論説 Commentary

Science and Technology Research and Education in Japan—A View from U. S. A.

Iwao OJIMA
Distinguished Professor, State University of New York at Stony Brook

Promotion of modern "Wakon Yosai"—Japanese-English Bilingualism

Since I was asked to contribute a commentary to the "Chemistry & Chemical Industry" magazine, I have reviewed the Commentaries printed in the last couple of years to understand what kind of issues are recognized as important and what kind of solutions are proposed in the Chemical Society of Japan. Among a variety of issues and solutions proposed, the problems associated with Japan's "internationalization" (or "globalization" in recent years) caught my eyes. To my recollection, this slogan has been used for more than 20 years. Accordingly, I was a bit surprised to learn that this "common sense" in the current situation in the world has not been achieved in the higher education in Japan yet. Dr. Fukuzumi critically commented on the substantial and worrisome delay in the education of practical English as well as internationalization of the graduate schools in Japan in his article entitled "Overcoming an 'allergy' to internationalization" (March 2009 issue), which is consistent with my own understanding of the situation in Japan.

It has already been a long time after English (especially American English) became the common language of the world in science & technology, business, and diplomacy. It is also important to realize that the "terminologies" in science & technology became English as well. As "terminology" includes concept, logic, methodology, etc., obviously it would be the best and beneficial to use English textbooks, having discussion in English, and giving exams in English in the higher education of science & technology. Also, it is important to understand correctly that the language barrier is unexpectedly high and there are numerous words and terminologies, which cannot be translated. Therefore, the ability to think and understand in English, i.e., not through translation, is required.

I should point out, however, the critical importance of learning and mastering mother language, Japanese, by the end of college education. Japanese language involves very unique way of thinking and expressions, which is clearly different from highly logical English language. This uniqueness is the basis of Japanese culture without any doubt. If a Japanese researcher or engineer comes up with a world-leading novel and creative idea, it should be based on a unique Japanese way of thinking. Consequently, I believe that Japanese-English bilingual students, scientists and engineers should be cultivated in the science & technology education in Japan, based on the modern "Wakon Yosai" concept, i.e., learning Western culture, science and technology with Japanese spirit.

Gap between Excellent System Formation and Cultivation of Capable Workforce

It is indispensable to cultivate high quality and capable workforce in order to accomplish high quality research & development in science and technology. Even when a perfect system (infrastructure) is established, expected good results would not be achieved if the corresponding high level is not secured for essential scientists and engineers who are actually responsible to promote research & development. It is quite clear that the system formation (infrastructure organization) is outstanding in Japan as exemplified by two articles by Mr. Arimoto (January 2009 and May 2010 issues). Historically, it has been a stronghold of Japan to achieve exceedingly high efficiency without depending on geniuses (exceptionally talented intellects) through the formation of exceptionally well-organized systems, and the traditional Japanese national character is well suited to this approach. However, currently the responsibility of sustaining this approach is shifting to the next generation and the generation after in Japan since the generation that was highly loyal and dedicated to the system as well as the following "baby-boomer" generation completed their tasks and roles. Do those new generation Japanese people have proper unyielding spirit and capability to survive and win the ever-increasing international competition in the world, which is getting smaller and smaller due to the explosion of population? This is a good question.

Several commentary articles pointed out serious concerns about the current graduate school education in Japan. For example, current young generation students and Ph.D. holders are passively conservative and thus they tend to stay inside Japan, avoiding their study and experience abroad, which is challenging and a burden to them. As a consequence, the number of students and postdoctoral researchers who are studying in the U. S. and Europe has decreased substantially. This is indeed a serious concern. It would not be competitive at all if one does not make strategies without experiencing the competitor's way of thinking and methodology in international competitions.

Science & Technology Research and Education in the U. S. Graduate Schools

This worrisome situation in the graduate school education in Japan appears to make a contrast to the healthy graduate programs in the U. S. universities. I have been engaged in the research and education in a graduate school in the U. S. for more than a quarter century and think that the U. S. graduate school education system is still leading the world even at the times when the competition for getting research grants from the federal agencies becomes exceedingly competitive due to the recession of the U. S. economy. The U. S. society is based on extremely strong individualism. Thus, everyone studies, makes efforts and works hard for himself/herself, except for the military service in the U. S. The citizens and residents have a strong conviction that they would succeed in the society if they are capable and working hard. Since the principle of competition is firmly established,

students and researchers who cannot receive satisfactory grades or achieve sufficiently good results are eliminated from educational or research programs. Graduate students in the U. S. are naturally exposed to different human races, cultures, customs, etc. during their graduate studies, as many well-prepared and highly competitive graduate students from all over the world are admitted to their graduate programs. The tuition, stipend, health insurance, etc. of all graduate students, even those from foreign countries, are fully covered by the university or individual professors during their graduate studies until they obtain their Ph.D. degrees in science and technology. Of course, they do not need to pay back those financial supports at all. Accordingly, it is very natural that those foreign graduate students, who benefited from the generous U. S. graduate programs, become strong supporters of the U. S. when they go back to their home countries. To my view, these graduate programs have been very successful as a worldwide strategy of the U. S.

In the U. S. graduate schools and research institutions, it is easy for individual professors and principal investigators to launch interdisciplinary and multidisciplinary collaborative research projects and when the results look promising for commercialization, they can swiftly found startup companies to do research & development of their inventions by acquiring rather generous small business innovative research grants or small business technology transfer research grants from federal agencies. According to the Carnegie Foundation's classification, there are 88 "Research I Universities" in the U. S. and the research grants from NIH and NSF are fairly distributed to those universities in accordance with their accomplishments. Epoch-making discoveries and inventions have not been made only at the "famous" universities. The high level in a broad range, fluidity of researchers, and thickness of talented researchers constitute the backbone of the science & technology research in the U. S.

"Asia Shift" of the Science & Technology Research Activities and the U. S. Response

Recently, a good number of Chinese researchers, who studied at the graduate schools, further trained as postdoctoral researchers at research institutions, and had been actively promoting research in academia or industry in the U. S., went back to China and built up their own graduate schools and programs, adapting the U. S. system. Most of the research themes are also originated from the U. S. For industry, many CRO's (contract research organizations) have been founded and flourishing, but CRO's need to abandon their IP right to do the work. Moreover, they are thoroughly exploiting the connections built up while they were in the U. S. Accordingly it is not an exaggeration to say that the U. S. and China are in the profit-sharing relations with regard to the scientific research and technology development. Thus, it is true that the "Shift in the center of scientific research to Asia" phenomenon (Mr. Arimoto's article, May 2010 issue) is taking place, but the global corporations and graduate schools in the U. S. do not seem to be expressing concerns. On the contrary, the U. S. academia and industry appears to think that it is a good thing to happen for their former students or colleagues. The continuous supply of highly talented Chinese students to the graduate schools in the U. S. appears to be stable, and the notable activities and achievements of Chinese-American scientists and engineers in the academia and industry are remarkable. Also, the contributions and achievements of Indian graduate students and Indian-Americans in the field of computer science, engineering, medicine, and biology are notable as well. By the way, the investment on the medical and therapeutic research in the U. S. is enormous so that the amount of investment, high level of quality, and thickness of talented researchers in this area is surpassing other countries. Apart from very strong pharmaceutical industries, the research endeavors in this field have been producing epoch-making devices and diagnostic instruments, which are creating new businesses. Of course, Japanese companies are participating in the promotion and development of this field as well. Research and business related to health and medicine will surely expand as the life-span and old population increase. Thus, the biomedical research is regarded as a very important worldwide strategy in the U. S. together with military and energy. Consequently, it looks pretty solid that the prevailing status of the U. S. in the science & technology research will be maintained, albeit the U. S. will face challenges from other countries.

Conclusion

Japanese academia has succeeded in "internationalization" for its academic achievements in research, as exemplified by the construction of a number of "Global Centers of Excellence (COE's)". However, there is some concern if COE's have accomplished the formation of truly interdisciplinary or multidisciplinary collaborative research teams. Undoubtedly Japan holds a huge economic power in the world, possessing 130 million in population. Nevertheless, it would be unreasonable and difficult to keep unilateral approach or strategy in competing globally, as pointed out in a couple of the Commentary articles. Consequently, it is concluded that Japan should explore coalition (consortium) and collaborative research & development of projects with clearly defined role-sharing agreements with other countries and cultivate talented and capable workforce which can promote such collaborative projects as soon as possible. In dealing with such endeavors, Japan should have a perspective wide view and flexibility, and also move proactively by leveraging the world-leading science & technology, which has already been established in selected areas.

The commentary shown here is written by a commentator invited by the Commentary Committee of the Society, and the author is basically responsible for the contents. The Society acknowledges that this is important and worth publishing. Opinions and comments of the readers are highly appreciated.
E-mail: ronsetsu@chemistry.or.jp

The author is responsible for the English-translated article.