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Innovators' Legacy：The Wisdom of Trailblazers

New Ethics for an Era of Human Security and Well-being

[Part 1] Thoughts on the Post-COVID-19, Post-Ukraine Era (1 of 3)

#Innovation Creation #Sustainability

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In 1971, Koizumi graduated from the Department of Pure and Applied Sciences in the College of Arts and Sciences of the University of Tokyo, and in the same year, he joined the Department of Optical Instruments at Naka Works of Hitachi, Ltd. In 1976, Koizumi submitted his thesis to the Faculty of Science and received his doctorate in science from the University of Tokyo. He discovered and developed many new principles in fields such as the environment and medicine, and applied them in society. In 2000, Koizumi was appointed General Manager at the Advanced Research Laboratory. He became Corporate Chief Scientist in 2003, a Fellow in 2004, and has been working in his current role since 2017. Koizumi is a Fellow and a member of the RCAST Board, the Research Center for Advanced Science and Technology (RCAST) of the University of Tokyo, a Foreign Member of the Chinese Academy of Engineering (CAE), and Professor Emeritus at Southeast University. He has also worked as Director at the International Council of Academies of Engineering and Technological Sciences (CAETS), and as board member at various research institutes and foundations in the USA, Europe, Australia, and other countries. Recently, he published "Albert Einstein's Inverse Omega: Considering Education from the Perspective of Evolution of the Brain (Evolutionary Pedagogy)" (winner of Papyrus Award, Bungeishunju Ltd.).

Highlight

In today's society, which is notable for its volatility, uncertainty, complexity, and ambiguity (VUCA), what do we need to do to create a better existence for individuals, companies, organizations, and the state? In this series of articles, Hideaki Koizumi, Honorary Fellow of Hitachi, Ltd., who is active internationally in a wide range of cross-disciplinary research activities, such as brain science, education, science, and ethical issues, discusses this question from a wide variety of perspectives, including the theory of ideas, philosophy, technology, science, and art. The theme of Part 1 is the question of how we should understand the post-COVID-19, post-Ukraine era. The coronavirus pandemic swept across the world for over two years and had a profound impact on the society and economy of every country. Then, just as we were starting to overcome this crisis, the Russian government invaded Ukraine, which had knock-on effects on the global food supply and caused upheaval in global security frameworks. In a world that stands at a crossroads on many fronts, what will serve as the basis of a better existence for individuals, companies, and the state? What do we need to do to cultivate new possibilities?

Structural Problems Behind Emerging Infectious Diseases

Today's world has reached a crucial turning point. We have heard such theories from many sources since the start of the novel coronavirus (COVID-19) pandemic. In December 2019, a patient with pneumonia from an unknown cause was reported in Wuhan, China. In only a few months, this disease spread around the world, with infection rates rising and falling repeatedly as the virus mutated. According to data from Johns Hopkins University, a total of nearly 600 million people worldwide had been infected by August 2022. More than 6.4 million people had died. Looking at the excess mortality rate*1, we can conclude that the true figure is even higher. On the other hand, we have taken steps to enable coexistence with the novel coronavirus by developing vaccines and drugs for the mutant strains and establishing new treatment regimens.

Meanwhile, on February 24, 2022, the Russian army invaded Ukraine. This sparked a new host of problems for an international community that was just starting to escape from the pandemic, encompassing energy, food, and global security*2.

These two problems may seem unrelated at first glance, but on deeper consideration we can see that they share many common elements. One commonality is that they are both turning points that have transformed conventional ways of thinking and objective frameworks, and another is that each is caused by deeper social issues. Many people have debated how the world will be different in the future beyond these turning points, post-COVID-19 and post-Ukraine. For an accurate prediction, we must look at both problems from a wider perspective and clarify the larger trends that are common to both. We must learn the genealogy of the religions that form the background to these trends, while also looking back at the complicated history of Europe.

Figure 1—Mother Volga: The Origin of Russia and Neighboring Countries

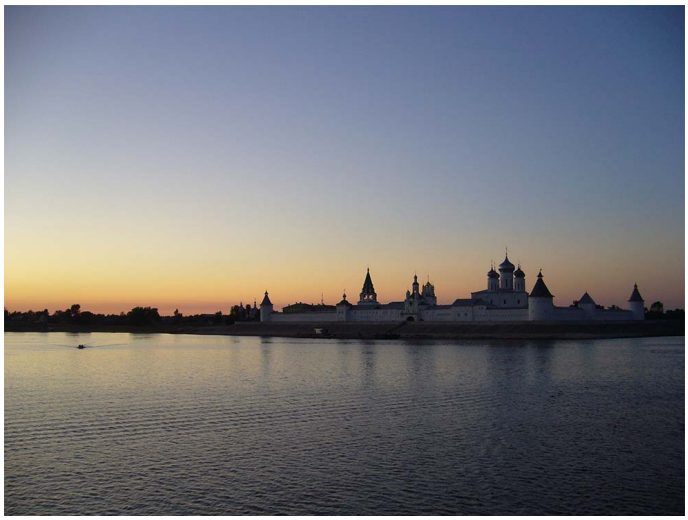


Photo by H.Koizumi

From the 9th century to the 13th century, there was a state in northeastern Europe known as Kievan Rus' (Роусь in Old East Slavic, Rus' is the origin of the word "Russia"). The current state of Ukraine fell within its borders. The great Volga River that flows through the center of the country is 3,696 km long. The river system and the constructed canals turned the inland capital city of Moscow into "The Port of the Five Seas," referring to the White Sea, Baltic Sea, Caspian Sea, Azov Sea, and Black Sea.

Figure 2—Canal Lock Technologies Overcome the Level Differences between River Systems

Photo by H.Koizumi

With a total length of 101 km, the Volga-Don Canal connects Russia's Volga River, which flows into the Caspian Sea, and the Don River, which flows into the Black Sea. The altitude difference of several hundred meters between the two rivers is eliminated in steps using canal lock technologies, enabling large Russian vessels to navigate between the Five Seas. Week-long international conferences have been held on cruise ships traveling up the Volga River. After many long trips on the Volga, I have come to understand how the Volga River system forms the geopolitical core of Russia and its neighboring countries (including Ukraine and Belarus).

The wider the view we try to take of the natural world and the human societies it contains, the more we need to return to the basics of our individual disciplines. Unless we clearly understand the core of our own field, we will not be able to connect or integrate it with others. But merely picking subjects from our own disciplines based on our own judgment will result in a random agglomeration, and will not form a useful basis for integration or connection to other fields. The Ettore Majorana Foundation and Centre for Scientific Culture (EMFCSC), located in Sicily, has been grappling with this difficult issue for more than half a century. This institution was founded in 1962 by Victor Weisskopf (1908–2002), Isidor Isaac Rabi (1898–1988), Antonio Zichichi, (1929–), and others. Paul Adrien Maurice Dirac (1902–1984) and Richard Feynman (1918–1988), who lived during the formative age of quantum physics and quantum electrodynamics and continued to think about the essence of matter until their later years, were also deeply involved. The medieval town of Erice stands on a 751-meter cliff that looks down on the Mediterranean Sea. Attracted by its mesmerizing churches and monastery ruins, many interdisciplinary international graduate programs have been held here every year. Of the young people invited to this program over the last half century, 102 went on to be awarded Nobel Prizes (The History of EMFCSC). Until the start of the coronavirus pandemic, I had been helping with this program every year for more than a decade. Since this program is not very well known in Japan, I would like to unveil some of its secrets in this series.

Figure 3—Hall at Ettore Majorana Foundation (Left), Discussion Room (Right)

Photo by H.Koizumi

In the hall, mentors who are world-famous in their individual fields first provide an overview of their disciplines and identify the essence of the issues (“mentor,” a word originating in Greek mythology, is a character who fulfills the role of passing on knowledge to a young or inexperienced person). Sometimes, as clouds float past the discussion room, dozens of young people selected by the mentors engage in lively debate in front of the posters. Breakfast starts early in the Foundation’s dining hall, mixed with more discussions of course, while lunch and dinner are enjoyed at one of the many delightful restaurants in Erice (expenses are fully covered by the Foundation). Later, the underground Marsala Room, replete with on-tap alcoholic drinks and a piano, provides the venue for more lively discussions well into the night.

***1 What is the excess mortality rate?**

In the context of this discussion, excess mortality rate is the number of people who died per unit of population, combining the number of people who died due to indirect COVID-19 causes (such as elderly people whose chronic conditions worsened due to treatment restrictions) and the number of people who died directly of COVID-19. This statistic is important for getting an overall view of the impact of COVID-19, but calculating an exact value is not easy. Although one article in an international academic journal (Lancet 2022) estimated the excess mortality of COVID-19 in Japan to be six times the normal rate, the general consensus is a level of about three times higher. Some countries actually saw a decrease in the excess mortality rate as measures taken against coronavirus infection reduced the prevalence of other diseases as well, and lockdowns and travel restrictions reduced traffic accidents. The excess mortality statistic is also greatly affected by how many elderly people live in a country.

***2 Global security issues and the pandemic**

The International Council of Academies of Engineering and Technological Sciences (CAETS) issued a statement in response to the Russian government’s invasion of Ukraine (CAETS Statement on Invasion of Ukraine - FINAL). CAETS is a group made up of national engineering academies from 31 industrialized countries, five of which abstained from voting for the corresponding United Nations General Assembly Resolution. (At the Emergency Special Session of the United Nations General Assembly on March 2, 2022, a resolution condemning Russia’s invasion of Ukraine was voted on by 193 countries and passed with 141 in favor, 5 against, and 35 abstentions.) The Ukraine issue raises questions about how academies should be administrated, because they are supposed to have a position independent of their governments. The possible use of nuclear weapons in particular has emerged as one of the most important ethical issues regarding the invasion. Preventing the hacking of the huge nuclear weapons arsenals is also an urgent engineering task.

One underlying cause of this pandemic has been the increased contact between humans and unknown viruses as civilization develops. As you know, viruses do not cause much of a problem when they are present inside organisms with which they have already established a symbiotic relationship. However, these same viruses can pose a serious threat when they infect organisms other than their natural hosts. It is believed that the novel coronavirus originated in a coronavirus that was prevalent in bats. acquired immunodeficiency syndrome (AIDS) is also believed to have been mainly transmitted to humans via primates. These ribonucleic acid (RNA) viruses, unlike deoxyribonucleic acid (DNA) viruses, have lower gene self-repair functionality and thus are more prone to mutation. The resulting extremely fast rate of evolution is a key characteristic of these viruses. This is also why a rapid scientific response is essential. In the summer of 2021, when Tokyo was hosting the Olympic Games, which were postponed from 2020, Japan was experiencing a serious fifth wave of the coronavirus pandemic (Delta variant). But from late August to the end of the year, cases decreased rapidly and were almost completely contained. The Delta variant in the fifth wave was a substrain unique to Japan (registered internationally as the AY.29 Delta variant); it was different from the Delta variant in other countries [discovered by research at Niigata University and the National Institute of Genetics (NIG)]. Some researchers have also argued based on the principles of evolutionary biology that defects in the evolution of the repair function caused the virus to self-destruct (however, the general consensus is that protective measures against infection were successful in containing the fifth wave).

One reason for the spread of zoonotic diseases that originate in animals is that human development means we encroach more and more into the habitats of wildlife, which increases our frequency of contact with viruses and bacteria carried by animals. As climate change melts glaciers and permafrost, ancient pathogens unknown to modern humans may be released from their long entrapment in the ice. As long as human-centered development continues to ignore the well-being of other species, and social systems continue to rely on fossil fuels that accelerate global warming, the threat of new infectious diseases emerging will never go away. This is a major structural problem.

Pandemic Response

The first I heard about the novel coronavirus was in January 2020, when still no infections had been reported in Japan. I happened to hear about the situation in Wuhan while I was giving a New Year's speech at the request of the Chinese Embassy in Japan*3. Since then, I have been advocating via symposiums and media organizations for a trans-disciplinary approach to tackle infections.

One feature of emerging diseases is the difficulty of responding to a rapidly changing situation that is outside our prior knowledge. Furthermore, exploding infection rates across many countries make it difficult for any one country to contain outbreaks. At another international conference discussing the novel coronavirus held in October 2020 (four related sessions at the Science and Technology in Society (STS) STS forum 2020), the head of China's infection control bluntly said, "When an apartment building (the Earth) is burning, it's not enough just to put out the fire in your own apartment (country)."

We should have learned from past pandemics the difficulty of dealing with viruses for which we have no previous data. On the other hand, this pandemic triggered the development of new genetic analysis methods, including amplification functions such as polymerase chain reaction (PCR). For the first time in history, we became able to clearly observe the evolutionary processes of viruses based on genetic information. Such new measurement methods and information technology should have been utilized to collect precise information and then enable scientific measures to be taken on a clear, logical basis.*4 But what actually happened is that each country chose its own methods to deal with the pandemic. This shows how difficult issues arise even when we try to take "scientific" action. Furthermore, the pandemic revealed the importance of taking a trans-disciplinary approach in a situation where concrete measures are urgently needed (the trans-disciplinary concept will be described later in this series), as well as the difficulty in rapidly bringing together scientists and engineers who were previously siloed away from each other.

Even countries with advanced healthcare systems suffered terribly in the pandemic. Although the Centers for Disease Control and Prevention (CDC) in the USA is the most famous and advanced center of disease control in the world, the World Health Organization (WHO) reported that as of August 15, 2022, a total of 3,185 people per million had died of COVID-19 in the USA. With its focus on basic research and its numerous winners of Nobel Prizes, the USA should have one of the world's best healthcare systems. Fatality statistics in other countries with advanced medical systems include 2,731 per million in the UK, 2,341 in France, and 1,738 in Germany.

I discussed this directly with Harvey V. Fineberg at the 2020 STM Forum. Dr. Fineberg is the former president of the Institute of Medicine (now National Academy of Medicine), a former provost of Harvard University, and former Director of the Harvard School of Public Health, and he was an excellent chairman at the 2022 STS Forum COVID-19 Symposium. Dr. Fineberg has formed collaborations with member academies of CAETS with the aim of establishing a scientific approach.

In contrast, the cumulative rate of confirmed COVID-19 fatalities in Japan is 281 people per million, despite delays in implementing scientific measures and drastic policies. One possible explanation is genetic differences in susceptibility to severe infection between human populations, arising from ancient regional differences in interbreeding between Neanderthals and Homo Sapiens. This was discovered by Svante Pääbo, who was awarded the Nobel Prize in Physiology or Medicine in 2022. The ultimate goal of infection control in a pandemic is to reduce deaths as much as possible. While some people expressed the opinion that disrupting the economy to control infection is unethical because the number of suicides will increase even more, a sound statistical analysis based on the previously described excess mortality rate shows otherwise. The differences in the response of each country can be explained by differences in society, culture, political systems, and ethical values. These differences are also connected to the Ukraine crisis on a deep level.

In both epidemiology and military affairs, measurement is a fundamental requirement. Measurement was fundamental to research at the MIT Radiation Laboratory, which changed history by helping to develop radar during the Second World War (described later in this series).

It is premature to think that Japan should follow the example of the USA and quickly establish its own version of the CDC. Japan should first develop its own future vision rooted in interdisciplinary collaboration in science and technology, and then build the actual agency based on this vision. Back in the 1970s, I conducted research at institutions in the USA, which seemed far in advance of other countries at the time. With the discovery and practical application of the polarization Zeeman method [Analytical Chemistry, Science (1977)], I was invited to be a visiting researcher on an annual or monthly basis by the Lawrence Berkeley National Laboratory (LBL), University of California, the National Bureau of Standards (NBS), [now the National Institute of Standards and Technology (NIST)], and the US Army Corps of Engineers Hydrologic Engineering Center (the oldest research institute for water resource management in the USA and the first to identify global environmental problems). Based at these institutions, I also conducted joint research with state bodies such as the National Institutes of Health (NIH), CDC, Environmental Protection Agency (EPA), Food and Drug Administration (FDA), and Federal Bureau of Investigation (FBI). Once we became able to measure things that could not be measured before, I got bombarded with requests from a wide variety of fields.

Furthermore, NIST, which is at the center of global development of measurement methods, is expected in the future to prioritize the development of more technologies to respond to pandemics. This is because the discipline of infection testing is only one small part of the analytic sciences, and it was previously in its own silo. When we have to deal with unknown phenomena, the very first step is to gather evidence. Only then can we move on to developing vaccines and drugs*4.

Japan's response*5 to the novel coronavirus has been rated highly, thanks to the excellent quality of the national health insurance system, as well as the dedication to hygiene among the general population. Even so, the unnecessary loss of life that occurred despite the best efforts of clinicians over long periods of time revealed latent issues in the Japanese healthcare system. These include structural issues in medical systems, political leadership, and the command of administrative systems and infection control. In Kyoto and Osaka, where the pandemic was particularly bad, young physicians took the lead in overcoming difficulties experienced by hospitals and established temporary PCR test sites. They also conducted home visits 24-hours a day on a rotating basis to try to bypass the limitations of emergency care facilities. I also think that the on-site capabilities that resulted in the successful development of antibody cocktail therapeutics at home (Masanori Kobayashi, Director of Kassai-Iin Clinic) should be highly praised. Some system design experts are emphasizing the need to improve medical systems without waiting for the full containment of the pandemic.

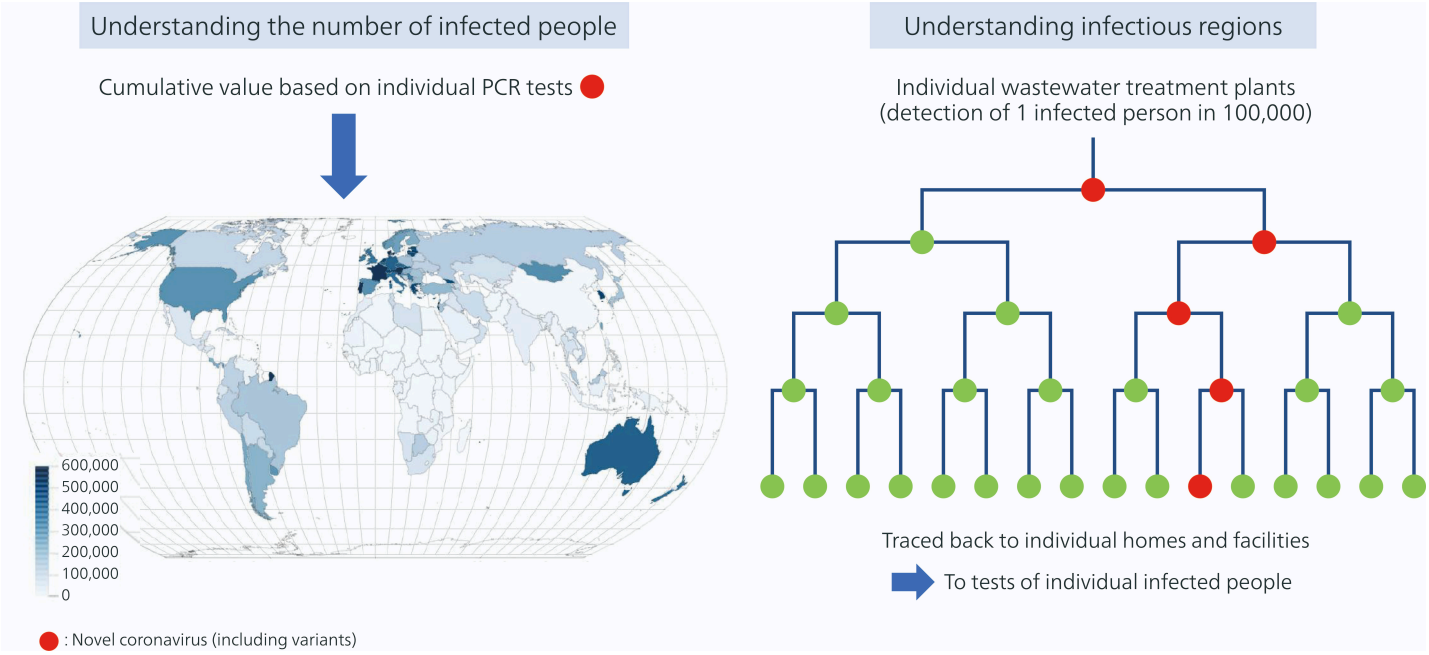
I too have conducted on-site collaborations, and made repeated suggestions for a new integrated measurement system in particular. This will enable us to understand current conditions and take the first step to dealing with the pandemic. Although concepts for new testing systems are not yet fully understood, one such new testing system in China won a CAETS award in 2021.

Another measurement system receiving attention is advance assessment of conditions based on sewage (measuring virus mutations and other trends). This is a new measurement concept where environmental meta-analysis is expanded to wastewater analysis. Environmental meta-analysis is a marine environmental analysis method where advanced genetic analysis is performed of a sample of seawater from a certain location, while at the same time identifying species from the genetic fragments using AI. Masaaki Kitajima, a member of the Japan Society for Analytical Chemistry (JSAC) and Associate Professor at Hokkaido University wrote the world's first review on wastewater analysis and has worked on improving the precision of such methods; for example, by increasing detection sensitivity up to 100 times. [M. Kitajima et al., "Analysis of Novel Coronavirus in Wastewater," Bunseki (Nov. 2020)]. In wastewater, viruses are adsorbed onto the surface of solid matter, requiring experience and knowledge in the field of analytical chemistry for high-sensitivity and high-accuracy analysis under such contaminants. The world's leading ultra-high sensitivity wastewater analysis method was developed capable of detecting one infectious person from among a population of 100,000. This method was actually applied in the Tokyo 2020 Olympic Village, and Professor Kitajima's group published the distribution of the novel coronavirus (including variants). [M. Kitajima et al., "COVID-19 Wastewater Surveillance Implemented in the Tokyo 2020 Olympic and Paralympic Village," Journal of Travel Medicine, 29, 3 (Apr. 2022)]

Devising an appropriate response to a pandemic is difficult for the field of infectious diseases to do alone from its silo. To gain a correct understanding of current conditions, the people who are infected must be identified, but in doing so, it is also important not just to focus on individuals, but also to keep the global picture in mind. In addition to the traditional direction of analysis focusing on the individual and then the global, we should also reverse the direction of this concept, and work our way back from the global to the individual level.

I believe that such trans-disciplinary concepts lie at the very heart of innovation, and this will be demonstrated throughout this series in various case studies.

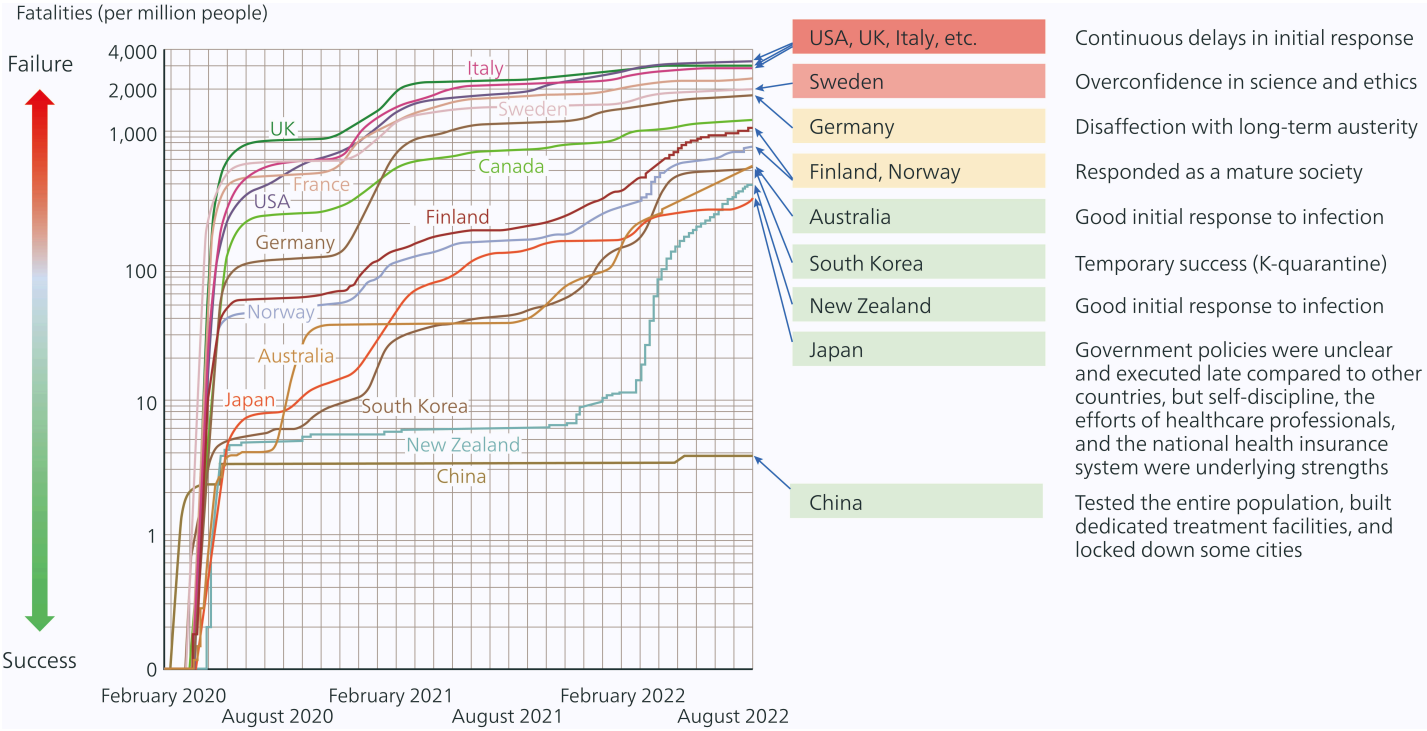
Figure 4—"From Individual to Global" and Simultaneously "From Global to Individual"



Note: This conceptual diagram was created based on statistical data from Sapporo Medical University and the Johns Hopkins University School of Medicine.
This conceptual diagram was proposed in a discussion with Ikujiro Nonaka at the 15th Topos Conference of the Future Center Alliance Japan, held on May 20, 2021.

In conventional PCR testing, the number of infected people is compiled by region, providing a view of infection conditions in that region. This is surveillance transitioning from the individual to the global perspective. Conversely, wastewater testing gives us an advance view of infection conditions across the entire region. Through the early detection of regional infections, authorities can deploy individual PCR tests and transition from a global to an individual perspective. The current highly sensitive wastewater testing method can detect infections on the order of one person in 100,000, enabling surveillance that is dramatically more efficient than individually testing the entire population. Furthermore, mutated variants can be accurately identified from virus fragments using AI.

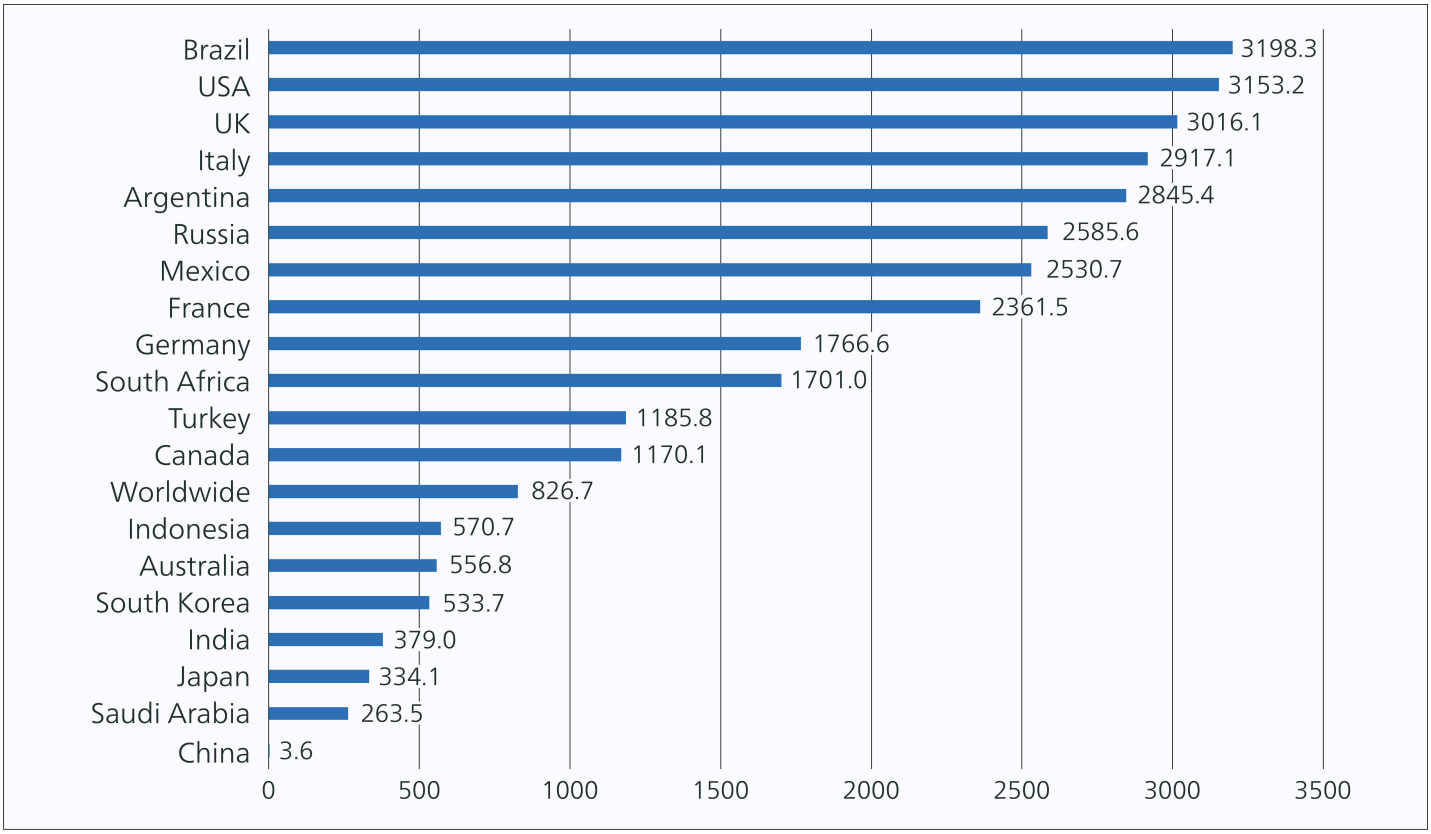
Figure 5—Response of Various Countries to Novel Coronavirus



Note: This diagram was created based on statistical data from Sapporo Medical University and the Johns Hopkins University School of Medicine.
Hideaki Koizumi's lecture materials from the CAETS COVID-19 Special Committee held on October 12, 2020, were translated and updated to current conditions in August 2022.

By tracing the tragic loss of life over time in this graph, which shows the cumulative COVID-19 deaths per million people, we can assess how each country responded to the pandemic. The examples of the USA, UK, South Korea, Sweden, Japan, and China are described in this article, but other notable countries with reliable statistics are also included here with a brief comment. Since the ultimate goal is to protect human life, the most appropriate benchmark for evaluating the success or failure of comprehensive infection control is the number of cumulative deaths or the excess mortality rate.

Figure 6—Number of Cumulative Deaths per One Million People Due to Novel Coronavirus



Note: This diagram was created based on statistical data from Sapporo Medical University and the Johns Hopkins University School of Medicine. Statistical accuracy varies by country. The actual number of deaths due to the novel coronavirus can also be estimated based on a statistical analysis of the excess mortality rate.

Although the statistical accuracy of the cumulative death data may vary by country, we can see the general trends in this graph. The cumulative number of COVID-19 deaths per capita in some advanced countries paints a tragic picture of the pandemic (data current as of Sep. 2022). The Royal Academy of Engineering (RAEng) in the UK has also started research from the perspective of science and technology.

***3 East Asia Round Table Meeting of Academies of Engineering**

The 24th East Asia Round Table Meeting of Academies of Engineering (EA-RTM) was held in 2021. This conference brings together engineering academies from three countries: The Engineering Academy of Japan (EAJ), the Chinese Academy of Engineering (CAE), and The National Academy of Engineering of Korea (NAEK). Since the first event in Osaka in 1997, the three nations have hosted the Round Table Meeting in turn. These symposiums deal with themes common to all three countries and provide an opportunity every year for the participants to discuss science and technology in a forum independent of politics. This framework organization is also affiliated with CAETS, which is composed of 31 countries. In 2019, with the cooperation of Shojiro Nishio, President of Osaka University (and EAJ Branch Chair), the Round Table Meeting discussed how to deepen collaboration in medicine and engineering from a trans-disciplinary perspective. The novel coronavirus emerged immediately after this, and as an extension of this meeting, the CAETS COVID-19 Special Committee was established before the CAETS 2020 Annual Meeting (South Korea, President Oh-Kyong Kwon, Oct. 2020). International committee meetings were held several times on an ad hoc basis, but continued collaboration became difficult for two main reasons; because committee members were very busy with infection control in their own countries, and because infection control itself became directly linked to decisions by governments. The CAETS 2020 Annual Meeting was held concurrently online, and after opening remarks by the Prime Minister of South Korea, a manager from the Korea Disease Control and Prevention Agency (KDCA) gave a report detailing the success of K-quarantine. However, it was also true that this policy placed huge burdens on the South Korean economy. The Committee for Recovery of Normal Life from COVID-19 was established in October, the same time as the CAETS group, but just as they were starting to take measures to relax restrictions, there was explosive growth in infections and control became difficult. South Korea's change of President was another reason for stagnation, which has extended to the present time. To achieve a proper balance between the economy and infection control, what is needed is the proper deployment of science and technology rather than wishful thinking.

***4 Novel coronavirus vaccines**

Anthony S. Fauci, Director of The National Institute of Allergy and Infectious Diseases (NIAID), was one of the world's leading officials calling for the use of vaccines. He served under both Republican and Democratic administrations (Presidents Trump and Biden) as the US Chief Medical Adviser, which is a politically independent position. An STS Forum was held remotely in October 2020 under the chairmanship of Henry A. McKinnel, chairman emeritus of Pfizer, Inc. Director Fauci made a brief appearance during the session on the novel coronavirus, where he strongly emphasized the importance of vaccines, which had not yet been approved, and overwhelmed the voices of those concerned with safety (this was the day after President Trump was airlifted to hospital via helicopter after being infected by COVID-19). In December of the same year, agencies from several countries, including the FDA, approved the emergency use of the COVID-19 vaccine developed by Pfizer and BioNTech SE [STS Forum: EAJ NEWS No. 187 (Apr. 2021) in Japanese].

***5 Response in Japan to the novel coronavirus**

Immediately before an Upper House election in July 2022, the Cabinet Office convened an Expert Meeting on Novel Coronavirus Disease Control. Dr. Ryozo Nagai, Director of Jichi Medical University and supervisor of the Hospital of the Imperial Household, was appointed Chairman. Dr. Nagai's views presented at this meeting were objective and full of useful information for responding to novel coronaviruses now and in the future.

(Responding to Novel Coronavirus Infections in Japanese)

Similarly, Dr. Toshio Kuroki (former president of the Japanese Cancer Association (JCA) and former President of Gifu University) published the following books about the post-COVID society through Chuokoron-shinsha. Inc. These brought together various articles related to the pandemic that he wrote from 2020 to 2022 based on many academic papers.

(1) The Science of COVID-19: Pandemic and Future Coexistence (Jan. 2020)

(2) The Battle with Mutant Viruses: COVID-19 Drugs and Vaccines (May 2022)

In these books, Dr. Kuroki recalled, "There were many problems in leadership," and, as touched upon in this article, "the most problematic issue" was virus testing. He wrote, "The Ministry of Health, Labour and Welfare... did not trust and irrationally opposed PCR testing, which is the most important basis for responding to infectious diseases. The government's disregard of PCR testing in the first two years had a deep impact. Even now, Japan ranks 134th in the world for the number of tests performed (as of Mar. 15, 2022). Testing in the sixth wave of the Omicron variant could not keep up with demand, resulting in the embarrassing need to issue guidelines that diagnosis should be based on clinical symptoms, not testing. The impact of disregarding PCR testing was felt not only in diagnosis, but also had a large negative effect on the entire medical field."

In fact, the same people who did not understand the correct concept of "conditional probability" in the initial stages and used it as a reason to not perform PCR testing are silent today. Some of the documentation from this time was compiled in "The Independent Investigation Commission on the Japanese Government's Response to COVID-19: Report on Best Practices and Lessons Learned" (Japanese version Oct. 2020, English version Jan. 2021).

This was the result of meetings that including the former Prime Minister Shinzo Abe and other related cabinet ministers, and was presented to Yoshitake Suga, the Prime Minister at that time (the chairman of the commission was Yoshimitsu Kobayashi, Chairman of the Engineering Academy of Japan and Chairman of Tokyo Electric Power Company Holdings, Inc.).

Response by the Swedish Government

Sweden continues to develop into one of the future role models for the world, scoring amongst the highest levels in objective indicators such as productivity, science and technology standards, educational attainment, and satisfaction of its citizenry. Its distinguished history includes not only the Nobel Prize, but also the establishment of the world's first engineering academy more than 100 years ago, the Royal Swedish Academy of Engineering Sciences (IVA).

Although Sweden is one of the countries I most respect in the world, and even though it is a rational welfare state with a proud history of progress in science and technology, its so-called "scientific" approach to the novel coronavirus was problematic. As this touches on the core of Human Security and Well-being that I will describe later, I would like to discuss it in a little more detail here. In general, failure has the negative, backward-looking connotation of remorse, but correctly controlled, failure is very important for ensuring a better future. In innovation, failures are often more meaningful than small successes. For example, the Institute for Brilliant Failures, led by Dutch Professor Paul Louis Iske, conducts research on the value that is created from failure.

In the early period of the pandemic, the Swedish government, which has an advanced health and welfare system, very quickly completed the preparations needed for genetic testing using methods such as PCR. (In contrast, the Japanese government was stuck within old frameworks of disease control, and unfortunately bottlenecks in testing and digitization of data continue to this day.)*6

On the other hand, the Swedish government did not implement strict restrictions on behavior, such as lockdowns, neither did they recommend the wearing of masks*7. Anders Tegnell, who was in charge of the government's COVID-19 policies, explained that the basis of these decisions was that, "The effectiveness of lockdowns or masks in infection control has not been demonstrated." The Swedish government was not necessarily aiming for herd immunity. In the early days of the pandemic, most people went about their lives with few social restrictions, and the government's actions were popular in many quarters.

But while this policy may seem logical at first glance, the end result was that the death rate per million people in Sweden of about 600 in August 2020 was more than ten times the level in the neighboring countries of Finland (about 50 people per million) and Norway (about 40 people per million).

I believe that the reason such a thing happened in Sweden, which has high standards of medical care, is rooted in the rationalistic view of life and death of their mature society, which places first priority on those people who are, ultimately, most likely to be saved. When I questioned Ayako Miyakawa of the Karolinska University Hospital at a remote symposium, she told me that in Sweden, it was difficult for patients over 80 years old or patients with existing conditions over 70 years old to be admitted into Intensive Care Units (ICUs).

An unforeseen issue was that because many of the care workers at facilities for the elderly were part timers (about 30%), they would bring in the virus from the outside and cause large clusters. In a mature medical system that performs medical care based on rational principles, it is possible that elderly patients will not be able to receive advanced or comprehensive treatments. These views may seem alien to our East Asian values of life and death, but I believe that discussion of such ethical issues will be unavoidable for Japanese people as well.

***6 Measures against infection in Japan**

In the early period of the COVID-19 pandemic in 2020, the launch of emergency coronavirus research by the Japan Science and Technology Agency was delayed due to vertical divisions in the government. (By coincidence, I was able to assess on-site conditions directly after being put in charge of evaluating various national research agencies by the Ministry of Education, Culture, Sports, Science and Technology.) In contrast, the Institute of Physical and Chemical Research (RIKEN) started an extraordinary project in April of the same year to research responses to COVID-19. They used the Fugaku supercomputer with its unparalleled performance to conduct a wide range of tests, including simulations of airborne droplets containing viruses, and the development of new virus detection methods.

***7 About masks**

Masks have been used since ancient times, with one of the first types developed to prevent breathing onto respected artifacts in Buddhism and Shintoism. In the late Edo period in Japan, Dr. Tachu Miya developed a mask similar to modern 3D masks to prevent mineworkers from inhaling harmful substances. In general, Japanese people are far less resistant to wearing masks than people in other countries. At the start of the COVID-19 pandemic, many infectious disease experts (including WHO) questioned the effectiveness of masks, because the size of the virus is very small at 0.1 microns. But in Japan, the effectiveness of masks was quickly confirmed by the Fugaku supercomputer. The antivirus performance of masks, the probability of the novel coronavirus contained in airborne droplets and aerosols reaching the respiratory tract and lungs, and the effectiveness of ventilation, were all confirmed scientifically. Since the virus is contained in airborne droplets, a properly worn non-woven mask is scientifically extremely effective.

Ethical Issues

In Sweden, "unexpected" events caused an explosion of infections on an order of magnitude greater than in its neighboring countries. The government gradually changed the trajectory of its policies, until it introduced travel restrictions as well. At the end of 2020, King Carl XVI Gustaf himself expressed his own desire to see policies more directly linked to human life, while still respecting the constitution. The existence of the royal family in a highly advanced society like Sweden is important. I respect the fact that the King wanted to say that the royal family stood in solidarity with the citizenry. I have also had the pleasure of speaking with His Majesty the King and Her Majesty the Queen Silvia on several occasions, and I have been deeply impressed by their thoughts on valuing science and ethics.

Responding to the novel coronavirus has required high ethical standards. In recent years, we have often heard about the concept of “triage,” the idea of prioritizing medical treatment in the event of a disaster according to who is most likely to survive. Although this may seem unavoidable under certain circumstances, the idea that terminal care should be shortened as a matter of course to maintain healthcare systems in an aging society is already at the root of WHO’s healthcare policies. This issue lies at the heart of “Well-being.”

Northern Europe stands at the pinnacle of “Well-being” in both physical and psychological terms, but is also in the midst of discussions that are reconsidering its ethical values, including views on life and death. Such issues cannot be avoided when deliberating how to create an ideal population pyramid in the future.

Importance of a Scientific Basis

At the start of the pandemic, the Swedish government (more precisely, an expert group at the Public Health Agency of Sweden) declared that it would not take any actions that had not been scientifically proven to be effective in the past. I guess you can call this “scientific” in a certain way. But this kind of “positivism” has problems of its own. We need to be humble and recognize that we have only scientifically explained a small part of the natural world.

In Sweden, IVA, the world’s first engineering academy that celebrated its 100-year anniversary in 2019, and the national parliament jointly established a “Pairing System” in the 1950s to foster lively discussion about policy based on science. This system pairs members of parliament with academy members and they exchange mobile phone numbers so they can communicate with each other at any time. Recently, expert knowledge of science and technology has been required even in the legislative process. Academy members who receive requests for advice from members of parliament perform research from their expert perspective to enable them to give more detailed explanations to the members of parliament, and prepare a range of options. The member of parliament then considers or chooses from the options based on a political perspective. This system is very useful because it enables both the members of parliament and the scientists to learn about each other’s fields and to connect their separate spheres of work.

But even in Sweden, where information is transparent and policies are devised based on advanced ideas influenced by science, such science-based policies can be problematic. I think we need to keep this in mind. Even an illustrious agency like the CDC in the USA can end up falling into a tragic situation, as I previously described. This reality shows that to respond to complex issues for which we have no previous experience, we need to form a new trans-disciplinary framework that enables us to view problems from a wider range of perspectives than before.

In the USA, a new organization called The National Academies was established a few years ago. This organization brings together the National Academies of Sciences, Engineering, and Medicine, as well as the National Research Council, and it responds to questions from Congress and the government and helps execute projects. In China too, an institution called the “Two Academies” composed of the Chinese Academy of Engineering and Chinese Academy of Sciences serves as an advisory body, mainly for science and technology policies. This shows a global trend of governments trying to gain a deeper and more multi-faceted understanding of science and technology, and reflecting this in legislation and policies.

Currently, the Engineering Academy of Japan, together with young Diet members involved in science and technology issues (recently some of these members have been promoted to important posts such as Minister, Vice-Minister, and Deputy Secretary-General) and the National Diet Library (part of the legislative branch), have started to study a system modeled on the Swedish “Pairing System” (Co-creation Committee of Public Policies, the Engineering Academy of Japan (EAJ), Dialogue between Policy Makers and Scientists: Chairman Hiroshi Nagano).

“Openness” is the Foundation of Trust

But at the current time, when trans-disciplinary frameworks are not yet functioning, how should we respond to situations for which we have no previous experience?

The first step is to diligently collect accurate information, perform statistical analysis, and open up the data to the wider public. We should quantitatively disclose to the public what kind of data we have collected, what kind of trends we can deduce from the data, and what policies we have decided based on this analysis. If we can do this, then it will increase trust in the government and foster greater understanding of its policies.

In one of philosopher Immanuel Kant’s later works, “Perpetual Peace: A Philosophical Sketch,” he outlined his ideas about a global republican system and cosmopolitan mindset that would achieve everlasting world peace, and argued that openness was a key method to ensure this. Politics should prioritize “morals” and politicians should be open about their maxims (subjective rules of behavior); that is to say, their intentions when implementing a particular policy. Kant believed that politicians should confirm with the general public whether their maxims are widely acceptable[*8].

Kant argued that morals should not be a matter of individual conscience, but rather universal rules that are accepted by everyone; acting according to such morals will prevent oppressive exercise of power by government. By being open about the intentions behind their actions and policies and the basis for their decisions, politicians can learn whether they are acceptable to the public. Kant believed that by incorporating these concepts into their everyday policymaking, politicians would be able to avoid war. I think that openness being the starting point for peace is a key insight. Historically, every war or conflict turns into a propaganda war to varying degrees once it starts. This is why it is so important to disclose correct information in times of peace. After war starts, the disclosed information cannot be concealed again.

According to the World Press Freedom Index, a ranking compiled and published every year by Reporters Without Borders, Japan dropped from 67th place in 2021 to 71st in 2022. The index evaluates and scores press freedom based on a range of criteria. The lower the ranking, the lower the openness, which is something I am concerned about. The top-ranking countries in 2022 were composed mainly of countries in Northern Europe. Norway was in first place, followed by Denmark, Sweden, Estonia, Finland, and Ireland. Even Sweden's COVID-19 policy was ultimately debated in an appropriate manner because the policy was introduced with high levels of openness and transparency. Such open debate is the driving force to a better future.

In January 2022, the Swedish government approved a construction plan for the final storage location of highly radioactive waste produced by nuclear power plants. The plan is to store the waste for 100,000 years in a facility 500 meters underground. According to a Swedish opinion poll, approximately 80% of the population supports nuclear power. Such high support has been built up thanks to efforts to deepen the understanding of the citizenry, such as regular briefings and facility tours for local residents held by government, local authorities, and companies; the high degree of independence of the safety inspection bodies; and a system that ensures even small problems are reported to the government and disclosed to the public. The same is true in Finland, which started construction on its final storage facilities before Sweden. These countries disclose not only good news, but also problems, and show their citizens how they are working to resolve them.

I was a member of the Research Evaluation Subcommittee at the Japan Atomic Energy Commission (JAEC) just before and after the Great East Japan Earthquake (Mar. 11, 2011). I repeatedly said that we should make greater efforts in researching the safety of nuclear power plants using specific statistics and theories, but I felt that my colleagues were not yet ready to accept my arguments.

Consulting primary sources of information is key to preventing ourselves from being misled by propaganda. Dr. Sadako Ogata (1927–2019, Japan's first United Nations High Commissioner for Refugees) was very concerned about the lack of primary sources of information released in Japan. I myself make great efforts to directly obtain information about matters that occur outside Japan. I use every opportunity at various international conferences and working as an advisor overseas to make sure I obtain accurate information*9.

***8 Ethics and morals**

The word "ethics" originates in the Greek language, while "moral" comes from Latin. These words are closely related, and philosophers have debated their definitions for centuries. Kant's concept of "morals" is used here, and it will be further elucidated later in this series of articles.

***9 Importance of "primary sources of information"**

CAETS, for example, is a valuable source of primary information about science and technology in each country. Engineering and technological science academies representing 31 countries were allowed to join this Council of Academies only after strict screening. It was my pleasure to serve on the Board of Directors of this council for two terms over 15 years. With regard to the current crisis in Ukraine, CAETS includes academies from five countries that did not support the United Nations General Assembly Resolution condemning the Russian invasion. I think that it is important to be able to continue direct discussion with these countries to maintain our objectivity and independence. Last September, I attended the CAETS 2022 Annual Meeting in Versailles, Paris, as a proxy for Yoshimitsu Kobayashi, Chairman of the Engineering Academy of Japan, where I discussed issues with academy members from various countries.

Until Next Time

When I was young, I worked at the Naka Works, Hitachi, Ltd. I was invited to join the Hitachi Henjin-kai, a gathering of doctoral degree holders, whose name is a play on words and can be loosely translated as, "The Society of Nerds." Without thinking, I replied, "I'm not a nerd, so I'm not joining!" Unfortunately, the executives heard about this, and they scolded me, "So you think you're too good to be a nerd? We'll make you work hard for the Society of Nerds!" They made me plan and run the society's symposiums and other events; I was so busy! Later, one of the executives, Hiroshi Asano (1925–2003, former Executive Vice President of Hitachi, Ltd.), told me he wanted to show me something. He politely pointed to a simple bookshelf in his office.

The bookshelf was categorized into primary information at the top, containing on-site information or information he himself had heard directly; secondary information in the middle from reliable people and original sources; and tertiary information at the bottom that seemed to be reliable. Each level was organized from left to right in chronological order from newest to oldest. I felt like I had uncovered a kind of secret knowledge, and if possible, I too would like to use this knowledge as a model with “on-site” information as the starting point in my own mind. Since then, I have always reminded myself of the importance of on-site and primary sources of information.

For example, in this series of articles, there are times when I describe statements by Pope Francis, President Xi Jinping, or Prime Minister Mahathir. This is primary information that I heard directly from them myself*10. The secondary information here corresponds to original sources or information directly confirmed from the actual experience of people. When using tertiary information, I have tried to clarify as much as possible the sources of all such information.

I believe this stance is ever more important today, because we often see reports that diverge from the truth not only on the internet, but even in the mainstream media.

As I touched upon in my discussion on the response to the novel coronavirus, I believe that this divergence between on-site conditions and leadership underlies many of our modern problems, including the Ukraine crisis. This is the background to the pitfalls and assumption of our information-driven world, a discussion I would like to continue in the next article.

***10 One chance encounter leads to another**

All the encounters I have had with so many people overseas have come about by chance; in almost no case were they the result of a specific invitation from myself. For example, in Sweden, I have had one serendipitous encounter after another. His Majesty the King is frequently involved with the academy (he is the patron of the IVA mentioned above). I received a request from Her Majesty the Queen Silvia to give a commemorative lecture about “Brain and Childcare” when she was presented with the Naito International Childcare Award, and I gave a talk in the presence of Her Majesty for about an hour. She asked me various questions about brain development at this time. In a symposium called “AI and Ethics” at the 100th anniversary celebrations of IVA in 2019, when it seemed like participants in the discussion were not on the same wavelength, I made a digression about how manga artist Osamu Tezuka’s desire to create “a robot that sheds tears” (Astro Boy) is symbolic of an oriental ideal; namely that warmheartedness is essential for ethics. Later at the dinner, Prince Daniel came up talk to me, intrigued about this subject (Prince Daniel is the spouse of Crown Princess Victoria, the next Queen of Sweden). He told me how he enjoyed my summing up at the end of the AI symposium. He said that just as Her Majesty the Queen Silvia is involved in important work concerning childcare and protecting the human rights of children, he would like to contribute to activities that help maintain physical and psychological health. Later, I found out that earlier in his life, Prince Daniel was the manager of a sports gym, and I was struck by the sincerity of his character. This is how one chance encounter can lead to another.

Photo by H.Koizumi

IVA’s 100th anniversary dinner was held at Stockholm City Hall in fall 2019. As all the guests stood up, His Majesty the King Carl XVI Gustaf and Her Majesty the Queen Silvia descended the staircase, leading the flag-bearers.

Hideaki Koizumi answering questions from Her Majesty the Queen Silvia after giving a lecture in Sweden, 2005

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