

Keynote Presentation
9th World Conference on Continuing Engineering Education
May 17, 2004, Tokyo

ENGINEERING EDUCATION IN JAPAN **- PAST AND PRESENT -**

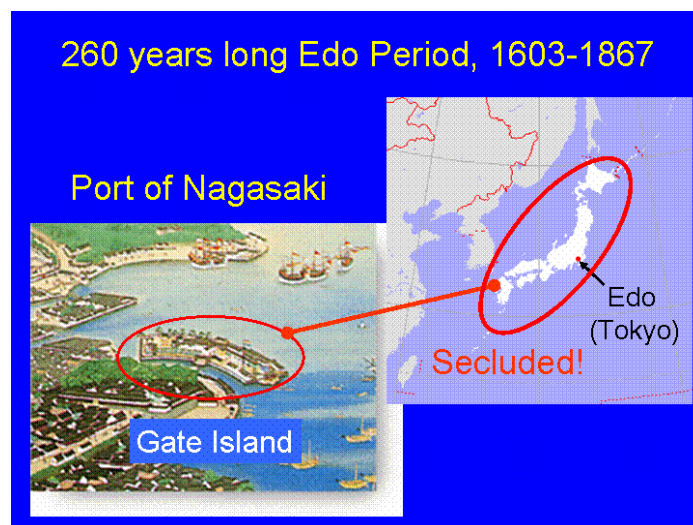
by
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Dear colleagues, ladies and gentlemen,

It is my great honor to have this opportunity to report you how we started our engineering education, what has been the feature of our education and finally what reforms we are trying to achieve. I hope our past and present story would convey some suggestion to you that may be useful for enhancing engineering profession in each country.

Now I begin with our past:

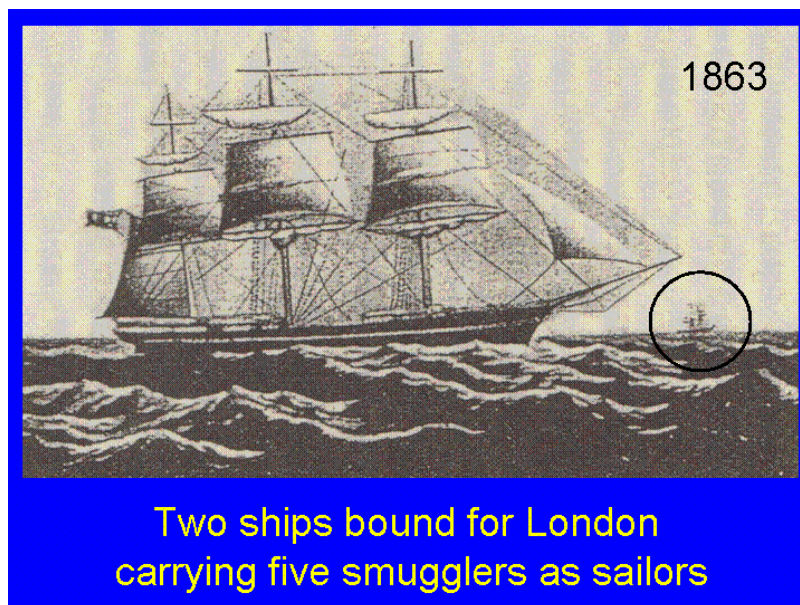
Japan's transformation toward a modern and industrial nation was triggered in 1868 by the well-known Meiji Restoration. Until then, fifteen generations of Tokugawa Shoguns governed a remarkably stable and war-free feudal era for 260 years. One of the most distinct features of this Edo period was the strict enforcement of closed-door or seclusion policy that prohibited any human interaction with overseas countries.



Contacts and trades with specific foreign countries were admitted at special places like Port of Nagasaki where Madame Butterfly fell in love with a US Navy Officer called Pinkerton. Strong demands from western countries for widening the doors caused severe diplomatic friction with the Tokugawa government especially after the dawn of the 19th Century. Repeated foreign intervention provoked nation-wide disputes over the seclusion policy, and further the legitimacy of the Tokugawa government. The magma of frustration grew steadily and exploded in 1868 as Meiji Restoration.

The governmental sovereignty was then returned to Emperor Meiji. However, the nation itself was left almost unchanged as it was 260 years ago. In order to join modernized nations, every national system such as government, law, police, army, education, post, transportation etc. ought to be built from nothing.

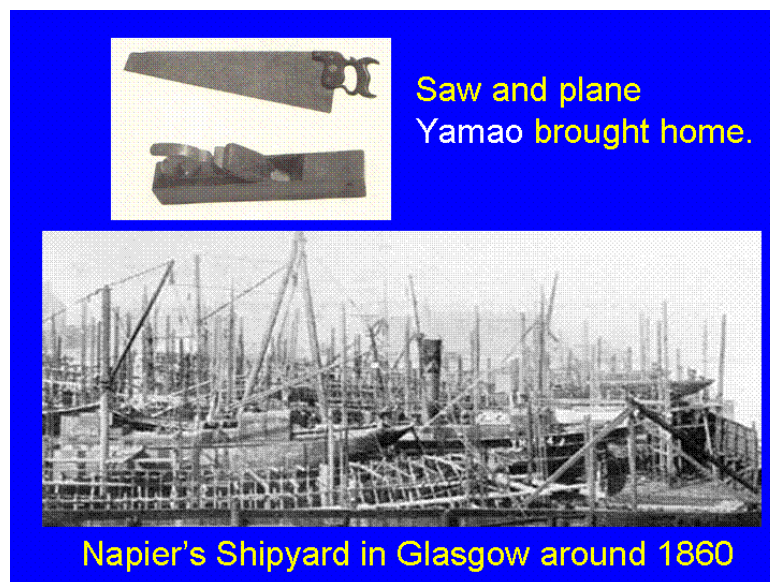
In 1863, five years prior to the Restoration, two ships carried five young smugglers bound for London. After the arrival, they became students of the University of London. They carried a secret mission from their local Lord to learn advanced social and industrial systems of western nations. They were expected to return home as a “living machine” or a seed of a new plant.



The five ambitious boys are shown in the slide below. They became later the first Prime Minister; Mr. Hirobumi Ito, Minister of Foreign Affairs; Mr. Kaoru Inoue, Minister of Industry; Mr. Yozo Yamao, the father of railway systems; Mr. Masaru Inoue and the founder of mint bureau; Mr. Kinsuke Endo.



Yozo Yamao studied engineering for three years at the University of London and went to Napier's Shipyard in Glasgow to learn the practice of shipbuilding as an apprentice. Two years later he decided to return home after he received the news of successful Meiji Restoration. He was then 30 years old.

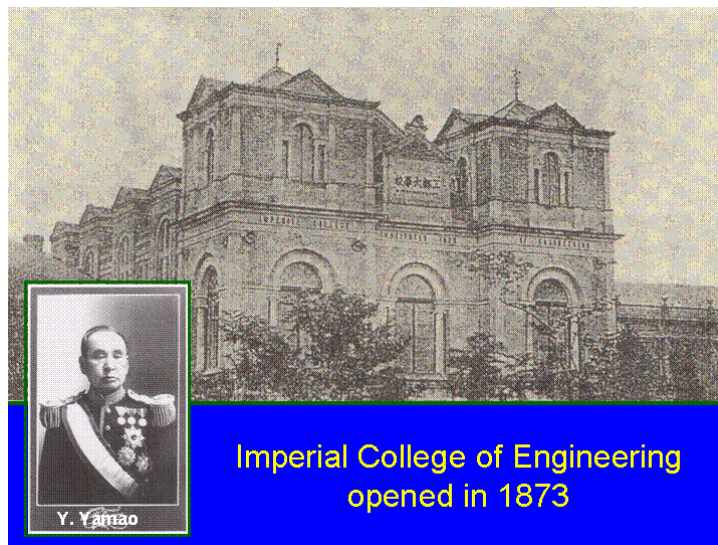


Yamao joined the new government and took initiative to lay the foundation for an industrial nation. Three years after the Restoration, Ministry of Industry was newly founded and he became the Vice Minister. Immediately after this assignment, he took action to establish a college of engineering that should produce core forces for nation's industrial development. Opposing to the ordinary opinion that "the graduates will be

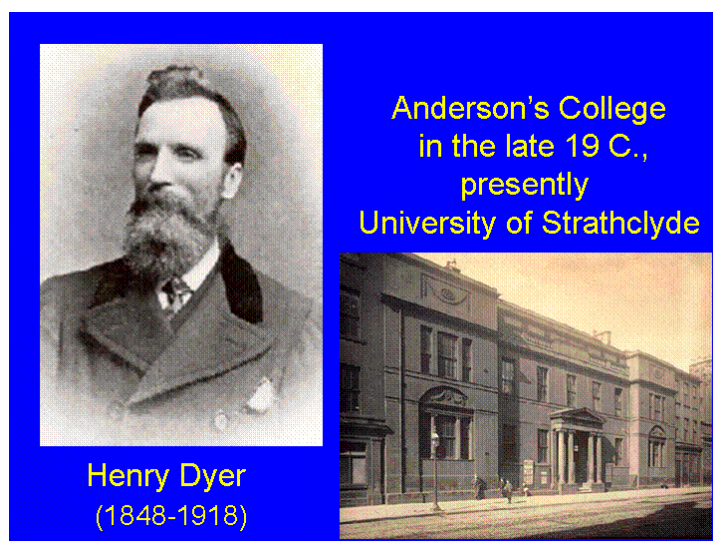
useless since there are no industries to work for”, he persuaded the leaders of the new government by the words;

**“Even if there is no industry at present in Japan, if we train a man,
he will cultivate an industry.”**

His deep insight to the future resulted in the opening of Imperial College of Engineering in 1873. After six years, the College sent out its first 23 graduates to industries and academia, and they all became the leaders of respective fields.



Henry Dyer, 25 years old graduate of Anderson’s College of Glasgow, was invited as the principal of the new College. He implanted here in Japan an education integrating engineering theory with practice, which he believed was ideal. His concept was rather new at that time and was not implemented even in his motherland. The education he established here became the very roots of Japanese engineering education.

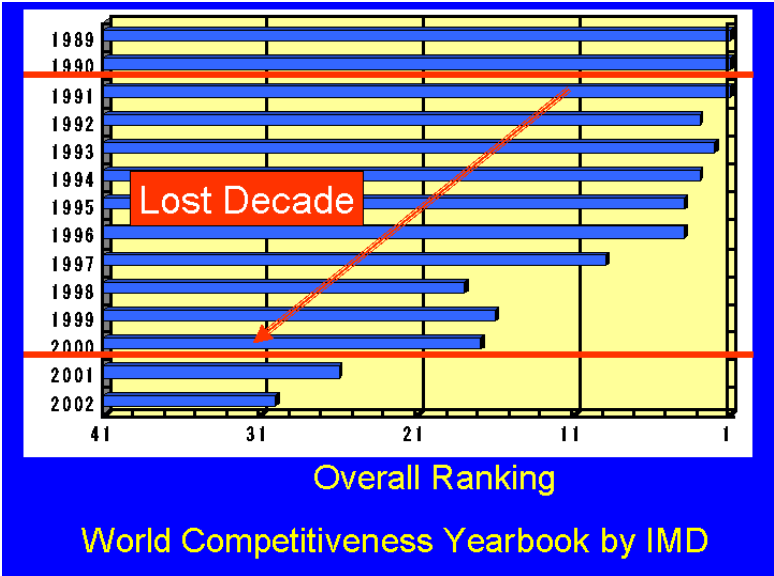


Emperor Akihito, when he was the Crown Prince, cited Yamao's words in his speech at the Centennial Anniversary of the Japan Federation of Engineering Societies that Yamao founded and served 36 years as the president. The spirit conveyed by his words carries great value not only in those days before industrial take-off but also today. Every time when we face a new difficulty, we have to return to his words. If we replace the word "industry" by the issue we confront, we will find a great suggestion and stimulation.

Now I come to the present:

The last decade of the 20th Century started in 1991, is called in Japan "Lost Decade". It took some time before we became aware that unprecedented changes started to emerge in politics, economies and technologies in global scale. These changes were surely triggered by and attributed to the extinction of the Cold War in 1991.

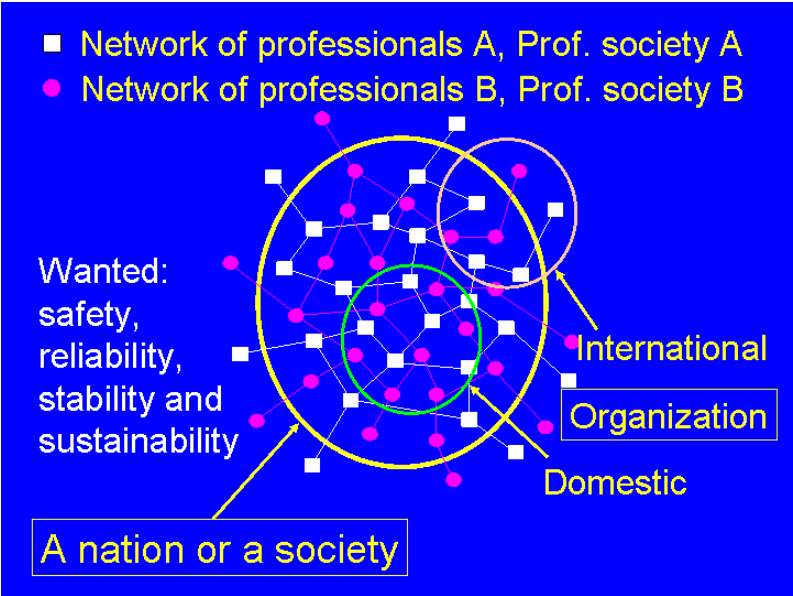
In addition to this drastic change in the international politics, Japan experienced in the same 1991 such domestic changes as the collapse of decade-long booming economy, start of commercial utilization of internet, rapid proliferation of information and communication technologies, deregulation of governmental control on the curriculum of universities, and so on. We could not foresee the consequences of these changes at the begging but became gradually aware of the difficulties we were facing, when we followed the decline of the international competitiveness measured by the IMD ranking as shown in this slide. Japanese position in overall ranking dropped from the top to 17th during the Lost Decade.



Because of the economic success and expansion in 1980's, we became too much confident in our system and believed that the situation would last forever. That was however an illusion. At the middle of the Lost Decade it became clear that we needed another restoration to reform our society and individuals so that we might better adjust to the new social and economic environment of the rapidly changing world.

The core of the reform was the transformation "from organization-based to individual-based society". Japanese style management had been so efficient and competitive till the end of 1980's. It could be implemented most easily in an "organization-based society" like ours. 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.

The globalization forced Japanese companies to shift to more globally competitive management style. Re-engineering, restructuring and reduction of manpower became common not only in deficit-ailing companies but also in profit-enjoying companies. Our society had to adjust to this new situation with great pains and frustrations of people who were unexpectedly dismissed from their shelters. We had no choice but shifting to "individual-based society", as it is common in the western countries.



In an individual-based society, professionals play an essential role in maintaining the quality of the society that can be measured by its safety, reliability, stability and sustainability, as illustrated in this slide. The whole society is covered and supported by the networks of professionals who bear the responsibility in respective fields with their ex-

expertise and morality. Many networks are needed such as network of medical doctors, of lawyers, of accountants, etc., and not to the last, of engineers who are responsible for developing, designing, manufacturing and operating human-made hardware and software, the core of modern technological society.

Even in the individual-based society, the role and importance of organizations will never change. Activities of organizations cross easily the borders of nations. Multinational enterprises are becoming common. The networks of professionals, that is, professional societies are also becoming borderless. In such borderless age, each professional must prove his or her own competence by some kind of globally acknowledged credentials, preferably by professional qualifications.

To materialize the transformation from organization-based to individual-based society, the hardest barrier existed in our culture and consciousness. We have long cultural tradition of respecting "learning" as the road to sublime truth, but of looking down "profession" as a mere means of getting bread. As the result of this subconscious prejudice, being a professional, especially being an intellectual professional, has attracted little interest and respect in our society. We need a revolution of our consciousness.

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 in a team, and participation in scientific research 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 past features of Japanese engineering education could be effective only in association with Japanese style management. It could not be a universal model for the rest of the world. As Japanese style management had to undergo rigorous reforms to adjust itself to the new environment, our engineering education was also forced to change accordingly.

For establishing engineering as a profession in Japan, we needed to share a com-

mon understanding with the society. Prof. Yoshikawa, previous president of Science Council of Japan and JSEE and present president of Japan Accreditation Board for Engineering Education, JABEE, made the following statement public in 1998:

- 1) The safety and reliability of modern society depend heavily on human-made products such as materials, buildings, vehicles, communication and information devices and systems, etc.
- 2) Engineers are thoroughly responsible for such products, 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 of Professional Engineer is urgent, that should be comparable with global standards.
- 5) Introduction of an accreditation system of engineering education at university level is also urgent. Accreditation not only assures the quality of fundamental education for engineers, but also generates strong driving force for the improvement of university education.
- 6) To maintain life-long expertise of engineers, the importance of Continuing Professional Development, CPD, must be recognized.

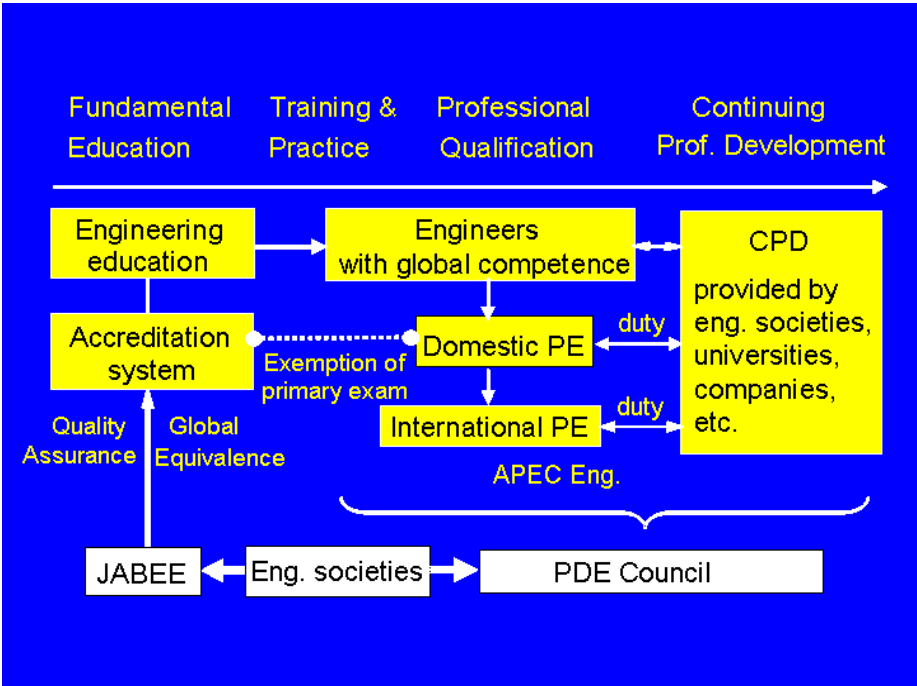
Responding to this statement, we started to re-engineer our engineering profession accordingly.

In order to enhance engineering profession in Japan, it is needed to build an integrated national system for supporting professional development of engineers throughout their life-long career. Such system must cover every stage of professional development, that is, fundamental education in universities, training and practice, professional qualification and finally CPD, as shown in this slide.

Engineering education in universities provides fundamental training needed for entry level engineers. To improve the quality of education and to ensure the global equivalence, JABEE was established in November 1999. Accreditation processes of engineering programs are conducted by JABEE with close cooperation of relevant engineering societies.

Those who have finished fundamental education start to accumulate training and

practice and gradually build up professional competence as globally deployable engineers. At an appropriate stage of the development, one may apply for a professional qualification such as domestic Professional Engineer as the token of an independent professional. Since the requirements for domestic PE and international PE, for example APEC Engineer or EMF International 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 regardless they hold an authorized qualification or not. Engineers without professional qualifications need CPD to maintain and enhance their employability. For PEs, domestic as well as international, CPD is requested as their professional responsibility. CPD is driven, of course, by the initiatives of individuals as the means of endless updating of their expertise.

Professional societies, educational institutions like universities, and in-house training centers of private companies; they are all providers of CPD service for engineers and must share their roles so that the clients may choose the most adequate one from a variety of offered courses that are so different in topics, level, duration and method.

There are so many participating organizations in CPD, the most downstream of professional development of engineers, PDE. There must be a coordinating body that harmonizes the interests of CPD stakeholders and integrates whole components into an effective and quality-assuring system. PDE Council is expected to perform this coordi-

nating function and is now under construction with close cooperation of major engineering societies, similar to the case of JABEE that performs coordinating function in the most upstream of PDE.

Conclusion

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 eroded. Short-term remedies are not sufficient to improve this situation. We are confident that our endeavor for the re-engineering of engineering profession in Japan will be a sure step forward to recovering the public confidence.

Every nation has own history, culture and feeling of amenity. The reforms we are trying to achieve seem all within the framework of so-called westernization or introduction of Anglo-Saxon systems. The same situation happened 130 years ago when we went through Meiji Restoration. After mixing and fusing native and imported wisdom and system, the leaders of Meiji succeeded to produce new systems tailored to Japanese climate and situation.

We hope the ongoing reforms in Japan will be successful, and our renewed system will be acknowledged as a universal model to enhance our service and contribution to the society.

Thank you very much for your attention.