

## ROLE OF ENGINEERING SOCIETIES IN ENHANCING PROFESSIONAL DEVELOPMENT

– ACCREDITATION, PROFESSIONAL QUALIFICATION AND CPD –

Hideo Ohashi  
Kogakuin University, Tokyo, Japan  
ohashi@cc.kogakuin.Japan

Globalization requested us to accelerate the mobility of engineers across the border of nations. Intensive efforts have been made in Japan under close collaboration of academia, industry and government to establish an integrated system that supports life-long professional development of engineers. This system should include at least such subsystems as accreditation of university education, training of entry-level engineers, professional qualification, and continuing professional development. In designing such subsystems, compatibility and equivalence to globally acknowledged standards were considered to be the key issue. Engineering societies shall be positively involved in all activities that help their member develop his or her professional competency for the life-time.

### 1. Introduction

The membership trends of KSME and JSME since 1975 are illustrated in Fig. 1. As to KSME, the membership expanded steadily and the increase became remarkable after 1990. It is worth congratulations that the trend was barely affected even by the financial crisis in 1997.

In the case of JSME, the trend is rather complex. Prior to the onset of Oil Crisis in 1973 JSME enjoyed a remarkable membership expansion, 2.5 fold in 20 years, that took place along with the rapid growth of our heavy industries such as steel, petrochemicals, shipbuilding, automobiles and electric machinery. The Oil Crisis urged our industries to convert their constitution to be less dependent on energy and material. The famous phase “Farewell to Heavy/Thick/Long/Big, Salute to Light/Thin/Short/Small” may characterize the changes needed in that period. JSME experienced a long stagnation period after the Crisis in spite of the massive inflow of new ME graduates, 20 thousand annually. The reason could be attributed to the fact that traditional trunk societies like JSME could not satisfy the needs of engineers who were struggling with the R&D of emerging and untraditional products. Members of JSME were eroded by smaller engineering societies that were specified in a narrower field or newly founded to confront an emerging field.

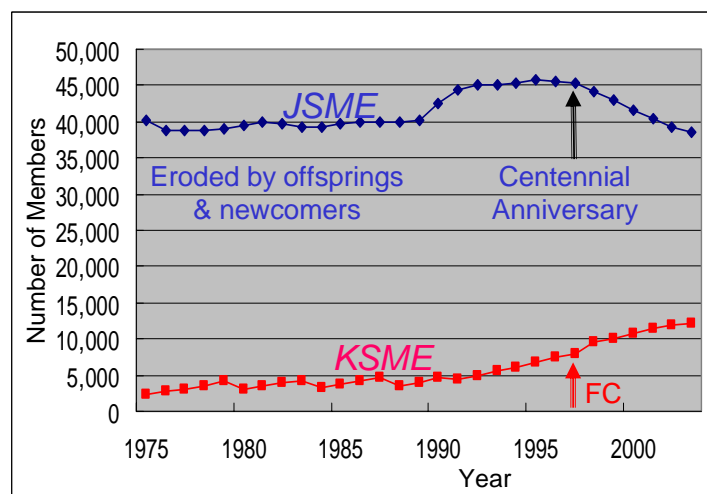


Fig. 1 Membership Trends of KSME and JSME

JSME's action to break this stagnation was the introduction of Division System. Twenty Divisions were inaugurated in 1987 and the response was quite positive. The membership started to regain and continued till the Centennial Anniversary in 1997. The last decade of the 20 Century is called in Japan "Lost Decade". The decade began with the collapse of booming economy carried over from 1980's. Responding to the stagnating economical environment, industries started to reshape themselves from fat to slim body that can stand severe global competition. The reduction of manpower became common under the name of "restructuring" or "re-engineering". This severe employment situation overwhelmed the JSME's efforts and the membership slipped to a regrettable shrink mode. Obviously many members started to judge critically whether the service and merit they receive deserve the fee. Members just for appearance or courtesy dropped out. Satisfaction became the key issue to sustain the membership.

JSME can survive only when the members feel it necessary for keeping and developing their professional competency. JSME's action toward this direction became visible by the establishment of Capacity Development Center in 2001, that bears the mission to enhance the involvement in accreditation, to certify specific engineering competencies by conferring diploma and certificate, and to support CPD (Continuing Professional Development). I hope those efforts would establish an ideal relation between members and the society, that is, "Co-existence for the co-prosperity".

## 2. Impact of Globalization

As the chronology shown in Fig. 2 indicates, globalization was triggered by the end of Cold War in the beginning of nineties. Since then, expanding economic activities and rapid diffusion of information technologies have been diminishing walls between nations. In such a borderless age, each nation can survive not in seclusion, but only in the economical and cultural interdependence in the global scale.

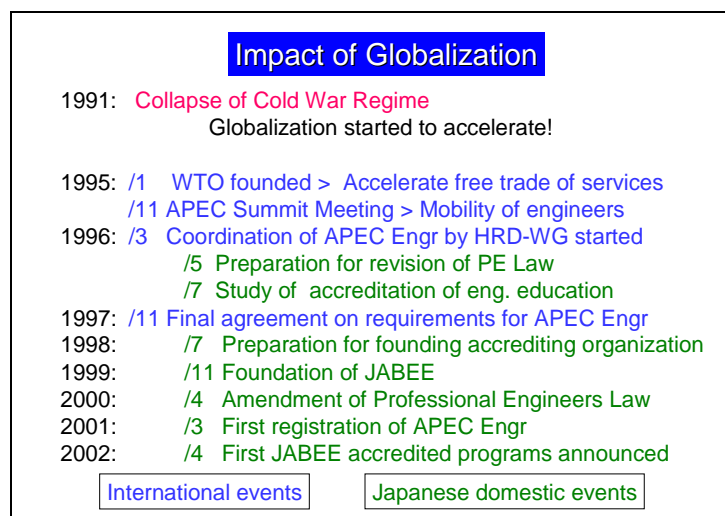


Fig. 2 Chronology

The year 1995 was a special one for engineering profession in Asia. World Trade Organization was borne in January this year and took initiative to remove the barriers that restricted free trade of not only commodities but also services. Services are provided by humans, especially by specialists like accountants and engineers. In accordance with this movement, APEC leaders gathered at Osaka Summit Meeting in November adopted a resolution to accelerate the mobility of registered engineers within the region

Next year in 1996, Human Resources Development WG of APEC started energetic coordination among member countries to establish a common regional engineering qualification, called APEC Engineer. The final agreement on the requirements for APEC Engineer was settled in Sydney Meeting of the WG in November 1997, and monitoring committees were founded in member countries for the registration of the new regional qualification.

In the initial stage of the coordination, the educational requirement for APEC Engineer was to complete an accredited engineering program at universities. Since the accreditation was not common in the majority of Asian countries, the requirement was later modified to include also engineering programs provided by government-recognized universities.

As the framework of APEC Engineer became gradually concrete, Japanese government started in 1996 to revise national systems to make them compatible with APEC or global systems. There were two major issues to cope with, that is, 1) introduction of accreditation system of engineering education at universities, and 2) revision of old-fashioned domestic Professional Engineers Law. The former was materialized by the establishment of Japan Accreditation Board for Engineering Education (JABEE) in 1999, and the latter by the amendment of the Law in 2000.

In March 2001, Japanese Monitoring Committee announced the names of 1500 APEC Engineers who were registered as the first entry. In April 2002, JABEE announced three accredited programs that obtained the honor of the first runners among over 1000 engineering programs currently offered in Japan. The big changes that took place in a relatively short period are all triggered and accelerated by the strong impact of globalization.

### 3. Recognition of Engineering as a Profession

In the process of converting our domestic systems to globally compatible ones, we experienced a lot of difficulties, especially in recognizing the meaning and importance of such western concept as "profession". In Chinese-character cultural zone of East Asia, there is no indigenous terminology corresponding to profession. Of course, we can find the word "profession" in every English dictionary but its superficial translation cannot convey the substance and weight that the word bears in western societies.

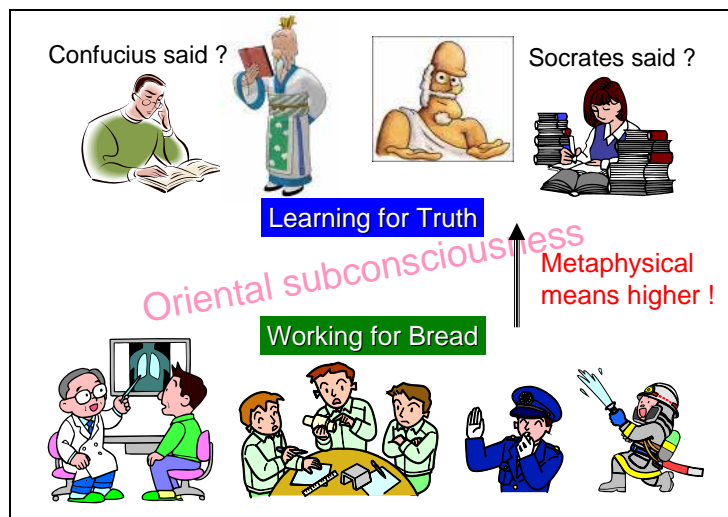


Fig. 3 Oriental Subconsciousness

In Japan, similar to other East Asian countries, we have had a long cultural tradition of respecting "learning" as the road to sublime truth, but at the same time, of looking down "working" as a mere means of getting bread. As the result of this subconscious prejudice that physical working is subordinate to metaphysical learning, our society has been insensitive to the dignity of those people who work in earnest and accomplish a variety of tasks that are needed to run a stable and reliable society. In this social context, being a professional, especially being an intellectual professional has attracted little interest and respect in our society. Only one exception is professionals in sports, because they earn an admirable income. Fig. 3 could convey to you the image that is still prevailing in our society.

This context was also common among university faculties. The mission of universities was thought to cultivate knowledge through research, to transfer knowledge through education and to select and breed potential successors for knowledge regeneration. University faculties and even students thought that the university is the place where knowledge is taught, but not the place where professionals are trained. The globalization requested us to change our traditional perception on profession and further on the mission of universities.

Engineering is, of course, one of the most important and responsible professions in the modern society that depends deeply on human-made hardware and software. Engineering faculties took the initiative to reform our traditional perception on university education. In the past, we thought that we should teach engineering related sciences as advanced as possible, and had little awareness that

our education was the entrance to the engineering profession. Now, majorities of our engineering faculties recognize that engineering education is the process in which entry-level engineers are trained. They shall have, of course, a sufficient ability to understand and apply engineering science.

For establishing engineering as a profession, we need to share the common understanding with the society. We have been trying to enhance our engineering profession and also to disseminate its role in the society.

#### 4. Life-long Professional Development of Engineers

In order to enhance engineering profession, it is needed to build an integrated national system. Such system can maintain the performance of engineers in the top gear throughout their life-long career, for the benefit of the society and the individuals as well. It must cover every stage of Professional Development of Engineers (PDE), that is, fundamental training in universities, training and practicing or Initial Professional Development (IPD), professional qualification and finally CPD, as illustrated in Fig. 4.

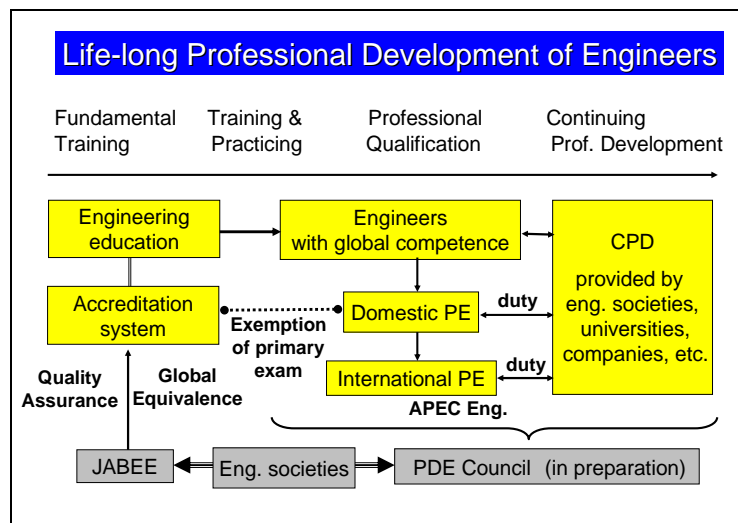


Fig. 4 Integrated System for Professional Development

Engineering education in universities provides fundamental training needed for entry-level engineers. To improve the quality of education and to assure the global equivalence, an accreditation system must be introduced. JABEE was established in November 1999 as a non-governmental organization for this purpose. Accreditation processes of engineering programs are conducted by JABEE with the close cooperation of relevant engineering societies.

Those who have finished fundamental education start to accumulate training and practice and gradually build up their professional competency as globally deployable engineers. At an appropriate stage of the development, one may apply for a professional qualification such as domestic PE as the token of an independent professional. Since the requirements for domestic PE and international PE, for instance, APEC Engineer, are fundamentally compatible, domestic PEs may apply for an international professional qualification, once their length of engineering practice exceeds the respective requirement.

CPD is essential for engineers of every stage. Engineers without professional qualifications need CPD to maintain and enhance their value or employability. For PEs, domestic as well as international, CPD is requested as their professional responsibility. CPD shall be driven by the autonomous initiatives of individuals as the means of endless updating of their expertise. Professional societies, educational institutions like universities, in-house training centers of private companies, and industrial associations of individual sectors; they are all providers of CPD service and must share their roles so that the clients, that is, all engineers have a variety of programs to choose from. In order to harmonize and integrate the activities of CPD providers into an effective and clients-friendly system, a coordinating body, tentatively named PDE Council, is currently in preparation with close cooperation of engineering societies.

The members of engineering societies come from all engineering-related sectors, academia, industry, government, local autonomy, etc. Engineering societies are the sole organizations that may

represent engineering interests in an integrated form. Engineering societies are expected to perform key contribution in every phase of professional development of engineers.

### 5. Progress of JABEE

In order to establish a quality assurance system of engineering education in universities, “Global Engineers Education Committee” headed by Dr. Yoshikawa was founded in 1997. After elaborate consultation and dissemination among relevant organizations, that is, educational institutions, major engineering societies, Ministry of Education, Ministry of International Trade and Industry, Science and Technology Agency and also employers represented by Keidanren (Japan Fed. of Economic Organizations), JABEE (<http://www.jabee.org>) was finally founded in November, 1999 as a NGO by the enthusiastic support of all relevant parties.

The organizational structure of JABEE is shown in Fig. 5. Membership of JABEE is categorized into two groups, namely regular and supporting members. The cooperation and communication with industries are materialized by the function of Industrial Advisory Board that has a direct channel to the President. Accreditation and Appeal Commissions are independent from Executive Committee that manages all pre-review/decision processes such as setting of rules, criteria and procedures.

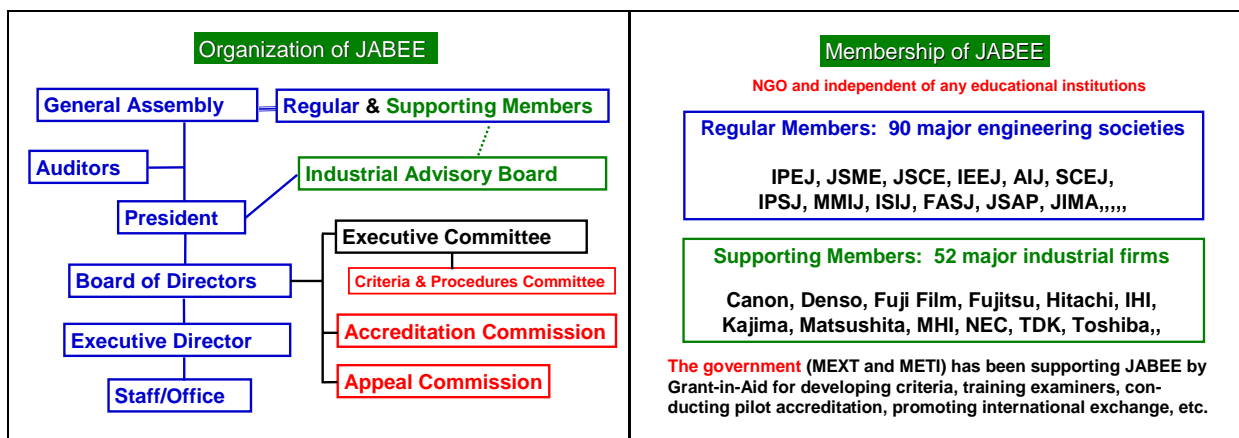


Fig. 5 Organization and Membership of JABEE

An engineering program applied for accreditation is first evaluated by the relevant engineering societies and then the decision is made by JABEE on the basis of their evaluation report, as shown in Fig. 6. In this context, only participating engineering societies are eligible as the regular members. Industrial companies that have strong interest in the quality of engineering education are eligible as the supporting members. Among 18 founding Board Members, 16 were presidents of major engineering societies. They are considered as the representatives of more than 90 regular member societies.

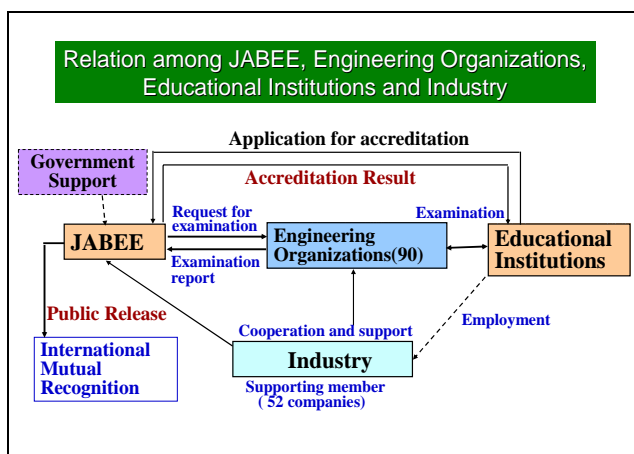


Fig. 6 Role Sharing in Accreditation

### Progress of JABEE Activities

Fiscal Year	2000	2001	2002	2003	2010 / Target
No. of Pilot Acc.	20	51	35	4	0
No. of Acc. Programs Sum Total		3 3	32 35	67 102	100 + 500 +
No. of Acc. Graduates Annual Sum Total		200 200	2300 2500	4700 7200	30,000 +
No. of Certified Reviewers	102	335	529	744	1200 +
Version of Documents; Criteria, Procedures, etc.	Ver.1	Ver. 2	Ver. 3	Ver. 4	

Fig. 7 Progress of JABEE Activities



Our accreditation practice follows basically that of Engineering Criteria 2000 adopted by ABET of USA. Introduction of outcome-based evaluation, engineering ethics and communication skill are examples of what were rather new for us.

The table shown in Fig. 7 summarizes the progress of JABEE activities since its foundation. In order to evaluate, inspect and then improve the accreditation processes, pilot accreditation was conducted prior to the formal one in every discipline. Dissemination of the significance of accreditation to educational institutions and the training of reviewers were also urgent tasks. At present, total engineering field is divided into 16 disciplines and the criteria are composed of the common and discipline-specific descriptions.

There are over thousand engineering programs currently running in Japan. By the year 2010, JABEE expects to accredit about half of them and to approach to a stable operation.

Financial independence is an important factor to operate an accrediting organization. Fortunately JABEE could get promise from the government and industries that they would support us for the first five years by governmental aides and membership fees of supporting members. The financial situation of JABEE is presently quite sound because of the external supports, however, we have to be independent in fiscal year 2005. We are almost sure to achieve the target.

It is also encouraging for JABEE that the government decided in March this year to connect the accreditation of engineering education with Japanese PE formally. Every graduate from a JABEE accredited program is exempt from the Primary Examination of PE and can start training and practicing as an Engineer in Training immediately after graduation.

Besides quality assurance, JABEE's another objective is to prove that the quality of our engineering education is equivalent to global standards. This can be achieved by joining Washington Accord (WA) as a signatory member, cf. Fig. 8. JABEE was first admitted as the provisional member at 2001 WA Meeting in South Africa. Two years later, JABEE submitted progress report at 2003 WA Meeting in New Zealand and requested signatories to dispatch formal review team to scrutinize our system and procedures. Three reviewers visited us twice and witnessed our review practice and decision making process in accreditation commission. We sincerely hope that JABEE would be admitted as the 9th signatory member at the coming WA Meeting held in Hong Kong next year.

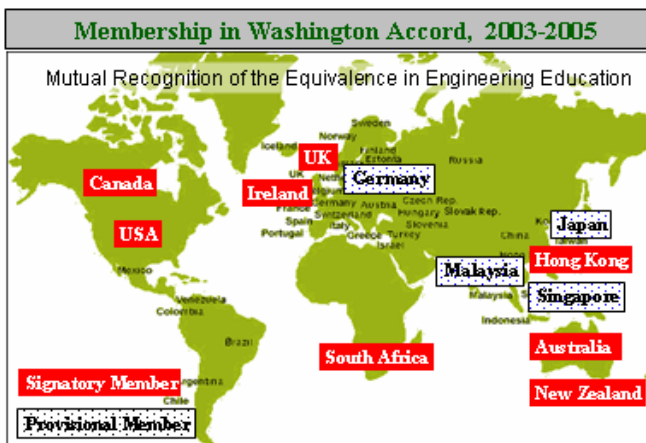


Fig. 8 Washington Accord

International Relations				
Year	2000	2001	2002	2003
Washington Accord Meeting		5 <sup>th</sup> WA/BM Provisional status		6 <sup>th</sup> WA/BM Application for Signatory status
Memorandum of Understanding	ABET		IEAust	
Observers sent to	ABET 12 IPENZ 1	ABET 7 CEAB 5	ABET 8 CEAB 5 IEAust 2	HKIE 4 ABET 5 CEAB 2
Instructors and reviewers invited from		CCPE 2	EC, IEAust, HKIE, IEI, IPENZ, EC SA (total 8)	CEAB, ABET, IPENZ as reviewers (twice)

Fig. 9 International Relations

The table shown in Fig. 9 summarizes how JABEE has been keeping the international relations with foreign accrediting organizations and engineering institutions. For the training of our reviewers and the preparation to join WA, their assistance was literally indispensable. JABEE is deeply indebted to the goodwill of global engineering community and would like to reciprocate in the future.

## 6. Amendment of Professional Engineers Law

Introduction of domestic professional qualification compatible with PE of USA, CEng of UK, CPEng of Australia, etc. is urgently needed in the era when engineering activities are expanding in the global scale. The past Japanese engineering qualification was based on "Consulting Engineers Law" and was utilized predominantly by consultant engineers in domestic construction business. The qualification lacked several basic conditions that are necessary to claim global compatibility

and equivalence. In 1999, the Council on PE submitted to the government a set of recommendations as the necessary revisions of the previous Law. The amended “Professional Engineers Law” was enacted April 2000 and went into effect from April 2001.

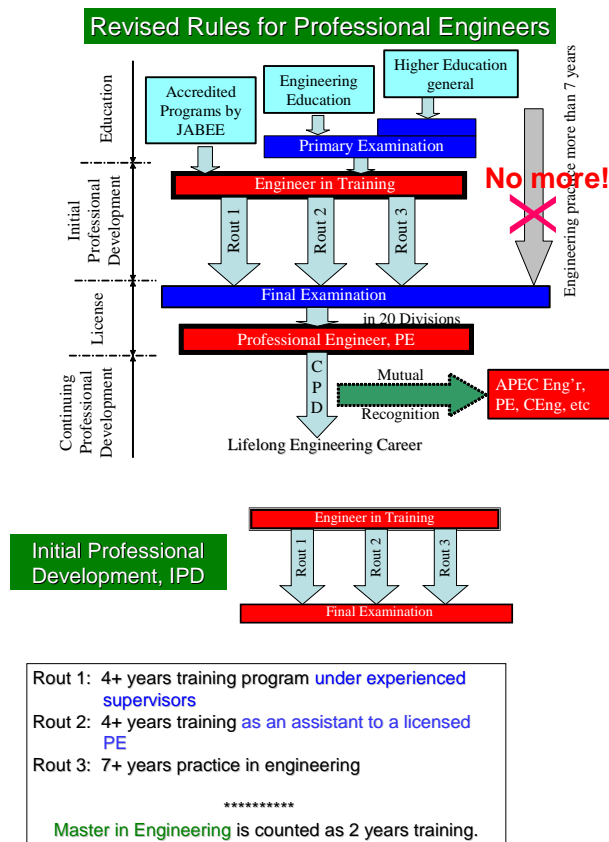


Fig. 10 Revised Rules for Professional Engineers

The amended Law defines new procedures to obtain and maintain the professional qualification called Professional Engineer (of Japan) as illustrated in Fig. 10. The procedures consist of Primary Examination, at least four years of training and practice (IPD), Final Examination, registration of PE, and requirement for CPD. Graduates of accredited engineering programs are exempt from Primary Examination, since the fundamental capability as an entry-level engineer is assured by the program itself.

The requirements and procedures for our registered PEs are globally compatible. It will be thus easier for Japanese PEs to apply for any regional or international engineering qualifications such as APEC Engineer or IMF International Engineer now discussed by Engineers Mobility Forum. There will be also little obstacles to the mutual recognition of professional qualifications among the interested nations. In 2003, Australia and Japan signed a bilateral agreement that the APEC Engineers of both nations are entitled to the same legal rights as a registered engineer in the counterpart nation.

The enforcement of the new Law will have great influence on the public perception of engineering profession. We expect that the number of PEs will increase and the average age of rookie PEs will reduce to around 30. The responsibility to the public (i.e. engineering ethics) is stressed in the new Law, hopefully helping regain public confidence on engineers and engineering achievements.

There are 2.5 million engineers with Bachelor degree in engineering or engineering-related disciplines in Japan. There were only 40 thousand registered PEs before the amendment of the Law. The number has increased to 56 thousand, a remarkable 40 % increase in five years. The amendment has been giving engineers a strong renewed incentive to professional registration and seems quite successful.

We have still no consensus over the desirable number of PEs in Japan. There are 250 thousand

Medical Doctors working in Japan who are responsible to support the health of 127 million people. Then, how many PEs are necessary who are legally responsible to support the health of our society, that is, the safety and reliability of modern society that is filled with human-made structures and systems? My personal answer is that we need PEs at least twice the number of MDs, that is, 500 thousand. I hope the target will be materialized in ten years.

## 7. Infrastructure of Supporting CPD for Engineers

Majority of engineers work not as an individual but as a member of organizations, quite different in size (small, medium and large) and objective (manufacturing, sales, operation, R&D, etc.). The needs of engineers for CPD are accordingly diverse in disciplines, level (entry to advance), duration (one day to a semester) and method (face to face to distance learning) as illustrated in Fig. 11.

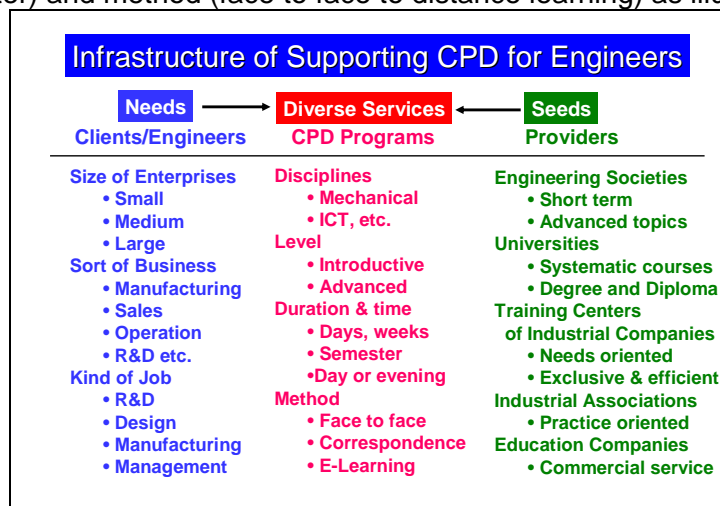


Fig. 11 Diverse Needs of CPD

The features of CPD providers are also diverse. Engineering societies have advantage in offering short-term programs with advanced topics, while universities offer long-term systematic courses that preferably lead to an academic degree or diploma. In-house training centers of industrial companies have long experience in enhancing practical business capability of urgent needs. Opportunities for e-learning are also expanding rapidly, such as the free site Weblearningplaza (<http://weblearningplaza.jst.go.jp/>) offered by Japan Science and Technology Agency.

At present, CPD providers are offering services independently and it becomes increasingly difficult for engineers to choose a most adequate program from the torrent of offerings. There must be an integrated data base of CPD programs for the convenience of the clients.

Japan Federation of Engineering Societies, an assembly of more than 100 engineering societies, set up in 2000 a committee (<http://www.pdecj.org/>) that should prepare the establishment of a council with the objectives summarized below:

- disseminate the importance of CPD among engineers and employers
- promote communication and cooperation of CPD providers
- accredit or endorse CPD providers and assure the quality of programs
- offer a common platform for the selection of programs based on the data base of available CPD services
- introduce common format for the annotation and labeling of CPD programs
- introduce common calculation method for CPD hours with properly defined weight factors
- introduce CPD record format of individuals that is interchangeable across disciplines

The preparation has been progressing with the strong support of the Ministry of Economy, Trade and Industry. New coordinating council, tentatively named PDE Council, will be established within a year and will expand its activities one step by another.

## 8. Conclusions

Every time when we hear such news as concealment of troubles in nuclear power stations, deliberate delays of recall notice of automobiles and so on, the public confidence on technology and



subsequently on engineers is hurt and deteriorated. Short-term remedies are not sufficient to improve this situation. We are confident that the endeavors for establishing engineering profession will be a sure step forward to recovering the public confidence.

Globalization has requested us to reform our system to be compatible with global standards. In many cases we found that the difficulties consist in the gap between western and traditional perception. In Korea and Japan, we may share a lot of common difficulties and, therefore, mutual communication and understanding are needed for the future cooperation, both from the global and regional viewpoint.