

JABEE's Role and Future Challenges

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ABSTRACT: The engineering education accreditation done in Japan by JABEE (Japanese Accreditation Board for Engineering Education) is described. A historical overview, brief summary of accreditation activities, international relationship especially with Washington Accord and future challenges of JABEE are presented.

KEYWORDS: Engineering education, Accreditation, JABEE, Washington accord

1. JABEE Historical Overview

A decade has passed since the Steering Committee for Globally Recognized Engineering Education began its activities in 1997. At that time globalization was rapidly progressing as the World Trade Organization (WTO) had just changed its focus from the liberalization of trade in goods to the promotion of human-resources mobility across borders. Professionals such as accountants and engineers were selected as the first targets of this effort. The first step in promoting the cross-border mobility of engineers was the introduction of common frameworks for engineering qualifications and for quality assurance of engineering education, under the leadership of APEC in the Asia-Pacific region and of the Engineers Mobility Forum (EMF) in the global arena.

To facilitate the mutual recognition of engineering qualifications across borders, it was essential to put in place quality assurance of engineering education that fully met global standards. The Steering Committee referred to above was organized to respond to these requirements. In close cooperation with academia, industry and government, studies were carried out to establish a system that assures the quality of engineering education at the university level. The accreditation organization for this purpose was finally founded in November 1999. Dr. Yoshikawa (the former president of University of Tokyo) was appointed as the inaugural president of the Japan Accreditation Board for Engineering Education, JABEE.

JABEE has been conducting accreditation of engineering programs at bachelor level offered by individual departments or courses of universities. Between 2001 and 2006, JABEE accredited 346 programs at over 140 educational institutions and disseminated its results to the world via the Internet. In June 2005 JABEE was admitted as a signatory of the Washington Accord, which is a global framework for assuring substantial equivalence of engineering education. Thus JABEE was able to obtain the global recognition that we had worked so hard to achieve.

2. Engineers, Technologists and Technicians

When we Japanese discuss engineering issues at international meetings, we are often confused by terminology that is different from our common usage. When we refer to engineers in Japan, we imagine people with various roles in engineering practice ranging from skilled operators in factories to designers and researchers in offices and laboratories. Consequently, the typical image of an engineer differs quite widely from person to person; this was also the case in Europe and America in the past. However, the following definition of engineering practitioners has now been established and is widely used. Those who are engaged in engineering practice are divided into three categories according to the required education and core competence, that is, engineer, technologist and technician. Engineers are characterized by their ability to apply scientific knowledge and create new concepts, technicians by their physical skills obtained by training and experience, and

technologists by characteristics lying between these two.

The education period required for each category varies according to core competence. More than four years of post-secondary professional education is required for engineers, more than three years for technologists, and more than two years for technicians. In short, you may think of engineers as university graduates in the engineering field, technologists as graduates of technical colleges, and technicians as graduates of training schools. Within each category, there exist licensed or registered qualifications authorized by the laws or regulations of individual jurisdictions. They are called Professional Engineer (PE), Engineering Technologist, and Engineering Technician, respectively. These standard professional designations may vary in individual nations or districts according to the relevant laws and regulations. In Japan the government-licensed qualification for engineers is called *gijutsushi* or P.E.Jp, which is equivalent to a PE. However, we have no specific qualification that is equivalent to Engineering Technologist or Engineering Technician.

In Japan, engineering education used to be understood as including every aspect of education needed to develop technology-related personnel from engineers to technicians. The education that JABEE accredits pertains only to education aimed at engineer development, therefore we need to stress that our "engineers education" is different from conventional engineering education. This distinction of concept was fully discussed when JABEE was launched, and we have been trying to make clear that JABEE is targeting exclusively "engineers education" within engineering education in general. Engineering education hereafter refers only to engineers education.

3. JABEE's Mission

As I mentioned, it is true that JABEE was launched as a means of adapting to the global environment, but the primary mission of JABEE is to improve the quality of engineering education in Japan and to lay a sound foundation on which our students can develop into strong and competent engineers. This is directly tied to the task of strengthening

Japanese industrial competitiveness in the various engineering fields and ultimately accords with Japanese government policy envisioning Japan as a scientifically and technologically advanced nation. According to this definition, engineers shall be provided with sufficient scientific knowledge and application ability and are expected to configure new concepts and seek new knowledge necessary for the next breakthrough. It is a natural consequence that some engineers are engaged in research on engineering problems, and may be called researchers. In Japan we often hear the opinion that engineers and researchers are different in nature, but this is contradictory to international understanding. The fact that Dr. Koichi Tanaka, who was engaged in the development of a mass spectrometry analyzer at Shimadzu Corporation, was awarded the Nobel Prize raised Japanese engineer's aspirations immeasurably.

If the quality of engineering education in Japan reaches a high standard, it is natural that it will be acknowledged worldwide. JABEE regards its membership in the Washington Accord not as a goal but as a consequence of our endeavors.

We do not deny that accreditation restricts the freedom of education to some extent because the stated criteria must be satisfied, even though the criteria are designed to be as simple and fundamental as possible. We should also take note that just before the new millennium accreditation criteria were substantially revised worldwide from input-based to outcomes-based standards, dramatically reducing the level of control in education.

Naturally recently founded JABEE has introduced outcomes-based criteria as well. Each program must clearly set out its specific educational objectives and verify by self-evaluation that the objectives are realized and that improvements are continuously made. This is precisely the essence of quality assurance. JABEE's responsibility is only to prove that the quality assurance systems of individual programs are properly functioning. The objectives of each educational program also refer to the level to be achieved. JABEE requires that the level must surpass the minimum that can be judged as acceptable for a bachelor degree in member jurisdictions of

the Washington Accord. This sometimes causes the misunderstanding that accreditation guarantees merely a minimum standard and so it is not worthwhile for an esteemed program. In fact, JABEE requires applicants to demonstrate and guarantee that they have exceeded the minimum level. With this in mind, we recommend that target levels are gradually raised, so that the program develops into a strong and competitive one in the future. Accreditation has its virtues as it can be used as a powerful tool for constant improvement. Educational institutions such as universities may be called educational providers that offer opportunities to meet the needs of students. If an educational institution is a provider, it is necessary not only to leave the service quality to the reputation prevailing in the society but also to endorse it by a fair and globally acceptable evaluation. Of course, the institutional evaluation process, which is already mandated in Japan, plays its role, but JABEE's program accreditation has a completely different role and scope because it is the only procedure available to evaluate the education process of individual departments or courses.

4. Accreditation as a Gateway for Professional Engineers

Professional Engineer, PE, is a standard designation for licensed or registered engineers, but its legal status is usually effective only within one jurisdiction. There are also PEs that are effective across national borders, such as APEC Engineer in the Asia-Pacific region, Euro Ing in the European region, and ultimately International PE (IntPE) that EMF is promoting worldwide. Any effort to introduce a common qualification within participating countries must be premised on the substantial equivalence of the quality of education in member countries. The Washington Accord is just such a framework for recognizing this equivalence, and the programs accredited by one of signatories are therefore equivalent in quality to those accredited by other signatories. The programs accredited by JABEE satisfy the requirements for engineering education not only in Japan but worldwide.

This perception that a professional qualification must be built on a sound engineering education at the bachelor level

was first realized in Japan in the year 2000, when the Professional Engineers Act was revised. Before the revision anyone could register as a P.E.Jp without specific educational requirements if they passed the PE examination after a minimum seven years of engineering practice. Since the previous system lacked any educational requirements at all, P.E.Jp had an inherent weakness in terms of claiming equivalence of qualifications across national borders. As a result of the revision a primary examination was newly introduced to certify that applicants possess academic ability equivalent to that of a four-year university graduate. This means that the requirement for an academic record has been replaced by an examination of individuals. Those who graduate from JABEE-accredited programs are granted an exemption by the government from the primary examination of P.E.Jp. The reason for this privilege is simply that nobody can finish an accredited program if he or she cannot achieve the level set by the program. Both those who have educational responsibility for an accredited program and those who grant the accreditation must be vigilant so that this system of guarantees does not break down.

Students who have finished a program accredited by JABEE may register as an Associate Professional Engineer (As.P.E.Jp) with the endorsement of a supervising PE immediately after graduation. If they pass the final examination after a minimum of four years' practice (reduced to 2 years for master's degree holders), they can be licensed as a Professional Engineer even under the age of 30.

This privilege is a great gift from university faculties to graduating engineering students, who stand at the starting point of lifelong career development. This was realized by the revision of the PE Act in the year 2000. This whole movement is based on our strong determination that engineers should bear increasing responsibility for the benefit of a society filled with man-made products and, at the same time, that professional engineers should grow to be a large group that is visible in society as the core of millions of engineering practitioners.

5. JABEE in the World

The Washington Accord, a framework for the mutual recognition of substantial equivalence

of accreditation systems, holds biennial meetings where the signatories reevaluate each other periodically and decide on the admission of new members. The members are engineering accreditation organizations representing specific jurisdictions and conduct due accreditation processes for educational institutions within that territory, such as ABET of the United States and JABEE of Japan.

JABEE was admitted as a provisional member at the 2001 Meeting in South Africa and obtained signatory status at the 2005 Meeting in Hong Kong. JABEE participated in the 8th Meeting held in June 2007 in Washington, DC, for the first time as a signatory and joined the discussion on new members. The current membership of the accord is illustrated on the world map shown below

There are now 12 signatories, indicated in red on the map. Following the initial six jurisdictions (USA, Canada, Australia, New Zealand, Great Britain and Ireland), which inaugurated the accord in 1989 in Washington D.C., Hong Kong became a signatory in 1995, South Africa in 1999, Japan in 2005 and Singapore in 2006. Korea and Chinese Taipei were the latest signatories admitted at the 2007 Meeting. As you can see on the map, the center of membership has been shifting toward the Asia-Pacific region while the dominant presence of Anglo-Saxon nations in the early stages has been gradually diminishing. It is particularly impressive that fast-developing Asian economies are keen to join the

Washington Accord and to prove that their engineering education has reached a global standard.

In establishing a new accreditation system, JABEE received valuable advice and guidance through Memorandums of Understanding (MOUs) signed with accreditation organizations in the USA and Australia. When JABEE applied for provisional membership in 2001, the accreditation organizations of Canada and New Zealand supported us by sending recommendation letters to the secretariat. JABEE, as the first member from the non-English-speaking world, is in a position to help surrounding countries establish their accreditation systems. JABEE supported the entry of two signatories in 2007 by signing MOUs with the accreditation organizations of Korea and Chinese Taipei. JABEE is also cooperating with Japan's giant neighbor, China, by signing a MOU with CAST (Chinese Science Technology Association). JABEE was instrumental in the admission of Russia as a provisional member in 2007 by sending a recommendation letter.

JABEE's primary mission is, as mentioned above, to strengthen Japanese engineering education, but we consider it equally important that we make international contributions in proportion to Japan's industrial power. JABEE, which is a private organization, has a ceiling on its engagements due to its financial circumstances. Nevertheless, JABEE is keen to promote international cooperation with financial support from affiliated members and

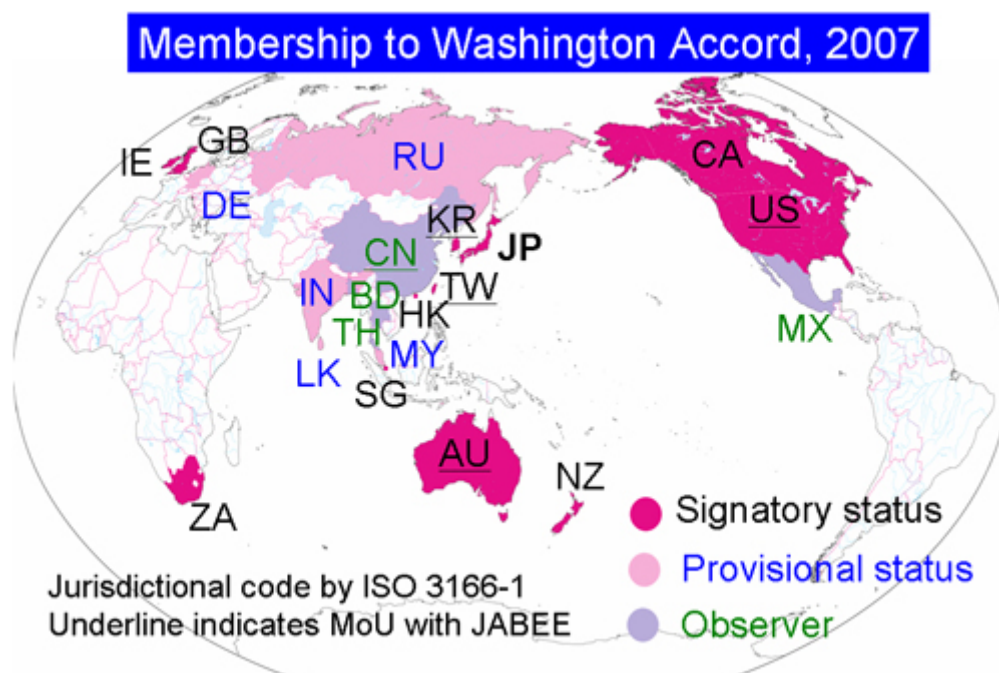


Figure 1. Washington Accord Membership as of June 2007 (Country or district code by ISO 3166-1. The underline represents MOU signing partners.)

others. We wonder what would have happened to the international status of Japanese engineering education if JABEE's launch had been delayed for five years. We sincerely appreciate the significance of both the timing and the speed of responding to the changing situation. The participation of European countries in the Washington Accord is still lagging. This could be attributed to the fact that major European countries are now fully engaged in the reform of their higher education systems in compliance with the Bologna Declaration. The target is to introduce a common education system within the European region so that students and faculties may move across national borders as they wish. The new European system consists of three study stages, that is, a three-year bachelor program, a two-year master's program and a three-year doctoral program. Due to this reform it became necessary for European countries to prove that the outcomes of their three-year programs are substantially equivalent to those of four-year programs now common among signatories of the Washington Accord. We have to find a path to overcome this systemic inconsistency.

The Washington Accord is a framework for mutual recognition of engineering education. Such a framework is also necessary for the education of engineering technologists and technicians. We have the Sydney Accord for the former and the Dublin Accord for the latter. Currently, Japan is not a member of either accord.

6. Future challenges

JABEE's accreditation is effective for five years. To renew the accreditation of a program, it is necessary to demonstrate that the program has evolved by PDCA cycles of quality assurance. The same evolution is required of JABEE itself. JABEE should evaluate its own performance periodically and take action to improve its accreditation operations.

JABEE's Rule on Organization and Operation states "JABEE shall inspect and evaluate undertakings defined in the articles of association, publicize its findings, and obtain third party verification." In line with this rule, JABEE decided to implement a self-evaluation at the Board Meeting in June 2005 and initiated a project team led by the president. The evaluation report was finally submitted to

the Board Meeting in June 2007. It was decided that an action plan for improvement should be quickly formulated and that the report should be audited by a third party independent of JABEE. Currently the details of this work are underway. Following are the summary of our future challenges, which are listed in what I consider the order of priority.

6.1. Wider Publicity of JABEE's Mission in Society and Industry

It should be admitted that awareness and recognition of JABEE's activities among people in industry is still insufficient. Those who are aware of JABEE's role and activities are restricted to major corporations that are often members of Keidanren, Japan's leading domestic business association. To become a household name in Japanese industry and even society as a whole, including among young people, would require us to place more emphasis on media communication than ever before and devote more effort to public relations. To be well known and appreciated is a wish we share in common with all JABEE stakeholders, students, faculties, engineering societies, industries and related government bodies, and this target will give us everlasting energy and inspiration for our future endeavors.

6.2. Increasing Maturity of Accreditation System

JABEE and its staff have been very busy launching the new accreditation system and spreading it throughout Japan as swiftly as possible. Since its foundation JABEE has been training new reviewers every year to cope with the growing number of applications, and also modifying its criteria and procedures through lessons obtained by experience. This take-off stage is surely over and we have to proceed to the next stage. From now on it is necessary to give greater attention to reducing the workload of educational staff who are too busy preparing for both mandated institutional evaluations by a government-approved agency and optional program accreditation by JABEE. As mentioned above, it is an important step for maturation of the system to create an external environment where the merits of accreditation can be fully appreciated by both students and teaching staff.

6.3. Extension of JABEE Accreditation to Master's Programs

Following rapid increases in the number of students advancing to master's programs in engineering disciplines, it has become a common understanding that graduates of master's programs have not simply finished an interim stage before pursuing a doctorate but have completed an advanced stage of engineering education. Industry is also moving in this direction when recruiting engineering personnel. As mentioned before, the standard and minimum education required for engineers was thought worldwide to be a four-year bachelor's degree, but following the advancement of science and technology, this standard is now changing. The opinion that the first professional degree of engineers is or should be a master's is becoming more prevalent. This approach has been partially realized already in European countries, and the US Academy of Engineering proposed in its report that the change should be implemented by 2020. I think Japan has no other choice but to follow this path. JABEE starts accreditation of master's programs in 2007. This is obviously to respond to the requests of industries that quality assurance is necessary for master's programs, and also to provide faculties with the means to strengthen their master's education and characterize the features and advantages of each program.

6.4. Promotion of International Cooperation

As a member of the Washington Accord our international commitment is increasing in such areas as support for and cooperation with other Asian countries and participation in accreditation reviews of foreign countries. In order to express candid opinions and take action assertively, we need to overcome a great barrier, that is, the language handicap.

In the context of international cooperation, JABEE has taken lead to organize NABEEA (the Network of Accreditation Bodies for Engineering Education in Asia) in 2007. NABEEA is a multi-lateral arrangement between groups of jurisdictional agencies in Asia responsible for accreditation of qualifications in their national jurisdiction boundaries who have chosen to engage in mutual capacity building to achieve harmonization of the accreditation systems at the fundamental level. Membership is

voluntary, but the members are committed to development and recognition of good practice in engineering education for the region.

The full member of NABEEA as of July 2008 are Accreditation Board for Engineering Education of Korea (ABEEK), Board of Accreditation for Engineering and Technical Education, Bangladesh (BAETE), Council of Engineers Thailand, Engineering Accreditation Council (EAC) Malaysia, Institute of Engineering Education Taiwan (IEET), The Institution of Engineers, Singapore (IES), Philippine Technological Council (PTC) and JABEE.

For further information on NABEEA, see <http://www.jabee.org/english/OpenHomePage/NABEEA.htm>

6.5. Registration of JABEE as a Public Organization

Since its foundation JABEE's has had the legal status of a private organization. JABEE is scheduled to be registered as a non-profit public organization by 2009 in compliance with the revision of the Public Organization Act in 2006. By filing an application immediately after the new procedure is implemented, we first intend to obtain legal status as a Public Organization and then a preferential tax status by showing that our mission is solely for public benefit.

7. Conclusion

JABEE has definitely finished its take-off period and is now moving towards cruising altitude, at which more emphasis must be placed on reliability and efficiency. JABEE keeps striving to establish its program accreditation system as the most effective tool to enhance student's willingness to study and also to encourage faculties' confidence in their education. We have a long way to go, but the light at the end of the tunnel is visible.

Acknowledgements

Most of the contents of this paper is borrowed from reference [1] and is the official statement of JABEE by the president, Prof. H. Ohashi. We appreciate for permission of Prof. Ohashi and JABEE to use this contents for the presentation at CAFEO 26.

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