Lecture

Message from the President
Leap into a Bright Future of IEICE with New Challenges

Masataka NAKAZAWA

1. Introduction

Two years ago, in 2017, the Institute of Electronics, Information and Communication Engineers (IEICE) celebrated its 100th anniversary and took the first step towards the next 100 years. This year Japan adopted a new era name, Reiwa. This means that IEICE has been active over four eras: Taisho, Showa, Heisei, and Reiwa. Clarivate Analytics selects the Top 100 Global Innovators every year and Japan has the largest number of companies on the list with 39 companies, followed by the U.S.A. with 33 companies, and France with 7 companies[(1)]. Among the 39 Japanese companies, a whopping 36 are IEICE members. On the occasion of its 100th anniversary, IEICE selected 242 milestones as outstanding achievements[(2)]. In addition, Japanese researchers played active roles in 34 of the 193 IEEE milestones[(3)]. These facts remind us that IEICE has made extremely significant contributions to the world.

However, the membership of IEICE has been declining at a rate of 700 members per year, a large proportion of whom are members from enterprises. Should this trend continue, the number of IEICE

members (currently 26,000) would be reduced by 14,000 in the next 20 years and go down to zero 40 years from now. Some may think that it would not a big deal if IEICE should go out of existence because, as long as IEEE, for example, survives, science and industry in the field of electronics, information and communication will continue to develop in the world. However, as an IEICE member who has derived extreme pleasure in transmitting information from Japan to the rest of the world and who has long been engaged in research in this field, I sincerely want to see IEICE continue to prosper.

As ICT makes progress, electronics,

information and communication technologies have become something taken for granted, just like air. The beauty of them is becoming inconspicuous. All types of technology experience such a fate at least once. Even a leading-edge technology ends up being a commonplace technology in time. There is no use crying over this tendency because it cannot be avoided. The raison d'être of IEICE is to link industry with academia in order to spur the creation of new non-commodity technologies.

Here, I would like to identify what lies at the base of the problems that confront IEICE and encourage every member to get actively involved in the publication and operation of IEICE, solve the various problems in a determined manner, and together build a new foundation for IEICE.

2. IEICE - changing with the times

Today, as Japan seeks to achieve Society 5.0[(4)], ICT is attracting attention as a means of realizing automated driving and robotics and of bringing innovation to a wide range of fields, such as agriculture, fisheries, forestry and transport, as shown in Fig. 1. The combination of a certain industry with ICT is represented by "○○×ICT." It is expected that these technical innovations will help to bring about a sustainable society, as shown in Fig. 2. As a creator of ICT, IEICE is right at the center of the envisaged society. Nevertheless, today IEICE is seeing its membership decline and somehow there is a sense of stagnation. Why? Researchers who have belonged to this institute have racked their brains to build the current global ICT society, as symbolically indicated by the milestones referred to above. Today, however, anyone can instantaneously obtain almost any type of information, including the types of information that people in the past could not get unless they belonged to the institute.

Researchers in industry are constantly kept busy as the ICT that they themselves have built accelerates industrial development. As a result, a gap can arise between industry, which is rapidly diversifying, and academia, which progresses relatively slowly. At the risk of exaggeration, I would say that, if the institute ceased to exist, researchers in universities would be in deep trouble because they would be deprived of opportunities for information exchange, discussion and publication. On the other hand, researchers in industry could continue to pursue their development without the institute. Time used to pass at approximately the same pace for both researchers in industry and those in academia. Today, they have different mindsets, the former growing impatient with the slow pace of the latter. Another problem is arising in universities. Lately, university researchers have become preoccupied with the external assessment of their work and have less time for real research activities, even giving rise to a question as to whether universities are sufficiently fulfilling their mission as research institutions. Universities should not busy themselves with non-academic activities, keeping "leading-edge research" in name only. Do we really no longer need IEICE? At the time when manufacturing was developing and the institute's membership was growing, we did not have to ask this question (although we should have asked it). Today, there is a paradigm shift in what the institute should achieve. How should we deal with this issue? We must ponder over what IEICE is and what its attractions are. I believe that what is

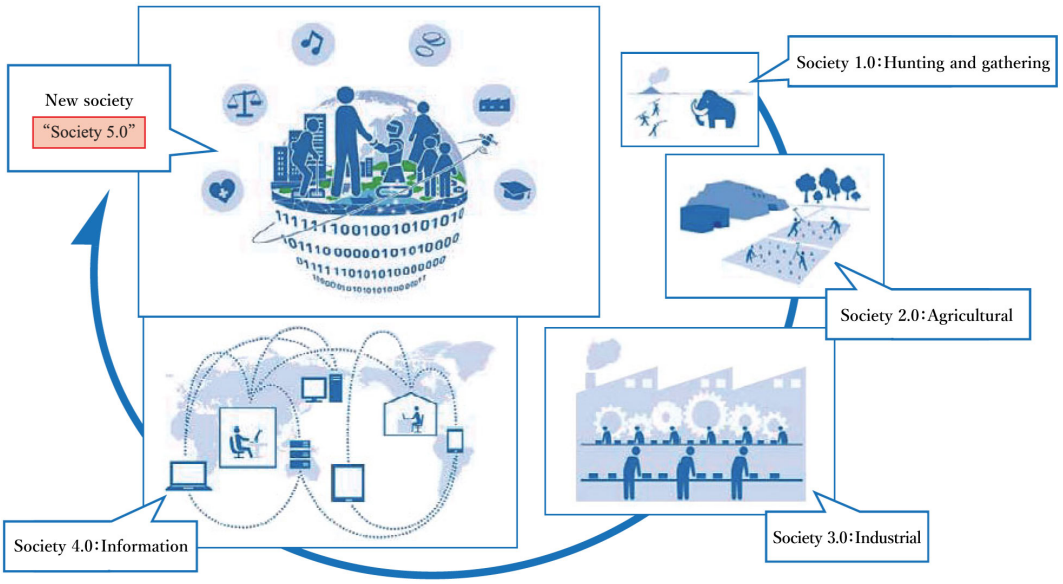


Fig.1 Society 5.0: A human-centered society that balances economic advancement with the resolution of social problems using a system that closely integrates cyberspace and physical space
(edited from "Society 5.0 Document" issued by the Cabinet Office (https://www8.cao.go.jp/cstp/society5_0/society5_0.pdf#search=%27Society+5.0%27))

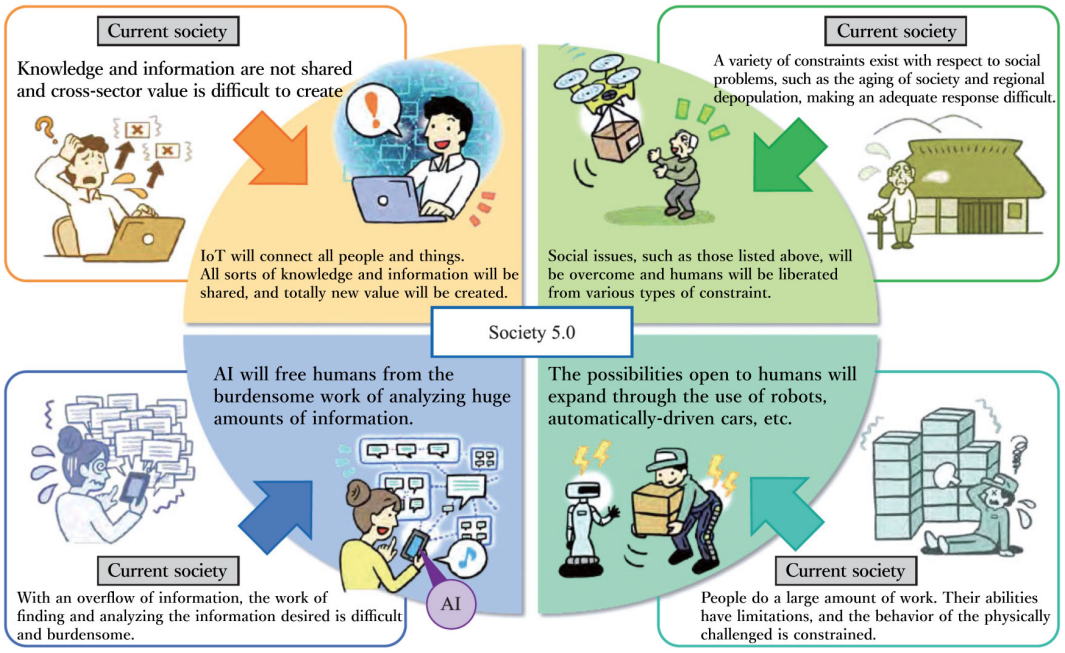


Fig.2 Society realized by Society 5.0: A society that uses a human-centered approach to addresse a variety of issues, such as how to use IoT, AI, and robotics and how to cope with the aging of society (edited from "Society 5.0 Document" issued by the Cabinet Office (https://www8.cao.go.jp/cstp/society5_0/society5_0.pdf#search=%27Society+5.0%27))

desired today is a new Institute of Electronics, Information and Communication Engineers best suited to the information society and that it is our mission to overcome the problems that stand in the way.

I believe that any scientific institute is meant to transform itself and grow with time. Poet Matsuo Basho advocated the principles of Haiku as "immutability and fluidity." Simply put, the world consists of things that never change (immutability) and things that change with time and pursue the leading edge (fluidity). This concept can also apply to the activities of IEICE. It implies that it is important for the institute both to build a firm foundation and also to seek to create leading-edge technologies. Such efforts enable the institute to become a permanent existence. We must take it to heart that there can no tradition if it is devoid of innovation.

I believe it to be of utmost importance for IEICE that its members hold discussions with others on their budding research and their achievements, in the course of their pursuit for basic research, developmental research or commercial development, and that they thereby contribute to the development of science and industry and help to enrich society. I hope to see the following. Students are trained through their pursuit of research and eventually bear the responsibility for sustaining the country in the years to come. Engineers in enterprises develop technology in collaboration with academia and lead IEICE by presenting their experiences in the institute. To create something new, people need to share the learning, passion, curiosity and faith that drive them. These cannot be learned via the Internet.

New value can be found only in the course of live discussions in scientific meetings and international conferences. New "wisdom" is grown through such discussions. People cannot encounter it via the Internet. In this sense, it can be said that the value of the institute can be ascertained by whether or not it infuses its members with a sense of fear that they may drop behind in technical development unless they attend the institute's events.

3. Learning from IEEE and OSA

Here I would like to think about how the two overseas institutes familiar to us, IEEE[(5)] and Optical Society of America (OSA)[(6)], differ from us and what we can learn from them. As you may know, IEEE is a large organization boasting a membership of 420,000 and net assets of 34.2 billion yen. It is more than a professional institute but a global company that continues to grow with a wide spectrum of business, such as standardization and insurance. Just like IEICE, OSA celebrated its 100th anniversary not long ago. It has 21,000 members and net assets of 10.7 billion yen. Although located in an America, it has members in more than 100 countries. Almost all

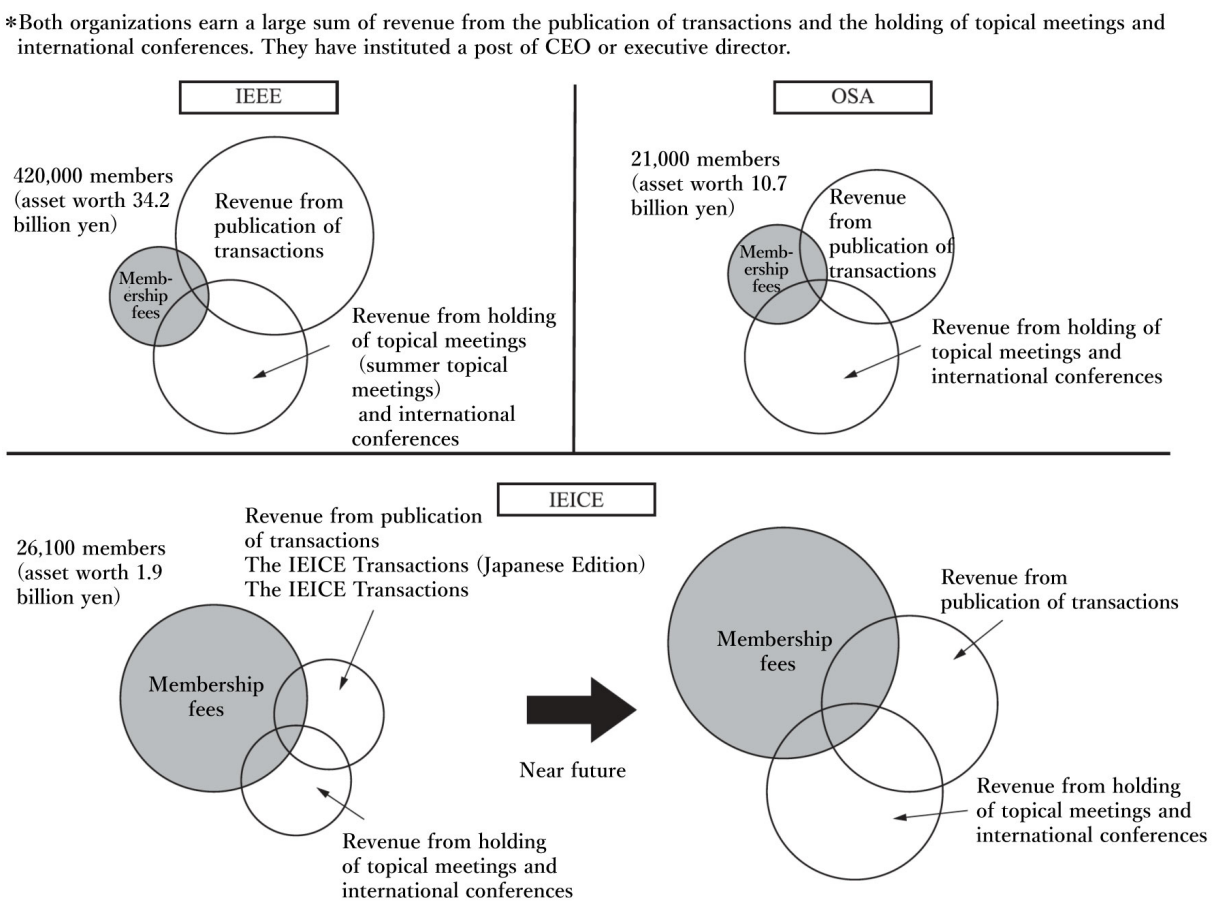


Fig.3 Future of IEICE envisaged by learning from IEEE and OSA: It is important for IEICE to increase the number of issues of transactions it publishes and the number of international conferences it hosts and also to take measures to boost its membership.

Nobel laureates in the optical field are OSA members. Both organizations place the highest priority on operating in the black. In comparison, IEICE has a membership of 26,000 and net assets of 1.9 billion yen. I have so far served as a member of the Board of Governors of the IEEE Photonics Society and a Director at Large of OSA. As I served in these capacities, I noticed some differences in character between them and IEICE. The differences I identified are summarized in Fig. 3. This figure does not give detailed numerical data; it is meant to indicate differences in operating policy.

The figure shows that both IEEE and OSA place emphasis not on earning sufficient revenue from membership fees for its operation but on how to enhance the status of its transactions and international conferences and thereby increase the numbers of paper submissions, publications and international conferences. Once, at a meeting of the Board of Governors in IEEE, I expressed my concern about the volume of revenue from the

membership fees, whereupon, I was reminded that the revenue from the membership fees was less significant than the revenue from publications, paper submissions and international conferences. To put it bluntly, even if the membership dwindles to zero, the institute can remain profitable as long as people submit papers and attend its international conferences. This story is really not exaggerated. The lowest membership fees of both IEEE and OSA are in the order of 10,000 yen, which is not much different from IEICE's membership fee of 13,000 yen. However, an author needs to pay more than 100,000 yen to have his or her paper published in a transaction of IEEE or OSA. A typical registration fee for an international conference is 50,000 to 80,000 yen. Since their transactions and international conferences have a high reputation, papers are submitted from many countries, and the review of papers is carried out around the world. Since it is globally known that IEEE and OSA transactions carry top level papers, it is of a great honor for researchers to have their names appear in these transactions. Editors of these transactions are eminent and active researchers and are good at proposing new topical meetings that everyone is likely to take an interest in. Transaction names are changed from time to time to be more appealing. In this way, these American institutes maintain a high scientific level, which is an essential requirement for such institutes, and at the same time establish connections with industry through international conferences, which host booths for assisting research activities and the outplacement of young researchers, and also play an important role in promoting exchanges between university and enterprise researchers. In addition, open access to transactions is widely adopted in the United States and Europe. IEICE should not be left behind in this trend.

IEICE earns most of its revenue from membership fees and the publication of technical reports by technical committees. It is difficult to sustain the revenue at the same level because, while the number of technical committees increased from 46 in 1990 to 85 in 2018, the number of issues of technical reports is declining year on year. Although technical committees are essential parts of the institute, they operate in a somewhat insular manner and thus few people from abroad attend them to present papers. Unfortunately, the activities of technical committees fail to generate revenue. Is this because people can get via the Internet information similar to that available from these activities? Today technical committees are in a transition to digital publication of their documents. It is necessary to take this opportunity to adopt measures to prevent the decline in revenue, such as collecting fees for participation in meetings hosted by technical committees. The revenue from membership fees is also decreasing over time. I suspect that IEICE's current business model is failing. If the institute is to grow, it is critical that it endeavors to publish high-quality papers, actively holds international conferences, and provides better services to its members, just as a business enterprise tries to raise its status and serve their customers.

IEICE has another big problem. It is a problem that can also be found in other scientific institutes in Japan. Japanese researchers, including those in enterprises, tend to submit papers to overseas institutes, such as IEEE and OSA, in preference to

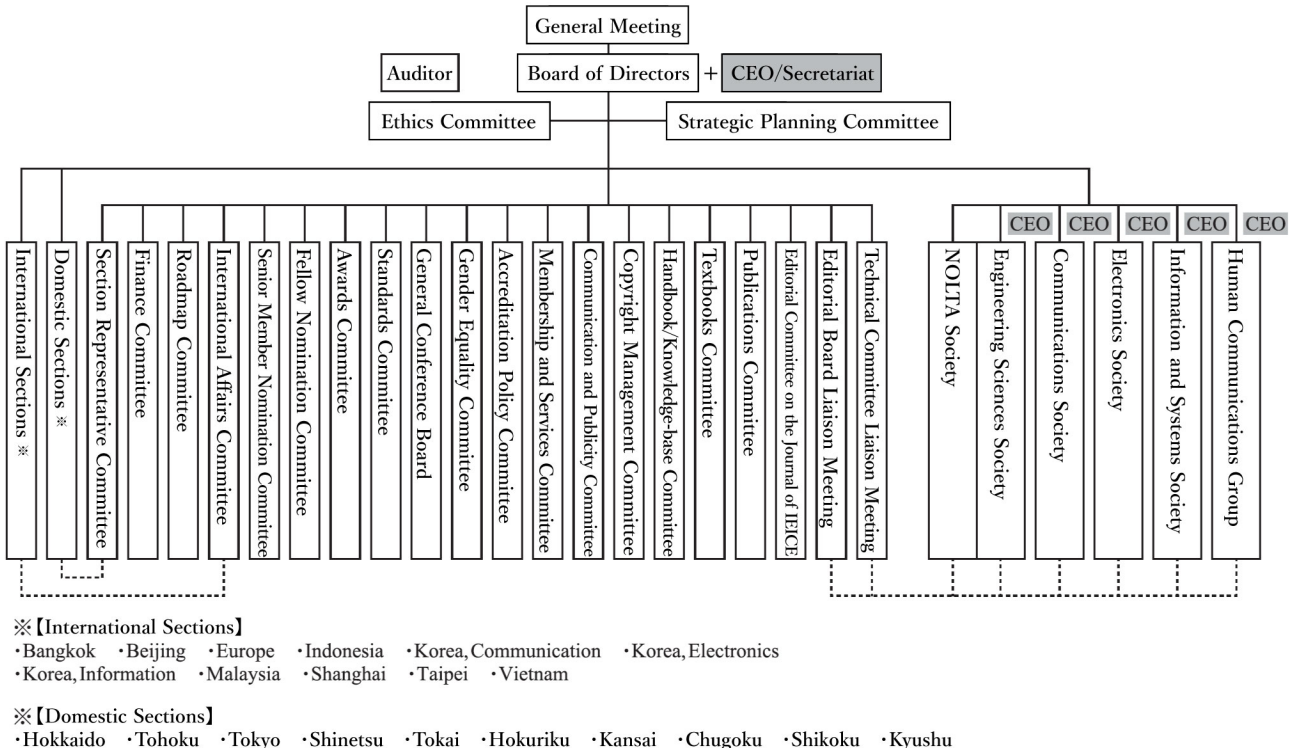


Fig.4 Proposed future organization of IEICE: Alongside the president, there should be a post of CEO or Executive Director who works full time and manages the IEICE organization. The CEO links Board of Directors, Societies and Secretariat. Each Society has its own full-time CEO, who runs the Society with the president of the Society.

IEICE. The same can be said of international conferences. I myself have submitted two-thirds of some 500 papers I have authored to transactions published in the United States or Europe. It is understandable that researchers who have produced excellent results would rather report them in overseas transactions to get a higher global recognition. Japanese researchers have traditionally been doing so. Of course, there is no way to control the will of the researchers unless there happens to be a general consensus among Japanese researchers to submit papers to transactions published in Japan in preference. However, we can, for example, have excellent papers released abroad published in our transactions as invited papers. It is important to spread information about leading-edge research in Japan in this way and stimulate discussions on such topics in IEICE general conferences and society conferences. People will attend these conferences if they know that the conferences provide them with the opportunity to have discussions on or hear about technologies that lead the world. Japan has a large number of capable and active researchers. I believe that, if they participate in IEICE's editorial committee activities and international collaboration, international conferences hosted by IEICE can earn as high an esteem and popularity

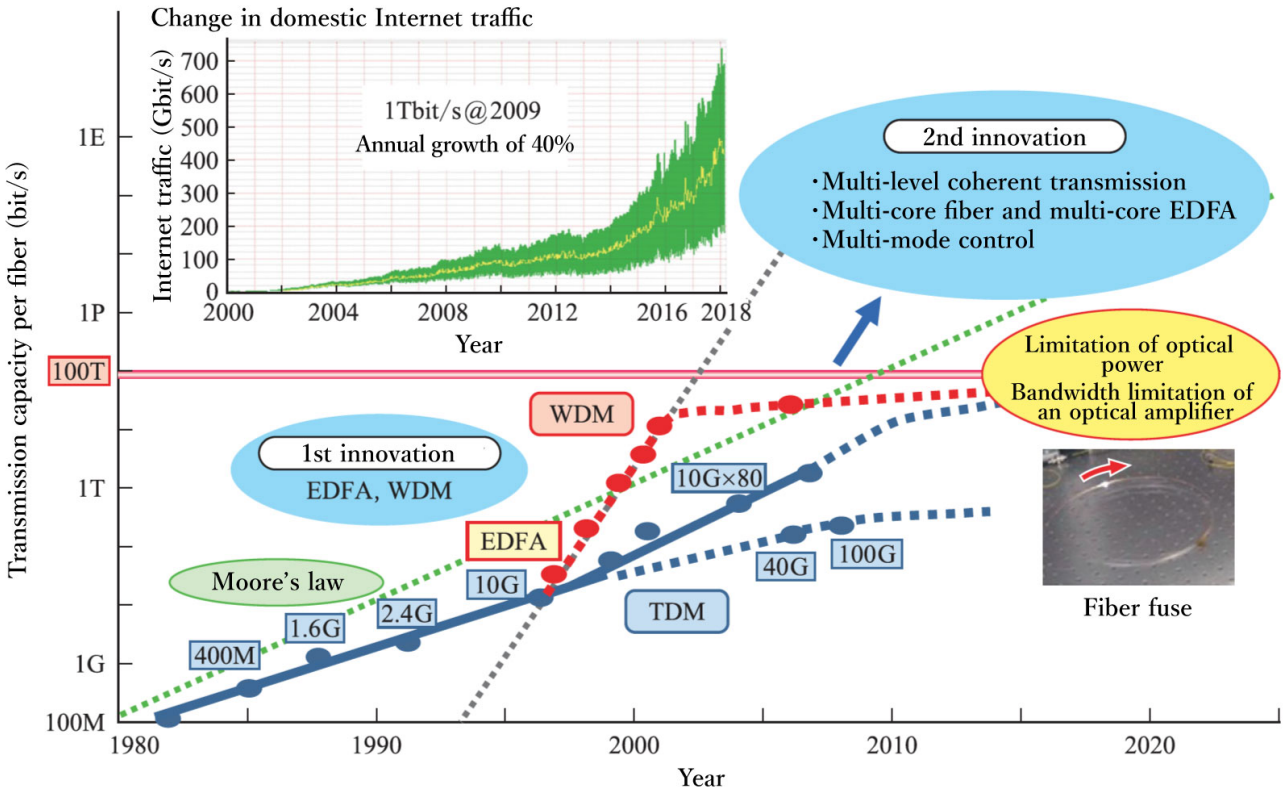


Fig.5 Overview of technical progress of optical fiber communication

as those hosted by U.S. scientific organizations.

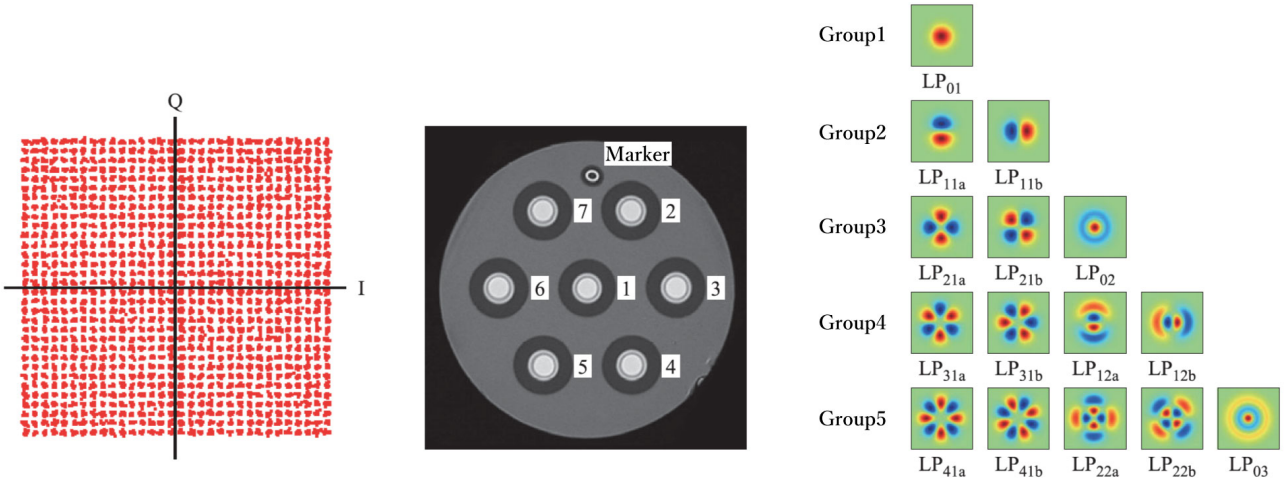
The way IEEE and OSA run their organizations differs from the way IEICE does. They have a post of CEO or executive director alongside the president. The CEO or executive director runs the organization with responsibility for financial matters and for the development of the organization. IEICE can consider adopting the same system. Fig. 4 shows an overview of IEICE's organization. Since it is volunteers who run the institute, they can do only so much. I believe that IEICE needs a full-time CEO who is responsible for its financial matters and general operation, as shown in Fig. 4. Similarly, each society needs what may be called "Society CEO," a full-time technical-marketing-type official, who acts as a facilitator for the society. They will link IEICE members, the Secretariat and the Board of Directors and enable the institute to grow further. However, we need to find a budget for employing them. Each Society should move into the black and achieve its growth on its own. I stress this because, without it, the institute cannot survive and prosper. The objective is not to make money but to maintain profitability so that the institute can offer a large amount of scientific benefit to its members and remain financially healthy. As shown in Fig. 3, it will be necessary for the institute to seriously study how to increase its revenue from the publication of transactions and the hosting of international conferences. Besides the operations related to transactions and international conferences, I have

another concern. IEEE, for example, drives several initiatives: "Women in Engineering (WIE)," which facilitates the participation of women engineers in its activities; "Life Member Affinity Groups (LMAG)," which involve elderly members; and an organization that supports young members. The decline in population in Japan will inevitably have a significant impact on IEICE. I hope that elderly members with a will to participate in the institute's activity will do so in every possible way.

4. What we can do to make IEICE thrive

An important endeavor that IEICE should engage in to become a globally noteworthy organization is, above all, to generate seeds for the development of new technologies. I would like to consider this issue based on my own experience. I have long been engaged in research on optical communication. Not long ago, someone said to me, "Are there still things left to do for optical communication?" Optical communication technology has made great progress. It is a far cry from how it was 30 years ago. Considering this, the questioner may have thought that there is nothing more to do. Optical fiber communication has a limit to the level of input optical power, a phenomenon known as "fiber fuse." If the input power is too high, the optical fiber will melt. For this reason, there is a limit to the number of wavelengths that can be used in wavelength division multiplexing (WDM) systems. However, communication traffic is growing at an annual rate of more than 40%. It has always been the case that after 20 years a communication system must be able to carry a volume of traffic 1,000 times larger than at the time in question. To face this challenge, IEICE members from industry, academia and government in Japan, including the former IEICE President Masanori Koshiba, got together and discussed how we could increase the capacity of optical communication in the coming years. The meetings took place in 2008. Fig. 5 shows a diagram of the future vision that we arrived at then. In the course of these discussions, three technologies characterized by "multi" were conceived: multi-level modulation, multi-core fiber and multi-mode control. Each "multi" technology increased communication capacity tenfold. Thus, together, they can support communication traffic 1,000 times greater than is possible without these technologies. We named them 3M technologies and announced them to the world[7]. The 3M technologies are shown in Fig. 6. They rapidly spread in the U.S. and Europe, where researchers studied these technologies intensively, as if to beat us at our own game. Today, the 3M technologies have become a prominent topic, attracting researchers to international conferences in the U.S. and Europe. Both IEEE and OSA are reaping significant benefits, both financially and in scientific advancements, from these originated-by-IEICE technologies.

Considering the importance of the 3M technologies, IEICE established Extremely Advanced Transmission (EXAT), as a Workshop Type 2, 10 years ago[8]. This has been holding an international conference in Japan every two years and is gaining worldwide recognition. Today, the 3M technologies are even attracting the attention of the Patent Office of Japan, which conducts a survey of how the 3M are used in industry, and kindly provide the institute with information about



(a) Multi-level transmission (b) Multi-core fiber (c) Multi-mode control

Fig.6 Description of the 3M technologies: multi-level transmission, such as QAM digital coherent communication; multi-core fiber, which offers space division multiplexing; and multi-mode control technology, which enables simultaneous transmission of multiple modes over a single core.

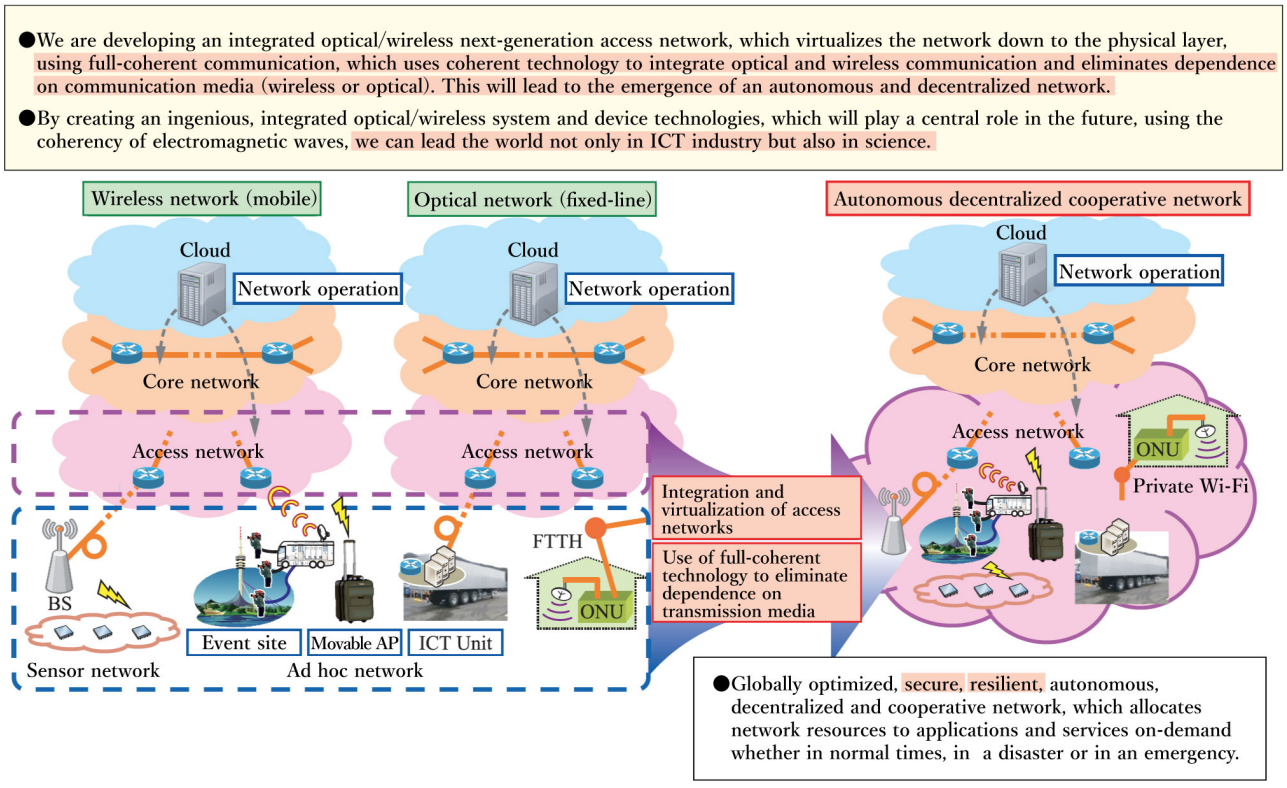


Fig. 7 An example of a new access network which integrates optical and wireless communication using coherent technology : Our aim is to build a high-speed, high-capacity, low-latency, and highly reliable access network.

the worldwide trend of these technologies[9]. New technologies can emerge in other fields. I hope that each Society will form voluntary groups that will discuss what technologies will be critical in the coming years and endeavor to spread such information. Such groups may think about, for example, what the next-generation ICT or post-ICT will be, or about the relationship between ICT and life science, brain science and social science.

Experience tells us that, once a new initiative is taken, it is bound to see further development. We are conducting R&D on applying multi-level modulation to 5G and Beyond 5G so that wireless communication can be seamlessly connected with optical communication[10]. How this idea works is shown in Fig. 7. Wireless communication and optical communication have been studied and developed completely separately. Digital coherent transmission has equalized the capacities of these communications, making it possible to develop an access network that connects the two types of communication seamlessly. This is expected to make a high-speed, high-capacity, low-delay and low-cost mobile fronthaul possible.

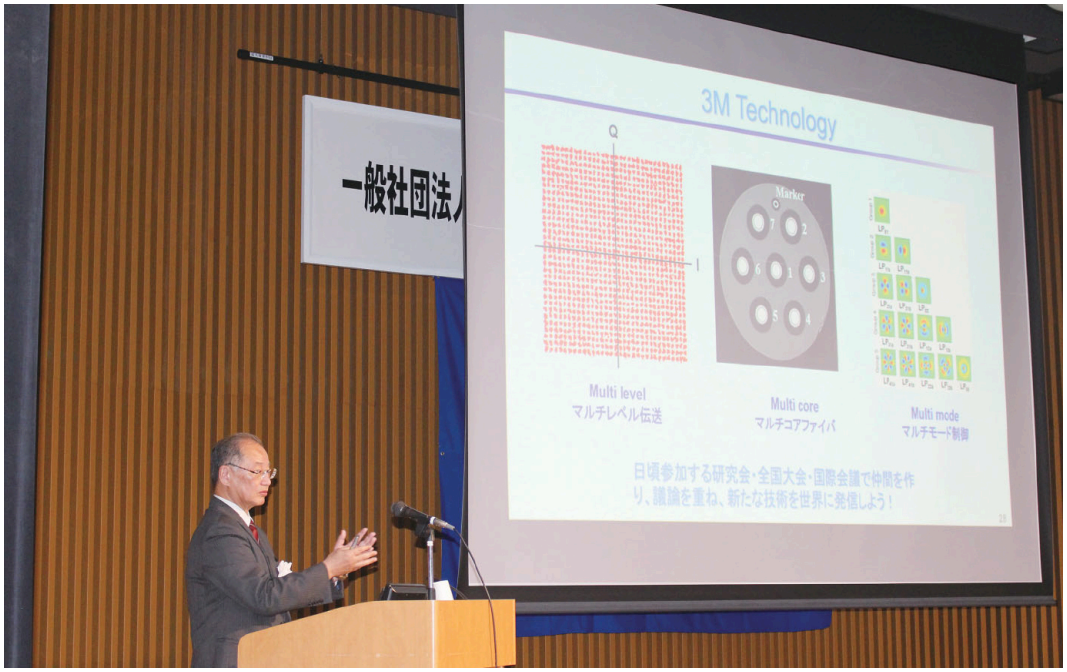
I stated earlier that Japanese enterprises, in particular those in the electrical and information fields, have been front runner innovators in the world. However, not many people know about this fact. It is now more crucial than ever for IEICE to transmit information to society. To do so, it is important to make its journals easier to read, and to include pages that are created in collaboration with related ministries, agencies and scientific institutes. It is also urgent to consider how, as a global scientific society, IEICE can provide benefits to overseas members.

5. Establishing strong collaboration with other institutes for electrical and information engineers

There are five institutes for electrical and information engineers in Japan: Institute of Electronics, Information and Communication Engineers, Institute of Electrical Engineers of Japan, Information Processing Society, Institute of Image Information and Television Engineers, and Illuminating Engineering Institute. They got together and created the Liaison Council of Institutes for Electrical, Information and Communication Engineers some 15 years ago[11]. The intent and purpose were to do the following under a single umbrella:

(1) Discuss matters for which the member institutes should cooperate, such as proposals to the government and the global transmission of information;
(2) Cooperate in and ensure mutual complementarity in workshops, seminars and conferences that each institute holds
(3) Improve the efficiency of the operation of institutes, including that of secretariats
(4) Discuss ways in which the institutes can cooperate with each other in the future

Additionally, the Council was to be a forum for the exchange of candid opinions about measures taken by individual institutes to deal with issues that commonly confronted them at the time and about how institutes should respond to changes in external social factors. Today, some 15 years from its inauguration, I believe that the Council should



not stop at information sharing and partial collaboration but further strengthen its commitment to collaboration.

Today, new industries are being created through the convergence of technologies in different disciplines. Such convergence, symbolically depicted by "○○×ICT," offers a golden opportunity for the development of the industries in which we are involved. To take advantage of this opportunity, we need to possess many technologies that can generate value through convergence. However, today all electrical and information institutes are confronted with a common problem: a decline in the number of their members, especially those working in enterprises. I propose that the member institutes should recognize the states of other institutes, and take strong and specific collaborative actions that have an impact on society. It is fascinating and challenging to work on cross-sectional, wide-ranging, or interdisciplinary themes, such as electric power×ICT, power electronics×ICT, and sensors×ICT. I believe that the sky is the limit to the application of ICT to electric cars and robotics. Such collaborations are favorable for industry and also for academia because they enable the latter to launch new research early.

Back in 2001, two years before the launch of the Liaison Council, IEICE and the Institute of Electrical Engineers of Japan (IEEJ) already had discussions on inter-institute collaboration (the Journal of the Institute of Electrical Engineers of Japan, vol. 121, no. 7, "Letter from the Institute" (2001)). A table used then in the discussion is shown in Fig. 8.

Times have changed dramatically since then. As we seek new collaboration, we want to develop a revised scenario appropriate for today and thereby to enhance the global presence of the institutes for electrical and information engineers in Japan. In talks about the management of enterprises, we often hear the word, "holding company." I believe that now is the time when we need an organization that may be called a "holding institute," which

bundles together institutes for electrical and information engineers.

I believe that the first step in this direction is for IEICE and IEEJ to collaborate closely. Such collaboration will enable the two institutes to bring out their full potential[12] and will lead to renewed

been conducting discussions since last autumn. I am requesting them to accelerate this discussion.

6. Conclusions

In an ICT society represented by Society 5.0, in which things are connected to each other via a sensor network, technical development is advancing at a speed more than double of what it has been. Accordingly, scientific institutes must change with the times. This is why it is difficult to operate any institute today. IEICE has a brilliant history and tradition dating back 100 years. "Tradition" means "continued evolution and development" rather than simple "inheritance." The concept of "immutability and fluidity" is still alive. Only those who change survive. New technologies arise from changes.

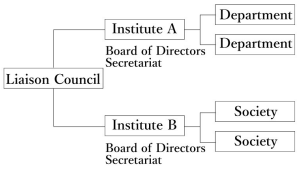
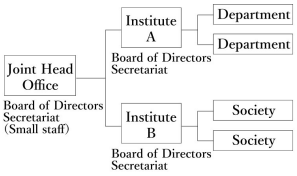
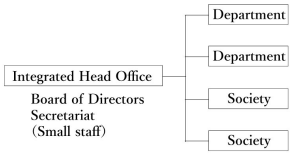
GAFA in the U.S. is a group of new IT service enterprises. They were born by shrewdly seizing signs of budding opportunities in ICT. Unfortunately, people in Japan have not been successful in capturing such new business opportunities. I believe that, as a way of making up for this failure, IEICE should make a further effort to contribute to the creation of social value. The Black Ships (the warships of Commodore Perry's expedition that came to Japan in 1853 to demand the opening of the country) of technology have come to Japan at different times with different appearances. Scientific institutes are effective development of both industry and the institutes. In the belief that it is particularly important today to explore a new way of managing the two institutes on the basis of their collaboration, the Strategic Planning Committee of IEICE and the officer in charge of general affairs and planning of IEEJ have organizations for confronting the challenges and discovering new value.

The way hardware and software have developed, as I understand it, is shown in Fig. 9. The relationship between project-based R&D and field-specific basic/core R&D is shown in Fig. 10. These days, software-oriented enterprises are exhibiting remarkable development. Consequently, an emphasis is placed on using ICT. However, it is equally important to consider how we can further improve ICT itself. In other words, it is important to undertake R&D in such a way that it balances advances in "By ICT" (using ICT) with those in "Of ICT" (ICT itself). This is the essence of Japan's aspiration to become a scientific and technological powerhouse. If project-based R&D should become dominant, there is a fear that R&D of basic/core technologies would be put on the back burner.

A look at the situation of IEICE indicates many negative factors: the weakening of financial strength, the need to improve public relations, and a decline in the membership and the number of transactions issued. I sincerely hope that IEICE members will make a greater commitment to participate in the institute's activities. President Kennedy said, "And so, my fellow Americans: ask not what your country can do for you - ask what you can do for your country." I would like to request you to ask not what IEICE can do for you, but ask what you can do for the institute, imagining that you are the president of the institute. Don't think that IEICE can do only so much just because

(Basic concept)

In response to changes in the industrial structure and R&D frameworks in Japan caused by globalization and to the policy of reforming research systems to turn Japan into a leader in the creation of science and technology, the Institute of Electrical Engineers of Japan seeks comprehensive collaborations with the Institute of Electronics, Information and Communication Engineers as a strategy to reinforce the institute, improve services to its members, revitalize the institute's activities, strengthen the financial base and to promote cooperation with other institutes both in Japan and abroad.

No.	Item	Alternative scenarios		
		1：Liaison council	2：Consortium	3：Integration
1	Organizational structure			
2	Basic items: (1) Basic concept (2) Organizational aspects (3) Operational aspects (4) Benefits to the institute/members	(1) The Liaison Council of Institutes for Electrical and Communication Engineers (2) The Liaison Council is established on top of the existing institutes. (3) Deals with negotiation with external organizations, and secures coordination with other institutes. (4) Members qualify as members of the other institutes and receive concomitant benefits.	(1) Bundles together different institutes (version of the Japan Federation of Engineering Societies dealing with the field of electrical technologies). (2) Resources are standardized and shared through joint operation. (3) Promotes jointly operated businesses. (4) Members qualify as members of the other institutes and receive concomitant benefits.	(1) Complete integration: encompasses each institute's activities, management and secretariat. (2) Existing departments and societies play the central role. (3)Autonomous management of departments is promoted. (4) Members can get information across different departments.
	Advantages and disadvantages	○ Reconciliation of opinions between the institutes is easy. ○ A single body handles all negotiations with external organizations. △ There is an additional overhead in operating the Liaison Council.	◎ Inter-institute barrier lowers, enabling many institutes to join the consortium. ○ A single body handles all negotiations with external organizations. △ Some secretariats become redundant.	○ The efficiency of handling international affairs and working with JABEE improves. ○ A single body handles all negotiations with external organizations.
3	Name (provisional)			e.g., Institute of Electrical and Electronics Engineers of Japan (IEEEJ)
4	Basic philosophy	Each institute has a clear philosophy, such as "science related to electricity" or "science related to electronic engineering and information communication."	Each institute has a clear philosophy, such as "science related to electricity" or "science related to electronic engineering and information communication."	It is possible to broaden the range of technology, such as "science related to electricity, electronics, information and communication."
5	Improvement in services to members vs. burden of membership fee	○Members can receive benefits of other institutes. △Members who belong to multiple institutes need to pay the membership fee of each institute. △There is limit to the scope of information that members can get about the field of the other institute.	○ Members can receive benefits of other institutes. ○ Members can get a wide range of information economically. Members can belong to multiple departments. ○ It is possible to give members who belong to multiple institutes a discount on membership fees.	◎ Members can get a wide range of information economically. Members can belong to multiple departments. ◎ It is possible to reduce the membership fees of those who belong to multiple institutes.
6	Vitalization of institute's activities	○ Joint workshops and conferences are possible.	○ Joint workshops and conferences are possible ○ Research activities in interdisciplinary or multidisciplinary fields are vitalized. ○ Publication of common journals and transactions allows information sharing and vitalization of activities. △ Each department's managerial ability affects activities.	◎ Research activities in the interdisciplinary or multidisciplinary fields are vitalized. ◎ Publication of common journals and transactions allows information sharing and vitalization of activities. ○Activities in cross-sectional technical fields (e.g., history of technology, ITS) is possible. ○ People in other countries in Asia can easily determine which institute to join. △ Each department's managerial capability affects activities.
7	Improvement in operational efficiency Expected economies of scale Possibility of consolidating secretariats Sharing of digitized knowledge	△ There is an extra cost in operating the Liaison Council. △ Operation will become difficult in 5 to 10 years due to decline in the young population.	○ Joint capital investment (e.g., digitization) is easy. ○ If the costs of departments' activities are separated from the costs of other activities, independent accounting can be strengthened. △ The cost of operating the Joint Head Office is significant. △ Operation will become difficult in 5 to 10 years due to decline in the young population.	◎ The cost of operating an Integrated Head Office may be lower than the cost before integration. ○ Joint capital investment (e.g., digitization) is easy. ○ If the costs of departments' activities are separated from the costs of other activities, independent accounting can be strengthened. ○ The Secretariat can be slimmed down. △ Unless the membership increases, the revenue from membership fees is reduced because members who used to belong to multiple institutes pay less.
8	Operation of Secretariat	△ There is a fear that each secretariat remains conservative.	○ The secretariats of the two institutes may cooperate. △ It is necessary to harmonize and consolidate the secretariat work of the two institutes.	○ It is essential to rearrange the assignment of tasks to staff and improve work efficiency. △ The volume of secretariat work of individual departments will tend to increase.

Note: ◎ means "much better than the current state." ○ means "better than the current state." △ means problematic.

Fig. 8 Comparison of different ideas on cooperation with the Institute of Electronics, Information and Communication Engineers (Source: "Letter from the Institute," Journal of the Institute of Electrical Engineers of Japan, vol. 121, no. 7, 2001)

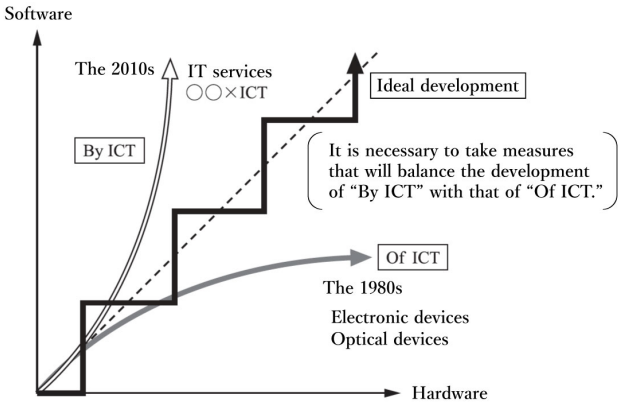


Fig.9 Advancement in hardware and software in different decades

From the 1980s to the 2000s, various devices were manufactured intensively to improve ICT itself, and the development of equipment, i.e., "Of ICT," advanced. In the 2010s, after the Lehman Shock, software has advanced due to the emergence of information service companies, such as those that eventually become known as GAFA. Advance is seen mainly in "By ICT," as symbolized by "○○×ICT" and Society 5.0.

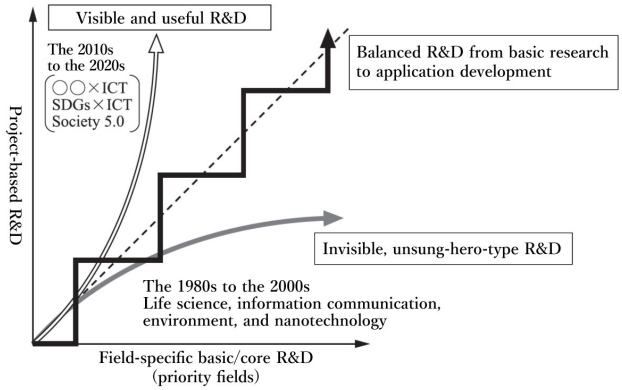


Fig.10 Relationship between project-based R&D and field-specific basic/core R&D

This figure is associated with Fig. 9. It is important to ensure balanced R&D from basic research to application development.

members participate on a volunteer basis. If members in both industry and academia make a firm commitment to pursue co-creation, the future of IEICE will be bright. Let us work together to make it a shining organization.

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