will hire additional staff such as fundraisers and experts for international networking. By taking advantage of our expanded global networks and potential affluent donors outside Japan, we will raise more funds to strengthen the university's financial base.

o We will invite our students to play a more active part in the administration of our international projects by expanding the activities of Q-Mates, a group of student assistants comprising both Japanese and international students, and various international student associations. In particular, students will be asked to provide advice and counsel at the student counter, attend to VIPs from overseas, give tours of campus, and coordinate with overseas alumni associations around the world.

4E. Steps to strengthen university governance

To realize our vision of "driving social change with integrative knowledge," we will strengthen the university governance, strongly promote education, research, and international collaboration that align with our vision, and advance initiatives that will bring social change through solutions to social issues and DX.

Benchmark universities: University of California at San Diego; National Taiwan University

UCSD's case can teach us much as we aim to strengthen university governance by the President. USCD (ranked 54th in the QS World University Rankings 2021) has a system whereby the Provost is given power to fine-tune the interests of the faculty senate and coordinate among the Vice Presidents and is involved in final decisions about hiring and faculty evaluation. National Taiwan University (ranked 66th in the QS World University Rankings 2021) has, together with a reward-for-high-performance system, an evaluation system whereby the performance of its employees is quantified so that it can make promotion decisions based on them, which will serve as a reference as we try to develop an environment where both the

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faculty members and administrative staff have incentives to do good work.

Performance Indicators

1. University governance strengthened and stakeholder engagement increased through the activities of the Head Office for the Design of Future Society.
2. University leadership further diversifies to consist of 40% females and international members (currently about 24%).

4E-1. Strengthen university governance by adopting corporate points of view for management

o We will change the style of **the university administration from operation to management with corporate points of view** by building both a mechanism whereby university leaders work closely together with all departments to achieve the President's medium- to long-term vision for the university and a mechanism whereby various stakeholders have their say in university policymaking. We will also strengthen the university governance by reinforcing the support system for the President through the appointment of **the provost**, the creation of the **Executive Office of the President** for strategy formation and university-wide coordination, and the activities of the Office of Institutional Research for evidence-based policymaking.

o The Head Office for the Design of Future Society will be part of the **Kyushu University Regional Collaboration Platform** for strengthening ties with the Fukuoka Directive Council (FDC)—a committee for industry-government-academia collaboration in Fukuoka—and the Organization for Promotion Academic City by Kyushu University (OPACK)—an organization set up for helping develop the Kyushu University Research City and act as a go-between for Kyushu University and these organizations. As such, it is designed to create new opportunities for collaboration in the region and strengthen its functions.

o We, as the region's leading institution of higher education, will join **the initiatives from the Renewable Energy Cooperation Committee, in which national universities in the Kyushu area work side by side to realize a carbon-free society**, and the Joint Programs with Colleges of Technology, in which we collaborate with nine local technical colleges on educating future leaders. Furthermore, we will make use of our resources on education and research by working closely with regional universities like Ritsumeikan Asia Pacific University, with which we jointly offer problem-solving-oriented education in a globalized environment.

o We will upgrade the current system whereby resources such as human resource points, education and research budgets, research facilities, on-campus workspace, and faculty time allocated to research are centrally controlled. This will lead to the improvements in our management system and the effective and efficient use of the university's resources. Moreover, to build an environment that incentivizes faculty members to work to the best of their abilities, we will revise our salary management system in such a way that, giving due regard to factors such as the employee's roles, powers, and responsibilities, performance will be evaluated more fairly and subsequent treatment made more appropriate. Salaries will reflect the outcome of this more equitable and comprehensive assessment. The outcome will affect not only the prospect of a pay raise but also how research funds and space are distributed.

o We will improve the quality of the university's global marketing by assigning **science communicators** to the tasks of promptly producing multilingual public relations materials dealing not only with the university in general but its research and education output and of supporting the President's and other leaders' active efforts at global marketing. These will lead to greater name recognition outside Japan and the formation of stronger global networks.

4E-2. Diversify the campus

- o We will diversify the university leadership[6] to adopt further a corporate management point of view. Currently, our leadership is made up of 29 individuals. Out of 29, six are women, one is non-Japanese, and two are external appointees. These appointments have been made in response to the need for more delicate management decisions and strategy formulation reflecting multiple perspectives. We shall continue with our efforts at diversification.

- o We have a track record of having appointed international talents to such important positions as heads of research institutes, managerial positions in central administration, and posts for advanced professionals (*e.g.*, science communicators). Based on these achievements, we will diversify further by hiring talents with different value systems and lifestyles, irrespective of factors such as nationality, gender, and age. By so doing, we shall build the kind of campus environment where each person's potential can be maximized, and we will globalize our education and research and generate new ideas not bound to traditional ways of thinking. These should lead to the creation of a truly diversified environment where we may bring **points of view regarding corporate management, globalization, and equity** into play when running the university.

4F. Steps to strengthen our financial base

To realize the vision outlined in the preceding pages and to be able to distribute our limited resources to these efforts according to their strategic importance, we seek to diversify our income streams through more competitive funding, a greater number of joint research projects, more revenue from intellectual property, increased donations from alumni and industry, and active use of the assets we own so as to strengthen our financial base.

Benchmark university: University of California at San Diego (UCSD)

As already described in Section 4C, UCSD (ranked 54th in the QS World University Rankings 2021) has a support office that helps obtain additional external research funding, actively promotes the generation of innovation, and coordinates industry-academia partnerships. As a result, the ratio of external funding to its latest total operating cost (excluding hospital-related cost) is as high as 46% (173.9 billion yen). Of this, 31% comes from industry-academia collaboration earnings (116.1 billion yen) and 4% from donations (15.8 billion yen). We aim to strengthen our financial base with UCSD's activities as a model.

Performance indicator

Ratio of external funding to the ordinary revenue related to research and education (excluding hospital-related income, which fluctuates greatly due to changes in social conditions) increases from the current 28% to 35% in ten years.

4F-1. Strengthen our financial base strategically

- o Under the President's leadership, we shall strategically promote measures to acquire external funding and have overhead costs funded, and we will build a system through which the budget will be reviewed and distributed more freely.

- o We will strengthen our research power by hiring and training superb researchers, upgrading support for young talent, helping researchers secure the time for research through FQR, and improving the research environment. By making effective use of the Q-Brain Bank, moreover,

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[6] The "university leadership" here includes the executive board members like the President and his Executive Vice Presidents, plus non-executive members like Senior Vice Presidents and Vice Presidents.

we will improve our support system for our researchers to successfully apply for competitive funding and secure additional revenues.

o We will conclude institutional collaboration agreements with large companies with the president himself acting as our top sales representative and increase the number of large-scale joint research projects. Taking advantage of the Open Innovation Platform (see Section 4C-1), which is designed to further strengthen research and industry-academia-government collaboration, we seek to increase the volume of research funding through joint research and to increase IP-related and other profits through technology transfer. By improving our entrepreneurship education and our own gap fund program, we aim to increase the number of university start-ups and advance the commercialization of research output, which will lead to additional investment from companies in our research. Through these measures, we will double joint **research funding from the current 2.5 billion to 5 billion yen in ten years**.

o We will ask the **Kyushu University CEO Club**, membership to which is restricted to Kyushu University alumni who have served as company CEOs, to help us connect to corporations inside and outside Japan and commercialize our research output. In this way, our networks with private corporations will expand, and the chances of us attracting large donations will improve. Furthermore, we will gradually increase the number of locally hired employees, including **professional fundraisers** who made careers in sales and banking. On top of strengthening our ties with local alumni associations, we will also bolster our network of overseas alumni and international students and better connect with currently and soon-to-be affluent individuals with significant resources to further grow the Kyushu University Fund. Through these activities, we will raise the revenues for the Kyushu University Fund **from the current 2 billion to 6 billion yen in ten years**.

o We aim to increase the volume of self-generated revenue—revenue other than the management expense grants—by lending the assets we presently own (*e.g.*, land and space) to private firms, using private funds for facility and maintenance work, and investing excess cash efficiently.

5. Toward a university driving social change with integrative knowledge

Kyushu University's Ito Campus, which was finally completed in 2018, together with our three other campuses has already started functioning as an innovation commons for proof-of-concept experiments and research for social implementation in collaboration with local industries and government. By making the best use this environmental infrastructure, we will invest all our resources that had been used for the campus relocation into steadfast efforts to realize **a university driving social change with integrative knowledge**. Kyushu University will then be transformed into the **core of an innovation ecosystem that forge new social and economic systems** while serving as a **platform of knowledge that drives world-class research and education**. This is Kyushu University's vision and the purpose it will bring as a Designated National University.