

**For Lifetime Career Development of Engineers  
-Reforms now taking place in Japan-**

Hideo Ohashi

President, Japan Federation of Engineering Societies  
Director, Engineering Division, Science Council of Japan  
President, Kogakuin University

1. Introduction

International reputation swings up and down like riding on a jet coaster. When Japanese industries boasted their competitiveness on the global market in 1980's, Japanese style management, featuring lifetime employment and in-house job training, collected world-wide attention. In those days commentary books on the secret of Japanese management were found in bookstores everywhere in the world. Now the situation turned around 180 degrees. The same management style is considered nowadays as the culprit of declining industrial power.

Engineering education of Japan has followed the similar fate. Our engineering education was once thought as the driving force of the epoch making industrial development. Numerous groups from abroad visited us and asked "what is the secret?" There was no secret indeed. We could only mention several features of our engineering education, for instance, emphasis on fundamentals and principles, cultivation of cooperative mind by experiment and practice, and enhancement of integration ability through graduation thesis. These features happened to match with the demand of Japanese industries, which did not expect job-readiness from fresh graduates and did lay value only on the possibility of future development. They considered new graduates as raw material, which should be forged to powerful components of each organization through long-sighted in-house training programs.

Lifetime employment was, however, the presumption of the above practice. The features of Japanese engineering education could work well only in association with Japanese management. It could not be a universal model for the rest of the world.

Since the end of the Cold-War Regime in the beginning of nineties, expanding economic activities and proliferation of information technologies have lowered the borders of nations. In this borderless age, each nation cannot survive alone, but only possible in the economical and cultural interdependence on the global scale.

The torrent of globalization forced each nation to make their system transparent to outside and compatible with global standards. Now, Japanese style management undergoes rigorous reforms to adjust itself to the new circumstances.

The subtle sharing of engineering education between academia and industries must also change. Japanese universities are no more allowed to stand as "raw material suppliers with domestic sales territory" but should move to globally competitive institutions that can assure the quality of education in more definite and visible way.

Korea and Japan share many common features of their social systems, which are, however, unusual from the rest of the world. Features of our higher education are, for example, high barrier for entrance (admission) but low for exit (graduation), heavy weight on graduation thesis, one-way teaching with little homework, etc. Because we face many common problems to cope with in the advent of the 21 Century, the present report, I sincerely hope, would evoke more tense interaction and cooperation among engineers of Korea and Japan.

2. Structure of Engineering Societies - Who is Representing What ? -

There are 2.5 million engineers in Japan. Among them, approximately 600 thousands belong to one or plural number of engineering societies/institutions (学協会) that have definite range of disciplines to serve.

Each engineering society has two major functions, that is, academic (scientific) and professional. Academic function of JSME (Japan Society of Mechanical Engineers), for example, is to promote the advance of mechanical engineering science on the basis of quality (originality) judgment by peer review. Another function is to help mechanical engineers maintain and develop their expertise as professionals. In the case of JSME, more than 70 % of members are engineers working in industries and, therefore, the role as a professional society should be at least as important as the role as an academic one. So-called trunk societies such as of Civil Engineers, Electrical Engineers, Architectures, Chemical Engineers, etc., have similar character to that of JSME, however, newly established societies for a very specified field such as Japan Society of Multi-Phase Flow have usually strong inclination to academic function.

JFES (日本工学会, Japan Federation of Engineering Societies, <http://www.jfes.or.jp>) is composed of 97 engineering societies and represents the interests of constituent organizations and subsequently of total 600 thousand member engineers. JFES is the member of FEISIEAP (Federation of Engineering Institutions in South East Asia and the Pacific) and WFEO (World Federation of Engineering Organizations).

SCJ (日本学術会議, Science Council of Japan, <http://www.scj.go.jp>) is a branch of the Prime Minister's Office (総理府), and is composed of 210 scientists representing all fields of sciences (humanistic, social, natural, engineering, agricultural and medical sciences). The members are nominated by election process in which more than 1200 academic societies participate, and are appointed by the Prime Minister for a term of three years (maximum reelection for three terms). SCJ is an advisory body to the government and society (function of a council) and also represents Japanese scientists domestically and internationally (function of a national academy). The Engineering Division of SCJ has 33 members, predominantly university professors, who have performed distinguished leadership in respective engineering societies. SCJ is the national member of ICSU (International Council for Science). At the recent General Assembly of ICSU held in September in Cairo, the president of SCJ, Dr. Hiroyuki Yoshikawa, was elected as the president of ICSU (1999-2002).

JA (日本学士院, Japan Academy) is a branch of the Ministry of Education (文部省) and is composed of 150 scientists with outstanding achievement. New members are nominated for lifetime by the vote of active members on recommendations submitted by JA and SCJ members, presidents and deans of universities, etc. 17 members are allocated for engineering. Among multiple mission of a national academy, JA bears the function of honoring distinguished scientists by awarding pension, conferring JA Award, publishing JA Bulletin, etc, and consequently contributes to the advancement of science.

EAJ (日本工学Academy, Engineering Academy of Japan, <http://www.ijjnet.or.jp/EAJ/>) was founded in 1987 as NGO. The Engineering Division of SCJ has only 33 members and their activities are restricted in many respects because of fixed budget and governmental regulations. The US counterpart, NAE (National Academy of Engineering), is a NGO and is quite powerful with its total 2000 members. The Engineering Division of SCJ is too tiny and powerless compared to NAE. EAJ was established to narrow this large gap. The members of EAJ are selected by Nomination Committee on recommendation of at least five members. Present members are about 650 and are beautiful mixture of leading engineers in academia and industries. Majority of Engineering Division of SCJ are also EAJ members. EAJ is a member of CAETS (Council of Academies of Engineering and Technological Sciences).

There are three academies, i.e., SCJ, JA and EAJ, in engineering and it looks quite complicated compared to a single academy like NAE that bears full-line academy function of US engineering. There are both advantages and disadvantages of Japanese system. The most distinct advantage of our system consists in that SCJ does represent 700 thousand Japanese scientists (researchers) of all disciplines, from philosophy to medicine, where JA bears simply the function of honoring outstanding scientists. SCJ should bear the role of national hub academy, around which satellite NGO academies of various disciplines such as EAJ share responsibilities in a harmonic way.

The structure and interconnection of the engineering societies of Japan are illustrated in Fig. 1.

### 3. From Organization-Oriented Society to Individuals-Oriented Society

Japanese society has been reasonably safe, reliable and stable. Who have been supporting the reliability of our society?

The answer could be "Organization-oriented society" as illustrated in Fig. 2-a. In this society, individuals have a strong sense of membership to organizations, especially companies, to which they belong. As the reward to the royalty, individuals are protected lifetime by the organization. In a red organization, there are only red employers, who are almost useless in a blue organization.

In this kind of society, the responsibility for a reliable society is borne by organizations, private as well as public, but not by individuals. Japanese style management (seniority system and lifetime employment) and "Organization-oriented society" are mutually dependent and inseparable. The globalization forces Japanese companies to shift to more globally competitive management. Re-engineering, restructuring and reduction of excessive manpower are now common not only in deficit-ailing companies but also in profit-thirsty booming companies. Our society has started to change also correspondingly, with great pains and troubles of people who are dismissed from shelters. What is the new goal of our society for the metamorphosis?

The answer could be "Individuals-oriented society", as it is common in the western countries. The Image of this society is illustrated in Fig. 2-b. The whole society is covered and fixed by the networks of specialists who bear the responsibility in respective fields with their expertise and professional morality. There need networks of medical doctors, of lawyers, of accountants, etc., and not to the last, of engineers who are

responsible for developing, designing, manufacturing and operating artificial hard-wares and soft-wares, the core of modern technological society.

To materialize the transformation from organization-oriented to individuals-oriented society, the hardest barrier consists in our culture and consciousness. We have long cultural tradition of respecting "learning 学" but of looking down "profession 業". In the consequence, being a professional, especially being an intellectual professional, has collected little interest and respect of our society. We need a revolution of our consciousness, that is, from ignoring to respecting professionals.

#### 4. For the Establishment of Engineering Profession

SCJ, JFES and JSEE (Japan Society of Engineering Education) wish to play a leading role in the above mentioned consciousness revolution, especially in engineering. In December 1998, the president of SCJ, Dr. Yoshikawa, made a declaration public in which following issues were pointed out:

- 1) The safety and reliability of modern society depend heavily on artifacts (artificial products; buildings, vehicles, communication and information devices and systems, etc.)
- 2) Engineers are totally responsible for artifacts, throughout planning, developing, designing, manufacturing and operating phases. Engineers must be qualified to accept such responsibility.
- 3) Society should recognize the role of engineers properly. To obtain the public understanding, there must be a publicly acceptable system that assures the professional qualification of engineers.
- 4) Introduction of Japanese version Professional Engineers is urgent, that should match, of course, with global standard.
- 5) Introduction of accreditation system of engineering education on university level is also urgent. Accreditation not only offers basic education for qualified engineers, but also generates strong driving force for the improvement of university education.
- 6) To maintain the expertise of engineers for lifetime, introduction of CPD (Continuous Professional Development) must be also incorporated.

We are now trying to establish a consistent national system that can maintain the activities of engineers at the top gear throughout their lifelong career, for the benefit of the society and the individual as well. Such system should include:

- Quality assurance of engineering education at the graduate level by introducing Japanese version of ABET (Accreditation Board for Engineering and Technology, USA). JABEE (日本技術者教育認定機構, Japan Accreditation Board for Engineering Education, <http://www.kanazawa-it.ac.jp/JABEE/>) is in the preparation stage with the enthusiastic support of Ministry of Education, MITI, STA and also Keidanren. JABEE will be founded on November 19, this year. Introduction of engineering ethics and enhancement of communication capability are examples of what's new to be implanted in engineering education. (Ref. 1)
- Introduction of engineering qualification compatible to those of our partner countries, such as PE of USA, CEng of UK, CPEng of Australia and so on. The present Japanese engineering qualification "Registered Engineer 技術士" lacks global equivalence and is isolated. The Council for Registered Engineer of STA has started to improve the present system. The revised system is expected to increase the number of qualified engineers tenfold from the present number (less than 40 thousand), to reduce the average age of newcomers to around 30, to incorporate accredited engineering education as the standard process, and finally to introduce CPD as the necessary condition to maintain the qualification.

Once we complete our national system for engineering profession, it will become far easier to adapt to any regional or international engineering qualifications such as APEC Engineer and International Engineer now discussed by Engineer Mobility Forum. Engineering societies are expected to play principal roles in the implementation of accreditation and CPD.

#### 5. Concluding Remarks

Recent criticality accident at JCO's Tokai facility indicates clearly that the core of Japanese technology has been eroding gradually. Short-term remedies are not sufficient to stop this tendency. We feel strongly that our society itself must be fundamentally changed. The endeavor described in the above, we hope, would be a sure step forward to turn the tide.

#### Reference:

1. Ohashi, H., Engineering Education in the Torrent of Globalization, Proc. Of 4<sup>th</sup> KSME-JSME Fluids Eng. Conf., Pusan, October 18-21, 1998, pp. 65-68.

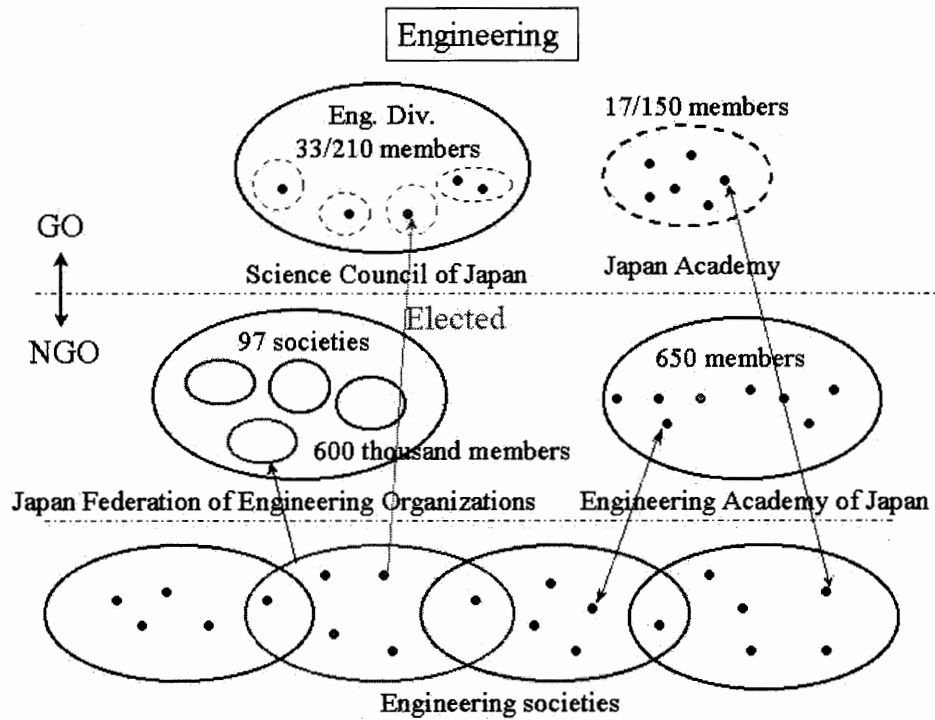


Fig. 1 Structure of engineering societies

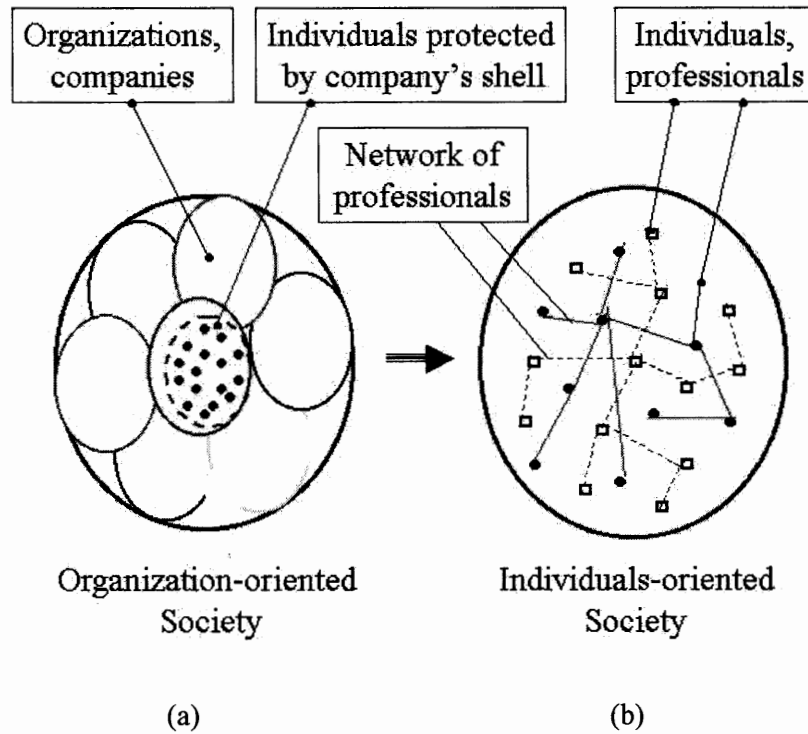


Fig. 2 Transformation of social structure