A Perspective on Science and Technology Diplomacy:

Medical Innovation and International Cooperation for Aging Society

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1. Introduction

The rapid development of science and technology has a profound impact on our values, lifestyle and society. The world of diplomacy is no exception, and the importance of science and technology in diplomacy has increased in recent years. More than ever before, diplomats and policymakers are required to adopt a strategic and effective approach towards science and technology diplomacy. From this viewpoint, Japan established the post of Science and Technology Advisor to the Minister for Foreign Affairs in 2015, and I am working as the second Science and Technology Advisor to provide scientific insights into foreign policy objectives.

Reflecting the recent geopolitical situation, discussions of science and technology diplomacy tend to focus on international competition and supply chain issues in key and emerging technologies in the context of economic security. On the other hand, science and technology diplomacy from the perspective of using science and technology to solve challenges common to all humankind, such as climate change and the achievement of the Sustainable Development Goals (SDGs), is still important. In this column, I would like to share my views on how science and technology can contribute to one of the challenges that many countries, regions and societies will face in common in the future, and what kinds of international initiatives can be considered in this context.

In the long-term perspective, the world's demographic situation is steadily shifting to an ageing population with low fertility rates. In the East Asian region in particular, it is expected that the population will rapidly age in the future. The increasing burden of medical and nursing care for the elderly will weigh heavily on public finances and society. To reduce this burden, it is necessary to increase healthy life expectancy and curb the costs of medical and long-term care services.

In Japan, where the ageing rate (the proportion of the population aged 65 and over in the total population) is the highest in the world, research and development is being promoted with the aim of creating a modern medical environment and medical services for a super-aged society, as well as to stimulate healthcare-related markets and achieve economic growth. For example, the government's Moonshot Research and Development (R&D) Program has set its goal 7 as "Realization of sustainable care systems to overcome major diseases by 2040, for enjoying one's life with relief and release from health concerns until 100 years old"[2], and is promoting related R&D projects.

I originally specialized in mechanical and fluid

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engineering, and have been involved in "medical-engineering collaboration" to apply my expertise towards the development of medical technology. Later I served as Secretary-General of the Office of Medical Innovation, Cabinet Secretariat, and as a board member of the National Cancer Center Japan, where I was involved in medical technology innovation from the policy side to the field. Based on these experiences, in the following I would like to briefly discuss the scientific and technological developments that are key to solving issues in an ageing society, with a focus on medical technology, and the related issues that could become important aspects in science and technology diplomacy.

2. Emerging technologies and their application to telemedicine

Recent improvements in the capabilities of AI have been remarkable. Its use is also advancing in the medical field, where AI diagnostic and treatment support is contributing to clinicians' decision-making, early detection of serious diseases and disease risk prediction. As a side note, I was once discussing with colleagues how to structure the vast amount of knowledge held by medical professionals and turn a novice doctor into an excellent doctor. AI assistance in the medical field may contribute to turning fledgling doctors into great doctors.

Another important technology is robotics. Surgical support robots enable minimally invasive, high-precision surgical procedures. The use of robots is also expected to expand in fields such as rehabilitation and nursing care. Further development of the medical and nursing care robotics sector is expected through future technological developments and in combination with AI.

The combination of these technologies with remote technology has the potential to greatly improve access to necessary medical care. In an ageing society with a declining birthrate, there is a risk that medical personnel may become limited, especially in rural areas, but the establishment of these telemedicine infrastructures will eliminate geographical reasons and ensure access to advanced medical care. In this context, for example, the recent successful demonstration of tele-surgery between Japan and Singapore by the Japanese-made surgical support robot "hinotori" was good news[3].

With regard to cross-border medical practices using telemedicine, it will be necessary to consider internationally a system to harmonize the qualifications of medical doctors in each country to make this possible. Data management for the cross-border exchange of patients' personal data should also be considered.

3. Personalized Medicine

In conventional medicine, patients with the same disease have been treated essentially identically. However, recent studies have shown that individual differences in treatment efficacy and side-effects can occur due to genetic traits in individual patients. Therefore, efforts have begun towards so-called personalized medicine, which analyses the genomic data of patients and enhances the effectiveness of treatment by administering medication and treatment that is more suitable for that patient. As examples from Japan, the National Cancer Center Japan has established a database for cancer genome medicine at the Center for Cancer Genomics and Advanced Therapeutics (C-CAT) in collaboration with core hospitals for cancer genome medicine, and implements cancer genome medicine using optimal cancer therapies. Tohoku University Medical Megabank Organization collects genome information and information on disease and life course data with the cooperation of people in the Tohoku region, and conducts cohort studies using big data processing and AI. These are aimed at creating "personal health management society" that realizes personalized prevention and personalized medical care according to differences in people's genes, their living environment and lifestyle. Personal health management will play a major role in extending healthy life expectancy in an ageing society.

It would be productive if such research could be carried out in cooperation with various countries and regions, but there is an important issue, which is the handling

[2] Cabinet Office, Government of Japan, Moonshot Research and Development Program, Moonshot Goal 7
https://www8.cao.go.jp/cstp/english/moonshot/sub7_en.html

[3] Medicaroid Cooperation, "Demonstration of Remote Surgery Using the hinotoriTM Surgical Robot System Successfully Performed Between Singapore and Japan"
https://www.medicaroid.com/en/release/pdf/231011_en.pdf

of highly personal information such as genome and disease information. There are significant gaps between countries and regions in the handling and approach to personal information. International cooperation is needed on mechanisms for handling data in a non-personally identifiable manner and, as mentioned above, on reliable data management and the rulemaking.

4. Regulatory Science

In the practical application of innovative drugs and new medical devices, it is necessary to assess and judge their quality, efficacy and safety appropriately and promptly based on scientific knowledge, so that they can be implemented quickly and safely. Regulatory science research for this purpose is becoming increasingly important in the diversification of modalities and rapid technological innovation resulting from the recent development of life sciences. It is still fresh in our memories that mRNA vaccines were developed and popularized in a very short period of time during the COVID-19 pandemic. Regulatory science played an important role on that occasion. It is desirable to promote international collaboration in regulatory science to prepare for possible future global pandemics.

Regulatory science is important not only in the medical field, but also in emerging technological fields such as generative AI and quantum technology, where the nature of research and development is currently being discussed worldwide.

It goes without saying that social issues such as those mentioned in this paper cannot be solved by experts and policymakers alone, but require communication and cooperation between sectors of industry, academia and government, and across borders. To this end, it is important to build cross-sectoral networks on a daily basis.

It would be a great pleasure if this article could provide an opportunity for readers to think about science, technology and diplomacy.

References

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