Achieving an innovation ecosystem together with Africa

Recommendations towards TICAD7

(Provisional translation)

Advisory Panel for the Promotion of Science and Technology Diplomacy

March 14, 2019

1. Background and perception of issues

In August 2016, in the lead-up to the 6th Tokyo International Conference on African Development (TICADVI), the Advisory Panel for the Promotion of Science & Technology Diplomacy submitted a set of recommendations entitled "A More Prosperous Africa with the Power of Science, Technology and Innovation" to the then Foreign Minister Fumio Kishida.[1] These recommendations consisted of the twin pillars of "Shift from brain drain to brain circulation – improve Africa's science and technology level through human resource development," and "Apply R&D results to overall society – social implementation".

Approaching TICAD7, scheduled in August 2019, TICAD Ministerial Meeting, held in October 2018, evaluated the point that the TICAD process starting in 1993 has thus far contributed to the development of Africa as a multilateral forum that voices the importance of Africa's ownership and international partnerships. It was also pointed out that there is a need to create a resilient and sustainable society although since TICADVI, the economy of Africa has recovered and there are prospects for continued steady growth, Africa still has to face up to an array of social and environmental issues, including health, insufficient access to energy in both urban and agricultural areas, and economic losses deriving from climate change and disasters. In response to the current situation, it is even more important that, three years after the previous set of recommendations, an idea of which growth should be encouraged in a sustainable manner that bears in mind the United Nations' Sustainable Development Goals (SDGs), while maximizing science, technology and innovation. The general direction suggested in the previous recommendations were: "Emphasis on Japan's qualities of strong technology capabilities and human resource development;" "Promote policy making and various initiatives based on reliable data and scientific evidence;" and "Top priority on Africa's development ownership and support for Agenda 2063." These are the principles that should be inherited in the new recommendations. At the same time, in line with the concept of a "Free and Open Indo-Pacific"[2], it has been sought that Japan takes a partnership-focused stance in which African countries are perceived as the neighbors of Asia, and listen to the voice of Africa and act in tandem.

The recommendations presented here, towards TICAD7, are based on the findings of interviews conducted at the 13 Japanese diplomatic missions in Africa[3], and the Advisory Panel's previous recommendations related to SDGs and TICAD. At the same time, they reconfirm the issues, and indicate the direction for utilizing science, technology and innovation (STI) in order to build sustainable development in Africa and a better partnership with Japan.

2. The main developments and issues after TICADVI

After TICADVI, not only the Japanese government and other public institutions, but also private sector companies and entities have conducted support and cooperation in diverse areas related to STI, aiming at African nations and their citizens. While some of these have included noteworthy developments, it was clarified that there still remain areas in which continued and strengthened initiatives are required.

(1) Developments

With regard to one of the previous recommendations "Improve Africa's science and technology level through human resource development," the following concrete developments have been reported, among others.

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[1] Submission of recommendations in the lead-up to TICADVI: https://www.mofa.go.jp/files/000185315.pdf (English)
[2] Free and Open Indo-Pacific: https://www.mofa.go.jp/policy/page25e_000278.html (English)
[3] Countries in which interviews were conducted: Ethiopia, Zambia, Tunisia, Madagascar, Kenya, Sudan, Tanzania, South Africa, Morocco, Rwanda, Ghana, Botswana, Egypt.

(i) The Japan International Cooperation Agency (JICA) is continuing to support the Egypt-Japan University of Science and Technology (E-JUST) and the Jomo Kenyatta University of Agriculture and Technology (JKUAT). These universities are currently producing significant research results, and are playing a central role in African R&D with, for example, the number of papers published per teacher at E-JUST becoming the highest in Egypt[4]. Furthermore, there are 24 students from other African nations attending the E-JUST graduate school, accounting for 14% of all students, while at JKUAT, there are 344 students (third to fifth batches) from 38 nations (including 138 Ph.D. students). The number of international students from other African nations studying at E-JUST and JKUAT is increasing, and this is greatly contributing to researcher exchanges and bolstering of networks between both Japan and Africa and within African regions.

(ii) At TICADV, held in 2013, Prime Minister Shinzo Abe announced the provision of opportunities for education at Japanese universities and internships at Japanese companies for 1,000 Africans over the term of five years under the "ABE Initiative" (African Business Education for Youth). As a result of this initiative, over the five-year period up until 2018, over 1,200 trainees and over 800 interns have been nurtured, and the human resource development to support industrial development, industrialization and nation-building in Africa is making steady progress.

(iii) With regard to the science and mathematics education support (basic education) that is so vital for the STI human resource development, over 9.6 million African children benefitted from JICA's basic education support over the term of 2016 to 2018 (an estimated value). The training for over 20,000 science and mathematics teachers at secondary schools in Africa has also been implemented. In addition to these achievements, supplementary mathematical education through school and community cooperation was implemented, utilizing the funds of Global Partnership for Education over a roughly three-month period as an activity of the project called "School for All"[5] which promotes community-based education development. The project covered 300,000 people across 3,500 schools in the Tillabéri region of Niger. As a result, the percentage of correct answers in mathematical tests taken by first to fourth grade children at the targeted schools rose considerably, from 40% to 70%.

(2) Issues

(i) Social implementation and brain drain

On the other hand, the problems pointed out in the previous recommendations, such as "Apply R&D results to overall society," and "brain drain due to lack of local positions for research human resources" are still perceived as unresolved issues in multiple African nations.

With regard to the results of joint R&D including the Science and Technology Research Partnership for Sustainable Development (SATREPS) [6] conducted by Japan, strengthening of initiatives that link to social implementation through the participation of private-sector firms and international institutions remains an agenda.

As for the brain drain, in order to respond to lack of research human resources, it is becoming vital to promote strengthening of collaboration between the existing academia at African and non-African universities, and research

[4] https://ejust.edu.eg/research/# Publications
[5] "School for All": https://www.jica.go.jp/english/news/field/2016/170208_01.html (English)
[6] SATREPS: https://www.jst.go.jp/global/english/index.html (English)
https://www.jica.go.jp/english/our_work/science/index.html (English)
https://www.amed.go.jp/en/program/list/03/01/001_tp.html (English)

institutions, and the creation of new networks and career opportunities through improvements to the local research and business environment.

(ii) Need for innovation

The SDGs cite ambitious goals such as "By 2030, ensure universal access to affordable, reliable and modern energy services," but it is perceived that these goals will be very hard to meet by merely continuing similar initiatives conducted until today. It is therefore important for Japan to encourage, in addition to Japan-derived technology and ideas, innovative initiatives in tandem with local partners to tackle local issues, while bearing in mind the attainment of SDGs.

(iii) Need for support in the area of information and communication technology (ICT)

Following the previous recommendations, the "mobile revolution[7]" is progressing further through the diffusion of mobile phones in Africa. On the other hand, sophistication of industries using ICT and the nurture of human resource in this area are becoming issues. For example, according to the concept of realizing an inclusive economic development through the popularization of e-money and mobile transactions that ultimately expands access to banking services, Madagascar has been preparing the relevant domestic legislation. It has been reported that cooperation in this area may lead to support, accompanied by large economic effects through the establishment of a system that circulates domestic savings to domestic investment.

3. Recommendations: Achieving an innovation ecosystem together with Africa

In the light of sections 1 and 2 above, when considering future contribution of Japan to Africa, the four "S" words of SDGs, STI, SATREPS and Society 5.0 are the vital keywords.

Since 2016, Japan has been putting forward the concept of Society 5.0 as the image of the future society that should be aimed for. It represents a vision of a human-centered future society in which both coexistence of economic development and resolution of social issues are aimed, while highly combining real societal space with base technologies, including Internet of Things (IoT), big data and artificial intelligence (AI) and others.[8] This society can be described as an ideal and common for all nations, including both emerging and developing nations that have been experiencing remarkable technological progress. Thus, in the process of aiming for the Society 5.0 goals of "resolving challenges and creating a future through STI", attainment of the SDGs is naturally unavoidable and STI is the trump card in solving this issue. Currently, an array of initiatives with awareness of SDGs is underway in Japan's economic and industrial world.[9] It is desired to build a mechanism for joint collaboration, though an open innovation etc., in order for Japan to attain the SDGs through STI in partnership with Africa and to achieve Society 5.0. In the final analysis, Japan and Africa should aim for the establishment of an "innovation ecosystem" in which innovation is created autonomously and sustainably in the form that accommodates widely different cultural and social environments of both Japan and Africa. Of course, although the realization of Society 5.0 is vital as an idealized image to be aimed for, as the type of STI currently required by the various African nations varies widely according to nation and region, it is essential that Japan must provide tailor-made cooperation while constantly verifying the real on-site needs of each and every African nation.

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[7] According to GSMA (Global System for Mobile Communications Association), the number of unique users of mobile phones in the 46 Sub-Saharan nations of Africa increased from 329 million people in 2014 to 444 million people in 2017. (GSMA：The Mobile Economy, Sub-Saharan Africa 2018）

[8] Submission of Recommendation towards Implementation of the Sustainable Development Goals (SDGs) (Recommendations for the Future): https://www.mofa.go.jp/press/release/press3e_000105.html (English)

[9] https://www.keidanrensdgs-world.com/ (English)

In the process of aiming to attain the SDGs through STI in cooperation between Japan and Africa, SATREPS is an important initiative, and a vital asset in science and technology diplomacy. Through SATREPS, matching of African social issues, Japanese ideas and technology, using STI, as well as facilitation for solving issues will play pivotal roles towards the realization of an innovation ecosystem, based on Japanese-African collaboration.

Based on the above-mentioned ideas as the fundamental notions, concrete recommendations are made as below.

(1) Support aimed to solve social issues including SDGs using STI

(i) Contributions to the development of STI roadmaps to achieve the SDGs

The SDGs were raised as common targets that should be achieved by all nations, regardless of whether they are developed, emerging or developing. In order to attain the SDGs that will contribute to the autonomous and sustainable development of Africa, the realization of "STI for SDGs" is one of the agendas that Japan and Africa should cooperate and aim for. Now in particular, concrete discussion has been conducted in the aim of realization of STI for SDGs. African development without the self-propelled attainment of the SDGs is quite impossible, and STI for the attainment of SDGs is the trump card in attempts to optimize and expand finite resources.[10,11] On the other hand, since the situations in which the each nation and stakeholder find themselves all vary, development of roadmaps regarding utilization of STI in attainment of the SDG is effective in order to promote systematic initiatives for realizing the SDGs. Therefore, if Japan clearly shows a basic way of thinking to the international society that can serve as a common philosophy for development of the STI roadmap or a model for the development of the roadmaps, it may become a method that serves as a propellant for formulating STI roadmaps for Africa. Furthermore, it is desirable that such an event would involve an environment in which the academia of African nations would be able to participate in the development of STI roadmaps for their own countries.

(ii) Promotion of open innovation

In order to use STI to solve social issues in Africa, including the attainment of SDGs, it is crucial to match science and technology with the social issues and needs in Africa, and to be free from conventional approaches. It is important to resolve issues by collaboration and co-creation, through continuous exchanges of opinions with an array of actors, such as international organizations, bilateral donors, Japanese governmental institutions, local governments, academic institutions, domestic and overseas funds and companies, and NPOs and NGOs etc., and in cooperation with existing networks and open innovation platforms, with ways out other than Official Development Assistance (ODA), such as business.

(iii)Further strengthening of SATREPS

SATREPS is a vital tool in order to solve global-scale issues utilizing STI, and should be promoted even more. In the future, it is more and more important to strengthen SATREPS in consideration of 1) enhancement of industry collaboration with private sector corporations with perspective of the social implementation of research results, and cooperation with international organizations; 2) strengthening of collaboration between science and technology cooperation and developmental cooperation; and 3) contributions towards achievement of the SDGs, and to realize the social implementation and the development and diffusion of achievement to other countries and regions.

[10]Recommendations for the Future: https://www.mofa.go.jp/press/release/press3e_000105.html (English)

[11]Recommendation on STI to Achieve the SDGs and its Guiding Tool, the STI Roadmap －To Think, Proceed and Create Together with the World－: http://www.mofa.go.jp/press/release/press3e_000105.html (English)

(2) Continuation and expansion of STI human resource development

Japan has long experience and knowledge in human resource development in Africa, and Africa highly expects contributions from Japan. In order to achieve high-quality growth in Africa, there is a need for the human resource development who will be able to solve numerous social problems that accompany growth and an ecosystem in which employment opportunities are assured for such human resource and the knowledge of STI and industrial development is give back to the society. To this end, it is important to strategically promote interaction among quality-assured universities and students in Japan and Africa. The points requiring particular emphasis in related to this matter are as follows.

(i) The interaction and development between Japanese and African researchers, and interaction between institutions

In addition to the JICA-sponsored JKUAT and E-JUST, around 20 Japanese universities and research institutions had hubs in 15 African nations as of 2015.[12] As the knowledge and networks that these hubs possess are making a considerable contribution to the promotion of interaction and of human resource development for Japanese and African researchers, it is necessary to continue the operations of these hubs and the further expansion and establishment of facilities should be considered. In addition, it is important to strengthen and expand the existing collaborative frameworks such as South Africa-Japan Universities Forum (SAJU) and Science Forum South Africa (SFSA), and in order to boost interaction and human resource development among Japanese and African researchers more than ever, it is also essential to create opportunities for high-level dialogues such as Ministers, ministries, universities or research institutions for science and technology policy between Japan and Africa.

Joint support on international joint research aiming at solving social problems such as the SDGs, based on the Japan-African exchange of researchers, by Japanese and African research support organizations under equal partnership would bring further contributions not only to the realization of SDGs and social implementation, but also to capacity building for research support organizations and research human resource, as well as to countermeasures for brain drain, thus it should be positively examined.

The Institute of Transformative Bio-Molecules at Nagoya University (ITbM), Kobe University and others have been collaborating with research institutions in Kenya and Sudan etc., and are involved in a research that will lead to the eradication of a parasitic plant “Striga” that blights grains in Africa. If any progress is made, a major contribution to resolving the food shortage in Africa will be achieved. Through these activities, interactions and human resource development among Japanese and African scientists who work on common issues, they will serve as “scientist diplomats” building a robust bridge for Japan-Africa science and technology cooperation. It is also expected that, as such relationships mature, the building of networks among academia, aiming to achieve each SDG will be facilitated.

(ii) Continuation of the ABE Initiative, encouragement of investment through public-private partnership, initiatives for job creation

By the ABE Initiative, the human resource development that can contribute to sustainable development in Africa through high-quality research in Japan and internships at Japanese companies should be continued. Since most of the trainees under this initiative have already returned to their home countries and are now active as young entrepreneurs, or workforce that bridge Japanese and African companies and organizations, initiatives are required to promote this trend. Based on the achievements made so far, it is desirable that initiatives that can be regarded as good practices must be effectively supported from now on, and expanded. In addition, Investment and Technology Promotion Office in Tokyo of the United Nations Industrial Development Organization (UNIDO) has conducted activities to facilitate

[12] According to a research by the Ministry of Education, Culture, Sports, Science and Technology (MEXT)

investment and technology transfers from Japan to Africa, such as arranging opportunities of meetings with Japanese companies for key persons invited from Africa, introducing the latest information on the investment environment and technology needs in Africa by hosting seminars and workshops in Japan, and installing technical advisors for investment promotion in Africa in order to support Japanese companies with an interest in entering the African market.[13] Thus, there is a necessity to further strengthen initiatives to support the expansion into Africa by Japanese companies, including start-ups led by the young generation, and business development and entrepreneurship in Africa by small to medium-size enterprises (MSMEs). For example, it is desired to create platforms that promote innovative businesses, including the provision of support and technical assistance by public-private partnership.

(iii) Continued and strengthened human resource development in ICT fields

Human resource development in ICT fields is an urgent matter in the sense of securing human resources who will support African industry in the future. It is necessary to support the development to an industry-academia-government collaboration by assisting cooperation among universities and local governments in the field of ICT, recognizing the human resource development in the field of information science in Rwanda, conducted by Kobe City and Graduate School of Information Technology of Kobe Institute of Computing, and in the field of telecommunications in cooperation with JICA volunteers as good practices.

Especially in Rwanda, JICA has been seeking enhancement of "ICT Innovation Ecosystem" that effectively and efficiently connects diverse stakeholders such as ICT companies, investors and educational institutions etc. with the aim of "increase of start-ups and actual employment, and strengthening of ICT industry."[14]

In addition, in cooperation with the University of Tokyo, Fukui Prefecture and the Japan Aerospace Exploration Agency (JAXA) and others, satellites have been developed and utilized to develop human resources who can provide solutions to social issues by using these satellites, through support to acquisition of technologies related to ultra-small satellites of universities etc., and development of actual satellites, and discharge of the developed satellites from the Japanese experiment module "Kibo" of the International Space Station (ISS) into cosmic space. It is desired to expand these efforts to other nations and regions.

(3) Social implementation of STI achievements through enhanced utilization of ICT

It is important to conduct social implementation through active utilization of the ICT for R&D such as SATREPS and creation of synergy effect between science and technology cooperation and development cooperation. In the field of agriculture, for example, in addition to energy saving and cultivation management by means of ICT, the promotion of smart agriculture that aims to improve productivity and quality, improvements in management capacity of agricultural statistics, the development of nutrition counselors, and nutrition evaluation and improvement through utilization of ICT have been conducted. For instance, in Tanzania, a monitoring system of agricultural data was built through technical cooperation provided by JICA, initiatives to improve the quality of data on agricultural development are making progress. In addition, utilizing the latest scientific knowledge, prediction about climate change through the Data Integration and Analysis System (DIAS) is contributing to the prevention and reduction of disasters, and protection against infectious diseases and others.[15] For example, in South Africa, a "Malaria Early Warning System", which predicts malaria epidemic, has been built and prediction on malaria epidemic are distributed to local medical institutions,

[13] https://www.jst.go.jp/sdgs/pdf/20180726/pro_111.pdf (Japanese)
[14] https://www2.jica.go.jp/ja/evaluation/pdf/2017_1700493_1_s.pdf (Japanese)
[15] The usefulness of DIAS is also mentioned in the "Recommendations for the Future": https://www.mofa.go.jp/press/release/press3e_000105.html (English)

the public and others. Hereafter, it is expected to prevent the spread of malaria infection all over Africa. Furthermore, in Botswana, the Japanese standard of digital terrestrial broadcast has been adapted and efforts toward the utilization of data broadcasting for government publicity etc. that targets its citizens are under process.

Thus, "integrating" technologies of the ICT fields with those of other fields such as agriculture, engineering, environment, energy, medicine, health and hygiene etc. contributes to solve the social issues in Africa. Furthermore, since Japanese industry and academia comprehensively possess various sorts of technologies in these broad disciplines, it leads to the setting of themes and implementation of projects in which the Japan can demonstrate its "strength" and "uniqueness".

From the perspective of utilization of data, the University of Tokyo, for example, is creating ultra-small satellites for utilizing water resource management along with the Rwandan government. These satellites are scheduled to be released from the Experimental Module on the ISS, "Kibo" during 2019 in collaboration with JAXA. It is desired to consider cooperation in space technologies, such as satellites, that support observations and communications in the future. Furthermore, the above-mentioned DIAS is a data platform for global environmental information storing all kinds of earth observation data, including satellite observations, and it is also desired that industry-academia-government will solve diverse global issues.

In addition, the development for STI human resources through education on mathematics which is common language of all science is important even in Africa, while a social importance in the fields in which mathematics and others are used, such as meteorological forecasts contributing to efficiency in agriculture, simulations for disaster prevention, encryption and data security for safety and security, is further increasing. As a preceding case, the Mathematical Society of Japan has built a collaborative relationship with the African Institute for Mathematical Sciences (AIMS) which has been training young and elite students and teachers across the African continent, making donation for dispatch of instructors and publications. Invitation of young students of AIMS to Japan is also currently under consideration. If the cooperation make progress, they will be evaluated as concrete initiatives contributing to sustainable development in Africa. Moreover, it is also important that this autonomous involvement to the sustainable development in Africa by these Japanese research communities will be expanded-regardless of field of specialization.

Recently, with regard to cutting-edge technologies including the IoT, big data, artificial intelligence (AI) and so on, which are the key elements in creatinga sustainable world in which SDGs are attained, discussions about a related modality of social principles are underway in Japan and overseas.[16] From now onwards, it is desired that these discussions will be shared all over the world including in African nations, and the ICT technologies contribute to resolutions of social issues in Africa in an appropriate manner as well. Effective utilization of the ICT in the cooperation with Africa is essential to actualize the support that "No one will be left behind". Furthermore, also in SATREPS, it is desired to conduct system improvements which encourage R&D and social implementation, actively utilizing the ICT as a tool.

4. Conclusions

In order to solve various issues that still remain in African nations, it is important to aim at development of sustainable relationships between Japan and Africa through involvement of all sorts of stakeholders, including academia in African nations, and continuous promotion of collaboration by equal partnerships.

[16] https://www8.cao.go.jp/cstp/tyousakai/humanai/ai_gensoku.pdf (Japanese)

Bearing this idea in mind, in order to aim establishment of an innovation-ecosystem in which an innovation is created autonomously and sustainably between Japan and Africa, the following are the key initiatives: 1) Support towards the resolution of social issues, including SDGs, utilizing STI, 2) Continuation and expansion of development for STI human resources, 3) Promotion of social implementation of STI achievements through strengthening of ICT utilization.

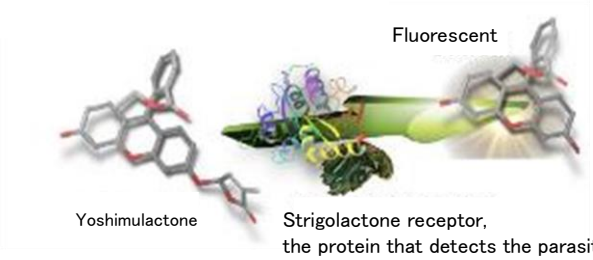
Through these initiatives, it is important to continue the cooperation in the Japanese-style that utilizes Japan's knowledge and sincerity for pursuing the social implementation of research achievements of "SATREPS" in order to attain "SDGs" which are social issues that should be solved. Japan and African nations, connected by "Free and Open Indo-Pacific", should address to the development of STI human resources in the ICT fields as well as interaction and trainings among researchers through strengthening and expansion of universities and research centers. Japan also should promote cooperation through "STI" needed in the African nations and regions. Among those, cross-sectoral and proper utilization of the ICT will support the social implementation of the STI, while Japan and Africa cooperate, eventually aiming at the innovation-ecosystem. This is the future of Japan-Africa cooperation that Japan embodies as a country aiming at realization of the Society 5.0.

Reference 1

Examples of initiatives on Japanese science and technology in Africa

Initiative to eradicate the parasitic plant, Striga: Kenya

As a part of "World Premier International Research Center Initiative (WPI)[1]", the research team from Nagoya University's Institute of Transformative Bio-Molecules (ITbM) is working on eradication of the parasitic plant, "Striga", which parasitizes the roots of crops, in Africa, such as maize, and absorb its nutrition and eventually kills them. Thus far, the research team discovered the protein that directs the germination of Striga, and effective molecules for expelling Striga has been identified. In cooperation with the International Center for Research and Education in Agriculture (ICREA) of Nagoya University, a field experiment is scheduled in Kenya for the summer of 2019. The results of this research were published in 2018 on the online edition of *Science*, an American science journal.



A clue to a solution for the food shortage in Africa by using fluorescent molecules

Initiative to eradicate the parasitic plant Striga: Sudan

In Sudan, Kobe University, as a representative research institution, is conducting an initiative to secure food and to overcome poverty by prevention and eradication of Stringa through a Science and Technology Research Partnership for Sustainable Development (SATREPS). To be more specific, 1) self-destruction of Striga seeds in fields where no hosts exist through a use of germination inducer, 2) prevention of Striga proliferation through resistant varieties, 3) use of Striga as a useful resource material with harness of an experience regarding the application of medicinal plants. The elucidation of research results about a grabbing mechanism of Striga's nourishing water was published in the February 2019 edition of *Nature Plants*, an international scientific journal.

[1] http://www.mext.go.jp/en/policy/science_technology/researchpromotion/title01/detail01/1374076.htm (English)

[2] https://www.jst.go.jp/global/english/index.html (English)
https://www.jica.go.jp/english/our_work/science/index.html (English)
https://www.amed.go.jp/en/news/program/0301B_00081.html (English)

Formulation of the Malaria Infection Warning System

Through SATREPS, using the Data Integration and Analysis System (DIAS), "the Malaria Infection Warning System[3]" has been built, mainly focusing on the southern region of Africa including the Republic of South Africa. The system provides predictions on malaria epidemics through the real time storage, integration and analysis of data on malaria patients and prediction on the climate change created by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC). The prediction on malaria epidemics obtained through this system is expected to contribute to infection control of malaria by its timely distribution to local governmental bodies, local medical institutions and the public as well as advance stockpiling of medicines and utilization for spraying pesticides and others.

Human resource development through mathematics

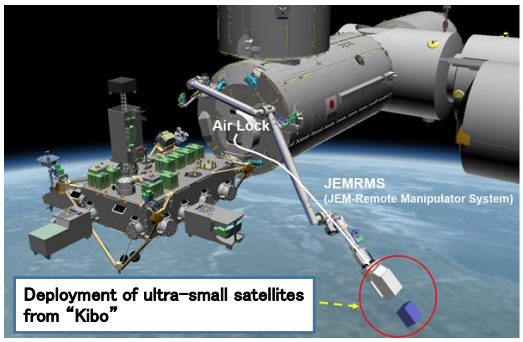
In 2003, the African Institute for Mathematical Sciences (AIMS), a pan-African networking institution focusing on mathematics, as the common base of science, was established with the aim of developing "the next Einstein", elite young human resources who can create science and technology by themselves. It is currently composed of six centers in South Africa, Senegal, Ghana, Cameroon, Tanzania and Rwanda, with the target of a further nine being established by the year 2023. The AIMS serves as a hub of international education and research on mathematical science that bring together excellent students and teachers from all over the African continent. Their activities are based on the following three pillars: 1) graduate school education; 2) teacher training, and 3) research (basic research on mathematics, and joint research with other fields and industry). Based on an MOU with AIMS, the Mathematical Society of Japan is carrying out the dispatch of lecturers and donation of the Society's publications.

Activities of Mathematical Society of Japan

3. The Malaria Infection Warning System uses the seasonal forecasting system developed under the SATREPS project for "Prediction of Climate Changes and its Application in the Southern African Regions" (adopted in South Africa in 2009).

Development of satellite technology for space emerging nations, and fostering of human resource

The University of Tokyo and the Japan Aerospace Exploration Agency (JAXA) are planning to release ultra-small satellite from the Japanese experimental module, “Kibo” on the International Space Station (ISS) in 2019, as part of the joint cooperation aimed at expanding the use of “Kibo”. The satellite was produced by the University of Tokyo in cooperation with affiliated agencies of the Rwandan government based on the technology of ultra-small satellites developed and tested at the University of Tokyo. The aim of the project is to utilize the satellite in water resources management and others in emerging nations for the space field such as Africa. In addition, as a strategic partner of JAXA, Kyushu Institute of Technology (Kyutech) is conducting the BIRDS project, that trains technical personnel and covers from development of satellites to operation in these nations. In 2017, five satellites belonging to Nigeria, Ghana and others were released from “Kibo”, and for Ghana, it became the country’s first satellite. An Egyptian satellite that is part of the Kyutech-JAXA collaborations is scheduled to be released in 2019. Moreover, under the “Kibo CUBE”, a cooperative program conducted by JAXA and the United Nations Office for Outer Space Affairs, a Kenyan ultra-small satellite was released from “Kibo” in 2018, being the country’s first satellite, and a Mauritius’s first satellite is planned to be released in 2020.



Human resource development in the field of telecommunications through inter-university agreements

In February 2018, an academic agreement was signed between Morocco's Cadi Ayyad University and Aoyama Gakuin University. Currently, a senior volunteer from the field of telecommunications is dispatched by JICA to the National School of Applied Sciences of Marrakech (ENSA), an affiliated college of Cadi Ayyad University. Led by the volunteer and the head of the department of Network and Telecommunications Engineering at ENSA, academic interaction mainly in network engineering is being conducted. In addition, based on the fact that the National Center for Research and Study on Water and Energy (CNEREE) of Cadi Ayyad University has been conducting a basic research on a solar generation system, JICA senior volunteers were dispatched to the Center from 2014 to 2016, and a joint research on solar generation systems was carried out.

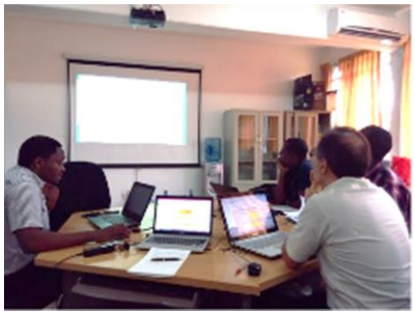
Development of young human resources in ICT fields

With Kobe Institute of Computing, Graduate School of Information Technology and Kobe City serving as the cooperative parties on the Japanese side, a grassroots-level technical cooperation proposed by a local government and granted by JICA named "the Project for Developing Young Human Resources on ICT in Kigali", is under the implementation. The goal of the project is to foster ICT technicians equipped with technical abilities and business skills required by companies. Students who graduated from the Kobe Institute of Computing, Graduate School of Information Technology and participated in the African Business Education Initiative for Youth (ABE Initiative) are devoting themselves to the project. Furthermore, one of the graduates from the university was appointed as the head of the Department of Private Sector Development for the Ministry of ICT of Rwanda, and is supporting the business development by Japanese companies in Rwanda. Furthermore, there are graduates of the master's course who have been employed by Japanese IT companies, while a student who opened up a business as media consultant was selected as a member of "High-level Panel on Digital Cooperation" established by the United Nations Secretary-General.

Promotion of investment and technology transfers to developing and emerging nations

With the aim of promoting investment and technology transfers, the Investment and Technology Promotion Office in Tokyo of United Nations Industrial Development Organization (UNIDO) invites key figures from developing and emerging nations to promotional events and arranges opportunities for them to meet with Japanese companies. In addition, Japanese environmental and energy-related technologies are publicized on the website of the UNIDO Tokyo Office (as of February 2019, 78 technologies from 68 companies are registered[4]). Also through hosting and supporting for seminars and workshops in Japan, UNIDO is providing opportunities to introduce the latest information on investment environment and technical need in developing and emerging nations. Furthermore, toward the promotion of investment in Africa, the UNIDO Advisory Programme in Africa has been underway since 2013, with highly experienced Technical Advisors for Investment Promotion being posted in Algeria, Ethiopia and Mozambique to support Japanese companies interested in expanding its business in Africa.

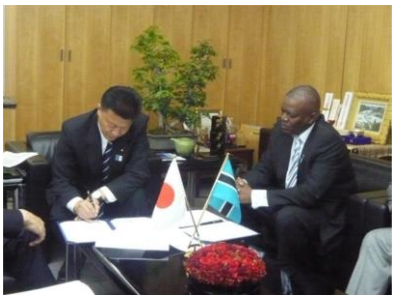
Initiatives to improve quality of statistic data on agriculture



The Government of Tanzania established Agricultural Routine Data System (ARDS) as a monitoring and evaluation tool for the Agricultural Sector Development Programme (ASDP), has been aiming to promote the ASDP through identification of performance in the agricultural sector. Since 2008, JICA has been supporting the establishment of ARDS and infrastructure development on its institutional and systematic aspects. It is currently providing support to improve the rate of submissions within deadlines, to improve data quality, to promote the utilization of collected data at national and local level, to make accurate measurements of ASDP2 performance, as well as to formulate and implement highly strategic plans based on data.

4. According to the findings of UNIDO Tokyo Office

Varied use of terrestrial digital technology



Republic of Botswana adopted the Japanese-style terrestrial digital broadcasting (ISDB-T: Integrated Service digital Broadcasting-Terrestrial) in February 2013, and Japan has thus far implemented support for the popularization of terrestrial digital broadcasting, including the dispatch of advisors on the closure of ISDB-T analog low wave broadcasting. Toward improving people's standard of life and safety, it is expected that data broadcast will be utilized in all sorts of fields.

Reference 2

Issues on SATREPS related to Africa currently under implementation

（As of March 2019）

Developing Countermeasures against Striga to Conquer Poverty and Improve Food Security

"Getting back our food that is being robbed by root parasitic weeds!"

【Recipient country】 Sudan

【Representative research institution in Japan】 Kobe University

Reference：https://www.jst.go.jp/global/kadai/h2807_sudan.html

Analysis of root parasitic weeds from a chemical perspective to provide information that facilitates development of an integrated management strategy

Striga is a genus of root parasitic weeds that parasitizes grassy crops, depriving them of nutrients and water. They have serious effects on global food production, particularly in Africa where agricultural damage amounts to over one trillion yen a year. This project aims to elucidate striga's germination mechanism to develop a management strategy for use in Sudan where people are suffering from the devastating damage caused by striga. We will also engage in the selection of resistant species and search for useful substances produced by striga to make use of them as biological resources. The findings of the project will be shared with local farmers to establish an effective integrated management strategy.

Increased food production through parasitic weeds control and creation of a new biological resource

A germination inducer will promote germination of striga seeds in fields without any host species present, while resistant crop species will reduce the proliferation of the parasite. The striga plants that survive will be used as raw material for extracting useful substances. This integrated strategy can be applied to manage other root parasitic weeds in the fight to overcome biotic constraints to global food production.

Project on establishment of the model for fertilizing cultivation promotion using Burkina Faso phosphate rock

"Promote local production and consumption of fertilizers using indigenous phosphate rock, and be free from imported ones"

【Recipient country】 Burkina Faso

【Representative research institution in Japan】 Japan International Research Center for Agricultural Sciences

Reference：https://www.jst.go.jp/global/kadai/h2809_burkinafaso.html

Development of domestically produced fertilizers using low-grade phosphate rock and improvement of fertilizer application techniques

Soil fertility is low in Africa and agricultural productivity is accordingly low, particularly because of the lack of phosphorus. In addition, fertilizers are very expensive in Africa compared to other parts of the world. The project will make use of low-grade phosphate ore produced but underutilized in Burkina Faso to develop domestically produced and reasonably priced fertilizers. It will also look to improve fertilizer application techniques and evaluate the possibility of spreading the proposed fertilizer product. It will also consider techniques to directly apply phosphate rock to propose an integrated strategy for the utilization of phosphate rock as an important natural resource of Burkina Faso.

Contribute to the stable food production of Africa by developing and spreading a domestically produced fertilizer

The project aims to improve agricultural productivity by developing and spreading domestically produced and reasonably priced fertilizers by making use of low-grade phosphate rock currently underutilized in Burkina Faso. Going forward, the outcomes of the project are expected to spread across Africa and beyond to contribute to stabilizing food self-sufficiency in Africa and fertilizer security in Japan and other countries of the world facing the depletion of phosphate resources.

Breakthrough in Nutrient Use Efficiency for Rice by Genetic Improvement and Fertility
"Sensing Techniques in Africa Challenges for Rice production with limited soil nutrients - Endeavor to increase yield under harsh conditions"

【Recipient country】 Madagascar

【Representative research institution in Japan】 Japan International Research Center for Agricultural Sciences

Reference：https://www.jst.go.jp/global/kadai/h2808_madagascar.html

To increase the rice yield under low fertility conditions through rapid diagnosis of soil fertility and the development of nutrient-use-efficient breeding lines

Madagascar is one of the largest rice producers in Africa with a per capita rice consumption twice as high as that of Japan. Its rice productivity, however, remains stagnated to date because of the lack of fertilizer input and nutrient-poor soils occurring in many areas of Africa. The project aims to develop rice production techniques to realize high yield even under low fertility conditions by combining fertilizer application techniques suited to the soil nutrient characteristics of the field and new breeding lines with high nutrient use efficiency. It will also evaluate the impact that the adoption of such techniques has on the income and nutritional status of local farmers.

Toward the stabilization of African food production and a paradigm shift in agriculture

The project will contribute to stabilizing food production in Africa by disseminating rice production techniques suited to the poor fertility soils common in Madagascar and elsewhere in Africa. Furthermore, the development of techniques to raise crops with high nutrient use efficiency is expected to help promote the conversion from resource intensive to a resource-saving and sustainable agriculture.

Valorization of Bio-resources based on Scientific Evidence in Semi- and Arid Land for Creation of New Industry

"Creation of new industry through valorization of bioresources in North Africa"

【Recipient country】 Tunisia／ Morocco

【Representative research institution in Japan】 Alliance for Research on the Mediterranean and North Africa, University of Tsukuba

Reference：https://www.jst.go.jp/global/kadai/h2706_tunisia.html

Basic design for commercialization and process of industrialization

Focusing on the plenty of bioresources found in Tunisia and Morocco, we implement functional analysis and epidemiologic studies to develop seeds of technology for the development of food and cosmetic products, and technologies of authentification of origin of products and their type towards the development of new products. We also conduct ecological studies and analysis of the production, export and consumption i.e. value chain of local products. Through this comprehensive approach, we implement an integrated studies based on scientific evidence for the development of seeds for technology and contribute to develop high value-added functional food and pharmaceutical products. Finally, we aim to create new industries producing materials for development of functional foods and medicinal cosmetics through the collaboration with private sector.

* Bioresources as a part of the dietary culture with the oral tradition of their medicinal effects.

Establishment of scientific evidence to support the medicinal effects of bioresources and construction of a value chain

By implementing research and development of bioresources based on scientific evidence, we aim to upgrade the production capacity of high value-added agricultural products and to improve technical capability of private sector. In line with the governmental policies targeting the food industry, we will contribute to develop a coherent value chain from production to export, and establish bases for supply and export of high value-added agricultural products in Tunisia and Morocco.

Establishment of an Early-warning System for Infectious Diseases in Southern Africa Incorporating Climate Predictions

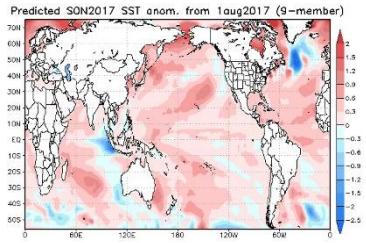
"Fighting against Infectious Diseases with a Warning System Integrating Different Areas of Research"

【Recipient country】 South Africa

【Representative research institution in Japan】 Nagasaki University

Reference：https://www.jst.go.jp/global/kadai/h2509_southafrica.html

Establishment of an early-warning system for infectious diseases in Southern Africa, incorporating climate predictions



In Southern Africa, where poverty is prominent, lives are threatened by infectious diseases. Recent climate changes have increased the possible risks of infectious disease outbreaks in unexpected regions and on scales previously unknown. This project is developing an infectious disease outbreak prediction model that incorporates the influences of a variety of environmental factors into the climate change models in order to predict the outbreaks of malaria, pneumonia, and diarrheal diseases such as cholera that are predominantly affected by climate conditions. The ultimate aim of the research is to build an early warning system that can be applied in implementing effective countermeasures for infectious disease.

Future application of the system for areas other than Southern Africa!

By effectively utilizing the informative resources available to government institutions based on the early warning system, the number of people suffering from diseases can be reduced. The predictions can be applied through approaches involving appropriate preventative measures during warning periods and in high-risk regions (including implementation of countermeasures, preparation of medicines and diagnostic kits for an early response). In the future, the system can also be expected to be developed and deployed in areas outside Southern Africa.

Production of Biofuels

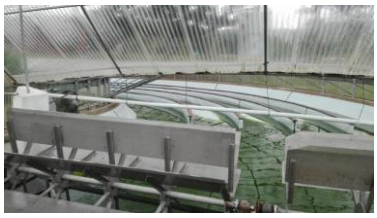
"Using Algal Biomass Reduce CO_2 emissions by converting microalgae into biofuels and fertilizer mats!"

【Recipient country】 South Africa

【Representative research institution in Japan】 Nagoya University

Reference：https://www.jst.go.jp/global/kadai/h2705_southafrica.html

Converting microalgae produced from sewage into fuel and fertilizer using new solvent extraction methods!



Although mass culture of CO_2-absorbing microalgae from sewage was successfully achieved in the Republic of South Africa, in order to convert these into fuel a drying process which uses fossil fuels is required, leading to a contradictory state in which the process actually increases net CO_2 emissions. To solve this problem, we are developing a fuel conversion (oil extraction) device that uses a new solvent known as liquefied DME, which we will install at the local site. Microalgae residue is mixed with wood chips and formed into mats, which are used as fertilizer. To ensure these technologies take root in the Republic of South Africa, we are also working to construct a sustainable environmental business model and train local personnel.

Reduction of CO_2 on a global scale using microalgae, which possess outstanding photosynthesis capabilities

The new extractant allows conversion of microalgae to fuel in warm water at a temperature of less than 100°C. Furthermore, residue that has been converted to fertilizer can help enrich soil by recovering nitrogen and phosphorus from sewage. If the business model and personnel training methods related to these technologies can be expanded to other regions, this project has the potential to contribute to the improvement of the energy issues and the aquatic and geo-environment on a global scale.

Development of Next-Generation Sustainable Land Management (SLM) Framework to Combat Desertification

"An innovative transdisciplinary approach to fighting desertification"

【Recipient country】 Ethiopia

【Representative research institution in Japan】 Tottori University

Reference：https://www.jst.go.jp/global/kadai/h2801_ethiopia.html

Proposing a framework for next-generation sustainable land management (SLM)

The project will propose a framework for next-generation SLM in Ethiopia, incorporating effects such as enhanced prevention of soil erosion, improvement of land productivity and increasing local residents' income. Research sites will be set up in three different areas (highland, midland and lowland) in the Upper Blue Nile Basin, which suffers from serious soil erosion caused by rainfall so as to develop practices and technologies for improving land productivity by reducing soil erosion and introducing crop-livestock production systems as well as linking such efforts to improving the livelihoods of local residents.

Contribution to reduction of soil erosion, improvement of land productivity and local residents' livelihoods

Various SLM practices targeted to fight desertification have been implemented in many areas of the world, but their sustainability and effectiveness are being questioned. Hence this project aims to develop improved SLM technologies and approach that could address the major limitations of the currently implemented SLM practices and then to propose them to be used in the study sites and beyond such as to the entire Blue Nile Basin and other arid regions of the world that are experiencing similar problems.

Co-creation of Innovative Forest Resources Management Combining Ecological Methods and Indigenous Knowledge

"Creating the future of African tropical rainforests with local people"

【Recipient country】 Cameroon

【Representative research institution in Japan】 Kyoto University

Reference：https://www.jst.go.jp/global/kadai/h2902_cameroun.html

Using a combination of indigenous and scientific knowledge to design resource management model with ownership by residents

Sustainable use of natural resources is essential for the future of rainforests in southeast Cameroon. This project will make accurate estimate of wildlife habitat density using camera trap and design a sustainable management model centering on monitoring by residents. A sustainable model for promising non-timber forest products (NTFPs) will be built by standardizing production and processing methods. Operators will be educated to ensure the model to be established in the region and the implementation process will be proposed to the Cameroon government.

Preserve biodiversity with sustainable management of wildlife and non-timber forest products

The establishment of forest resource management based on proactive participation by local residents will promote preservation of biodiversity in the rain forests of Congo Basin. Also, utilization of diverse forest resources including wildlife and non-timber products as well as improvement in lives of local residents through commercialization of forest products can be achieved in a sustainable manner.

Project for Development of Sericulture Research by Applying Biological Resources and Molecular Genetics

"A sericulture revolution in East Africa, powered by Japan's silkworm and silk expertise"

【Recipient country】 Kenya

【Representative research institution in Japan】 National Agriculture and Food Research Organization

Reference：https://www.jst.go.jp/global/kadai/h2707_kenya.html

Selecting/breeding mulberry and silkworm species suited to Kenya, developing silk materials

Kenya's biological resources include mulberry trees, silkworms, and wild silkworms. We are working to study Kenya's native mulberry species in detail in order to select those most suited to the nation's climate and to achieve further improvement through breeding. We also aim to crossbreed Kenya's disease-resilient subcultural silkworm species with Japanese species that have been bred over many years to achieve high silk productivity, in order to develop a species that possesses both these qualities for commercial use. Furthermore, we will work to derive usage value from Kenyan native wild silkworms as a new silk material.

Development of a research and technology platform in Kenya for mass production of high-quality silk

We aim to establish a sericulture research center staffed with talented young researchers capable of leading independent Kenyan research and development, and to develop a technological platform capable of mass-producing high-quality Kenyan silk that rivals overseas products. Furthermore, we hope that the technologies developed in the research center will be deployed on a societal level through transfer to manufacturers and private companies.

Visualization of Impact of Chronic/Latent Chemical Hazard and Geo-Ecological Remediation

"Solve the lead (Pb) contamination problem through a multi-disciplinary approach!"

【Recipient country】 Zambia

【Representative research institution in Japan】 Hokkaido University

Reference：https://www.jst.go.jp/global/kadai/h2701_zambia.html

Optimizing contaminant removal methods, quantifying economic effects based on health risk assessments

In Zambia, where lead (Pb) contamination is a serious problem, we are working to elucidate the contamination mechanisms and risks posed to the ecosystem and humans. Then, by visualizing the economic losses involved, we aim to link this to the development of contamination prevention measures and environmental remediation technologies. In addition to conducting studies by remote sensing, characterizing soil and plants through surface studies, identifying lead contamination mechanisms in humans, visualizing health hazards and economic risks, and establishing environmental remediation technologies, we will also work to construct monitoring systems and foster the sustainable development of experts in the necessary fields through capacity building initiatives.

Contribution to the reduction of contamination through environmental remediation and assessment of health and economic risks!

Through these initiatives, we aim to achieve a reduction in lead levels in the younger generation who will shape Zambia's future (particularly infants), and the adoption of new protocols for environmental remediation and health risk assessment in Zambia as part of national policy. In future, we hope these efforts will ultimately contribute to countermeasures against metal pollution—a major global hazard that is primarily centered in Africa.

Advisory Panel for the Promotion of Science and Technology Diplomacy

Chair: Teruo Kishi, Science and Technology Advisor to the Minister for Foreign Affairs of Japan

Board members

Makoto Asashima

Professor Emeritus, the University of Tokyo; Honorary Fellow, National Institute of Advanced Industrial Science and Technology (AIST)

Tateo Arimoto

Professor, National Graduate Institute for Policy Studies (GRIPS); Principal Fellow, Center for Research and Development Strategy, Japan Science and Technology Agency (JST)

Masaru Iwanaga

President, Japan International Research Center for Agricultural Sciences (JIRCAS)

Masafumi Kaneko

Director/ Senior Research Fellow, PHP Institute, Inc., a policy think-tank

Masaru Kitsuregawa

Director General, National Institute of Informatics (NII), Professor, Institute of Industrial Science, the University of Tokyo

Yasuhito Sasaki

Director, Research Center for Radiation Oncology, Affiliated Clinical Research Center of Shonan Kamakura General Hospital

Takashi Shiraishi

President, Prefectural University of Kumamoto

Atsushi Sunami

Executive Director, The Sasakawa Peace Foundation; Vice President/ Professor at National Graduate Institute for Policy Studies (GRIPS)

Haruko Takeyama

Professor, Faculty of Science and Engineering, Waseda University

Akihiko Tanaka

President, National Graduate Institute for Policy Studies (GRIPS)

Michiharu Nakamura

Counselor to the President, Japan Science and Technology Agency (JST)

Yuichi Hosoya

Professor, Faculty of Law, Keio University

Yoshio Matsumi

Executive Board Members, ITOCHU Corporation

Yoshifumi Yasuoka

Professor Emeritus, the University of Tokyo

Yuzuru Yoshii

Professor Emeritus, the University of Tokyo; Professor, Steward Observatory, University of Arizona

Hiroyuki Yoshikawa

Professor Emeritus, the University of Tokyo; Member, The Japan Academy

(Reference)

The 8th and 9th meetings of the Advisory Panel on Science and Technology Diplomacy, which considered the recommendations were attended by Toshiko Abe, Deputy Minister for Foreign Affairs; Kiyoto Tsuji, Parliamentary Vice-Minister for Foreign Affairs; Tomoyuki Yoshida, Director-General for Disarmament, Non-Proliferation and Science Department in Ministry of Foreign Affairs of Japan; Masahiro Kawasaki, Deputy Director-General, Disarmament (at that time), Non-Proliferation and Science Department, Ministry of Foreign Affairs of Japan; and Masahiko Kiya, Deputy Director-General, African Affairs Department, Ministry of Foreign Affairs of Japan. The meetings were also attended by the following government ministries, agencies and related institutions.

Cabinet Secretariat, Office of Healthcare Policy
Cabinet Office
Ministry of Education, Culture, Sports, Science and Technology
Ministry of Economy, Trade and Industry
Japan Agency for Medical Research and Development (AMED)
Japan International Cooperation Agency (JICA)
The Japan Foundation (JF)
Japan Science and Technology Agency
National Institute of Advanced Industrial Science and Technology (AIST)
New Energy and Industrial Technology Development Organization (NEDO)

Furthermore, the Africa Study Group, functioning under the Advisory Panel, convened by a panel member, Akihiko Tanaka, as group leader, was attended by other members of the Panel, related government ministries and institutions, as well as the following experts and related organizations.

Kenichiro Itami
Professor, Director, the WPI Institute of Transformative Bio-Molecules (WPI-ITbM), Nagoya University
Mitsunobu Kano
Professor, Graduate School of Interdisciplinary Science and Engineering in Health Systems, Okayama University
Motoko Kotani
Executive Director, RIKEN; Director, Advanced Institute for Materials Research (AIMR), Tohoku University
Yoko Shinhuku
Associate Professor, Graduate School of Medicine, Kyoto University
Haruo Takeda
Executive Director/ Chief, Hitachi Ltd.
Tomohide Terasoma
Member of the Board, Mathematical Society of Japan; Professor, Graduate School of Mathematical Science, the University of Tokyo
Daigo Makihara
Associate Professor, International Center for Research and Education in Agriculture, Nagoya University
Tsuyoshi Matsumoto

Administrative Director/ Professor, the WPI Institute of Transformative Bio-Molecules (WPI-ITbM), Nagoya University

Yuko Yasunaga

Director, United Nations Industrial Development Organization (UNIDO), Investment & Technology Promotion Office, Tokyo (UNIDO ITPO Tokyo)

Ministry of Agriculture, Forestry and Fisheries

Fisheries Agency

Japan Society for the Promotion of Science (JSPS)

RIKEN

Japan Aerospace Exploration Agency (JAXA)

Record of Advisory Panel for the Promotion of Science and Technology Diplomacy/Africa Study Group

	Date held	Agenda
Africa Study Group 1st Meeting	October 10, 2018	■ State of preparations for TICAD7 ■ Latest information on the African Business Education Initiative for Youth Initiative (ABE Initiative) ■ Introduction of cases of Japanese cooperation related to science and technology in Africa ● Initiatives by UNIDO ITPO Tokyo ● Research activities of the International Center for Research and Education in Agriculture, Nagoya University ● Research activities at the WPI Institute of Transformative Bio-Molecules (ITbM), Nagoya University ● Activities of International Science and Technology Cooperation Section, Department of Social Infrastructure and Peacebuilding of JICA
"Advisory Panel for the promotion of Science and Technology Diplomacy" The 8th Meeting	December 19, 2018	■ Report on Senegal Workshop ● Announcement of an outline of draft recommendations and report on exchange of opinions
Africa Study Group 2nd Meeting	February 7, 2019	■ Exchange of opinions on revised recommendations on Africa ■ Introduction of cases of Japanese cooperation related to science and technology in Africa ● Activities of the Science Council of Africa and the Forum on Artificial Intelligence in Africa ● Collaboration between the Mathematical Society of Japan and African Institute for Mathematical Sciences (AIMS) on the Next Einstein Initiative
"Advisory Panel for the Promotion of Science and Technology Diplomacy" The 9th Meeting	March 6, 2019	■ Report on activities of the Africa Study Group ● Explanation on revision of recommendations with the keywords "4-S" (Society 5.0, SDGs, STI, SATREPS)


SUSTAINABLE DEVELOPMENT GOALS
17 GOALS TO TRANSFORM OUR WORLD
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS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