

EAJ Urgent Proposal 2019 “To Stop the Fall of Japan’s Level of Engineering and Technological Sciences”

Japan is a science and technology-oriented country, however, it shows a serious decline in the recent international comparative survey. A significant fall in every index such as the number, quality and productivity of academic papers published, and world university rankings is a matter of deep concern about Japan’s deteriorated research activities. While many other countries have increased science and technology budgets in this century, Japan remains at the same level. On top of it, many problems have emerged in the research performance in our country. This might end up weakening Japan’s presence in the world.

A serious reflection is being made that our science and technology policies and university reforms have been so inward-looking to get out of step with other developed countries. Proactively focusing on this critical issue, the Engineering Academy of Japan (EAJ) made an urgent proposal in May 2017. The proposal highlighted the issues as follows: enhancement of public funding for universities and public research institutes in terms of both quality and quantity, development of an optimum funding system that universities and industry should co-create and co-operate with each other, reform of a graduate school system to foster young human resources, mobility increase of research personnel, and improvement of an open vocational training system. Some progress has been observed so far including revision of the Research and Development Enhancement Act. Taking an opportunity for the government to draw up the Sixth Basic Plan for Science and Technology for the next five years from 2021, the EAJ would like to issue this proposal so as to follow up the proposal 2017.

Japan has already undertaken important reforms such as the establishment of the Basic Law of Science and Technology, formulation of the Basic Plan for Science and Technology and reorganization of universities as independent administrative institutes, which were all internationally regarded as forward-looking efforts.

However, in the course of dramatic changes in the world politics and economics illustrated by the rapid progress of the digital revolution and the rise of China in research activities, Japan has been suffering from social environmental changes like the rapid aging of the population amid extremely low birthrate and the fragile national finance. In such a situation, the international competitiveness of Japan in science and technology has been declining and the trend is not likely to stop without radical measures right now. With a view to activating Japan’s science, technology and innovation activities and achieving the upturn of the prolonged declining trend, the EAJ would like to make the following proposal.

- [1] Strengthening of university research
- 1-1 Significance of excellent universities

It is a matter of immediate importance to strengthen our university system, especially in the research functions. In this century, the leading countries of the world came to share the idea that having an excellent university system should be regarded as the fundamental strength of the country. It is because the excellent university system will help develop outstanding human resources, attract great brains from around the world and support domestic industry from a variety of aspects. As a natural consequence, each country has developed policies to strengthen the functions of universities including the enhancement of public funding for universities, which significantly increased research funds of universities.

In Japan as well, it is incredibly important to gain common understanding and support of the public about the merit of enhancing the functions of universities and to win a broad awareness that “having a group of excellent universities is of great value for society.”

1-2 Significance of diversity-oriented universities

One of the features of the university system in Japan is to focus funds and human resources more intensively on the top-ranking universities who are ranked among the top ten in the number of academic papers published for example. Excessive priority allotment might unintentionally lead to no competition and damage the integrity of the entire university system. While encouraging appropriate level of competition among the top-ranking universities, avoiding a focus narrowing down to the top-ranking universities and bringing up tens of medium-scale leading universities with competitive research activities, are essential. To this end, continued efforts should be made toward the improved funding system that would promote increased small-scale funding opportunities as well as continued and focused funding for the most successful and promising researches.

1-3 Stable and lasting university-related policies

University research should not pursue immediate fruits but focus on enhancement of basic research and creation of seeds of innovation. To this end, providing more stable and ample public funding is inevitable to encourage universities to tackle reforms and improvements in a longer-term perspective. On top of it, a better environment to concentrate on research and education should be facilitated easing the administrative burden on universities and professors from frequent policy changes.

Based on the above understanding, in order to promote more active university research, it is necessary to review public research funds exploring the optimum balance between allocated basic expenses and competitive research funds from the government as well as the most appropriate design of competitive research funds. In this regard, allowing sufficient time for professors to spend on research and education through reducing miscellaneous preparatory work for external evaluation of university activities is important. In parallel, organic linkages between universities should be more intensified and developed.

[2] Deepening of industry-university collaboration

2-1 Intensified industry-university collaboration

The missions of a university are, through on-target education, to produce human resources who can play a leading role in society and the world of academia in the next generations and to create seeds

of innovation in the academic research. Universities are responsible for developing the knowledge base, and industry is responsible for creating socio-economic values. Both should co-create and co-operate with each other fulfilling their respective roles. The demarcation between basic research undertaken by universities and development research undertaken by industry should be more clearly aware of. When universities would work on development research, it should be conducted in cooperation with industry. The industry-university cooperation in Japan has been shifting from the one-to-one cooperation between a researcher and a company to the more comprehensive cooperation like one-to-many or many-to-one, toward which industry and universities have been vigorously making efforts. As a result, research funds provided by industry for universities have been increasing.

What is important is, on the basic premise that universities should endeavor to acquire new knowledge and develop the knowledge base and industry should make the most of it to create socio-economic values, creating a research and development system where both industry and universities would co-create and co-operate with each other toward development and growth for mutual benefit.

2-2 Autonomy of universities and diversified research funds

Universities should strive for autonomy as the originally required form of management. The top executives of universities must reconfirm their responsibility of developing and implementing the university visions and strategies. They should also work harder to boost incomes for the universities. The government, on the other hand, must accelerate institutional reforms to expand funding opportunities from private sources to universities and make them available more flexibly. With the all-out cooperation and support of industry, an optimum funding system should be explored and developed among industry-university joint research funds from private sources, allocated basic expenses and competitive research funds from the government.

3-2 Mobility increase of human resources

Promoting of the mobility of research personnel facilitates the most appropriate personnel arrangement and flexible response to the changes and development of research content. One of the keys to increase the mobility of young human resources lies in the process of choosing graduate schools to go on. Research universities in the US would normally never accept the graduates of their own universities. It would be useful for Japan to take account of giving incentives, favorable treatment in scholarship for example, to undergraduates who are going on to the graduate schools of other universities. Also, in this context, the development of a group of leading universities that are following up the top-ranking universities is very important.

In addition, increasing the international mobility of human resources including those going out of Japan and those coming to Japan, is essential. It has been said in recent years that the Japanese young researchers are rather reluctant to work abroad. In most cases, one of the major reasons is a disadvantage in job hunting after coming back to Japan. In order to stop this trend, a point rating system of overseas working experience in an explicit manner should be introduced in open recruitment of research personnel at the Japanese universities and research institutes. In the wake of these efforts toward internationalization, universities should increase the ratio of professors who have a plenty of personal connections worldwide. Radical increase in the number of foreign professors is also requisite.

Without the mobility increase in society as a whole, radical increase of the mobility of research personnel would not be achieved. Japan should endeavor to create the situation in which switching careers would not bring disadvantages in career development in any occupation learning from the examples of best practice in other developed countries. Such efforts include replacing of the retirement allowance system with the annual salary system, offering of a portable pension scheme that would not work against cross-border career changes, creating of a system to promote continual career development for spouses even after the career changes of the persons themselves. and enhancing of open career education throughout the country. While universities have already started joining the efforts, accelerated efforts in Japan as a whole are required.

3-3 Support for diverse networks among researchers

In line with the development of interdisciplinary researches, providing opportunities to establish a diversity of networks is ever more important in fostering brilliant young researchers.

Foresighted and successful attempts have already been made in bringing together from different areas the brightest early-career researchers representing their areas to discuss predetermined topics at the interdisciplinary conference. One such example is the Japan-America Frontiers of Engineering (JAFOE) symposium that the EAJ has been working on jointly with the National Academy of Engineering in the US (NAE) with financial support from the Japan Science and Technology Agency (JST). Similar efforts should be promoted more widely in Japan. In parallel, for the government-sponsored project researches, it is considered effective to increase opportunities for researchers with different educational background and fields of expertise to cooperate with each other.

[4] Venturing into new disciplines

4-1 Prevention of conservative tilt in the Japanese research

New knowledge that brings about changes in society is often generated in new research fields and areas. In this sense, more of the Japanese researchers are encouraged to challenge new research areas and subjects. Universities, in particular, are expected to play the primary role in basic research that would generate new disciplines and contribute to society. However, the analysis in the recent years shows that the Japanese researches in general are increasingly conservative and that evolved-type researches based on the accumulated results in the long-lasting traditional areas are increasing. Increased percentage of competitive funds in the total research funds acquired by a university researcher may be responsible for the trend. As past results and performance are more valued in the screening process of competitive funds, applicants would naturally choose research subjects with proven performance in Japan. Recently in grants-in-aid for scientific research, a list of research performance like published papers has been eliminated from the requirements for application. Reforms as above should be accelerated. For those researchers who are venturing into new disciplines, small but accessible research funds, so-called newcomer funds, should be explored regardless of age.

Further, challenging proposals by promising young researchers should be positively adopted even if they still need polishing. It is also important to value overseas working experience of applicants for competitive funds. Without efforts to boost the number of researchers who are venturing into new

disciplines, Japanese research activities will be getting out of step with the global trend and resulting in a Galapagos syndrome.

4-2 Foresighted evaluation

Foresighted evaluation of researchers is as important as supporting of new challenges by researchers. In evaluating researchers, uniqueness and potential of researches must be valued. For young researchers in particular, the first task is to discover high-impact themes from around the unexplored virgin areas, tackle them and achieve outcomes. At the same time, accurate assessment of the direction of the research projects sponsored by the government and others is extremely important. In this regard, evaluators who have foresight beyond common knowledge as well as good judgement of the future of science and technology from a world-level perspective are needed. To this end, inviting outstanding experts widely from the world and giving important positions to those who created new disciplines in reality and/or successfully made innovations are essential.

4-3 Strengthening of research in informatics

Mathematical science, such as mathematics and statistics, and informatics are considered to be increasingly important in the future development of research activities. They have been strategically promoted as priority fields and boast of high-quality researches, however in quantity-wise, Japan continuedly looks poor against Europe and the US. Lack of researchers, particularly that of highly qualified researchers is a weakness of Japan in the highly information-oriented fields of life science, material science and engineering. It is necessary to promote, from a long-term perspective, development of high-level researchers in mathematics and science who are needed in society, industry and a variety of research fields.

[5] Conducting of a comprehensive review of key policies and reforms

As mentioned in the beginning, Japan in this century has been working on the reforms of science and technology systems from a variety of dimensions. Nevertheless, Japan's science and technology level in general has been falling down in the world. While individual policy reviews have been made before, a comprehensive review at this stage after twenty years since the implementation is required. More specifically, key reforms and policies before should be viewed as a group, and how they worked as a group or did not work as expected should be reviewed in a more objective way by international experts.

Quantitative data should be valued in the review, but sticking too much on quantitative data is likely to mislead to the analysis focusing only on the part where the data is available. To this end, one option would be to designate a certain number of outstanding experts here and abroad as reviewers and collect comprehensive and qualitative data through collective views of them all. This enables an objective verification from a variety of perspectives such as pluses and minuses resulting from interactions among multiple policies, changes in global research activities, with or without progress in internationalization, and environmental influence including research funds and financial condition. Based on this verification, close discussion on the framework of future policy development is needed.

In universities, the duty as the president is improving of the research and educational environment, which should be implemented referring to world-class models on the basis of comparative survey of the developed countries. To this end, at least in the top-ranking universities and hopefully also in the leading universities, a standing committee accommodating university presidents and professors from developed countries should be established to seek advice and reviews.

When considering the expansion of research funding, the international comparison about the productivity of academic papers might be required. In this regard, it must be noted that the Japanese criteria of the university-related statistics such as research funds and research personnel is different from that of other developed countries. For example, all faculty members at universities are counted as researchers in Japan, however in Europe and the US, FTE (full-time equivalent) based figures are used. This naturally has an affect on the figures of research funds, and therefore, the Japanese figures of invested resources appear larger. Statistics should be compiled in the internationally comparable and comprehensive format.

In conclusion, university-related challenges must be implemented at the university's own responsibility in the first place. To this end, it is necessary to win much more understanding and support of society and the public. What the government should achieve as a key player must be carefully selected. In case it is hard to push forward in a single uniform way throughout Japan, while in respect of the visions of the specific districts, starting from wherever possible as soon as possible is critical.

The EAJ is a public interest incorporated association comprised of individual members from industry, academia and the government and supporting corporate members. Raising to the government big challenges listed above once again, the EAJ would like to insist on having the opportunity for the interested parties from industry, academia and the government to share the challenges, urgently propose solutions and take specific measures as an overarching approach. The EAJ hopes that this proposal could provide a breakthrough for Japan under a trial.

The EAJ will continue discussions on the innovative research and development system unique to Japan and make proposals in a timely manner. Any comments from interested parties will be most welcome.