Journal of Pressure Vessel Technology

Guest Editorial

The Global Mechanical Engineer—The Future of the Profession in 2028

Our engineering profession is facing tremendous challenges, especially as we take a long-range look at the trends and issues developing throughout the next 20 years. Even now, we see rapidly developing economies leading to greater global environmental pressures and competition for declining resources. In the future, the mechanical engineering profession will be pressed to develop new technologies and techniques while promoting sustainability and it will have a greater need for shared knowledge in order to compete and collaborate. The next generation of engineers must be equipped with the knowledge to do business in global markets, no matter where their desktops reside or how local their business interests.

To explore our future in 2028, ASME recently took the lead in addressing what lies ahead for the mechanical engineering profession, convening a global summit in Washington, D.C., in April 2008 at the National Academy of Sciences. The summit engaged invited leaders in a dialog about trends and issues likely to shape our profession over the next 20 years, supported by ASME's environmental scanning research. A broader survey of engineers helped frame current perspectives.

The mechanical engineering profession is dealing with the mandate for individuals and organizations to learn, to innovate, and to adopt and adapt faster than ever before. The surveyed engineers strongly agreed that they need to coordinate multiple disciplines to complete more complex projects. To add to this, research indicates that the regulatory framework will continue to grow in complexity with a workforce that is increasingly decentralized and entrepreneurial in nature. There is a competitive edge that calls for greater technical knowledge and more depth in management and problem solving. What drives that competitive edge for knowledge?

First, it is the increased competition for engineering talent worldwide. For example, India, China, Brazil and Russia are investing in basic research and encouraging growth of industries around their leading universities. Developing nations are rapidly building up their engineering workforce, although the standards vary a great deal. Global competition for talent is a boon for many countries but also a brain drain in others. Parts of Africa and Latin America send significant portions of their populations to study and work abroad. And every nation is affected by losing highly qualified engineering talent when it follows R&D migration.

In the future, when we look at engineering as a career, there may be more distinctions between technicians and professionals on various levels. How do we harmonize this aspect of engineering education on a global level? ASME research says to follow the growth trends of large multinational engineering corporations, which expect certain skills and knowledge from the workforce. The other area of growth to watch is newly industrialized, developing nations such as China and India.

The second thing driving the competitive edge of knowledge is the accelerated pace of change, in technology and other areas. Most engineers understand this intuitively and point to how quickly our personal computers become dated pieces of e-waste. This accelerating pace of change, coupled with the need to create sustainable systems, already challenges how engineers problem-solve.

Third, engineers need to master non-technical skills. Engineers are good at design and analysis, but they also need to manage complex technology projects across local and remote teams, sometimes even across borders. Engineers today can already identify a need for what we call "soft skills" such as language skills and cultural competency. Some people call these "higher order skills," because they are deal-breakers in determining success. It will become essential that engineers know how and when to incorporate social elements into a comprehensive systems analysis of their work.

Engineers with global attitudes are able to place technology in a global context, recognize the multidisciplinary and multicultural approaches to problem solving, enhance their communications skills, and achieve a greater understanding of diversity. The aim is to stay agile and adaptable in the work environment. The ideal is to be creative and culturally aware with a strong sense of professionalism.

Dramatic changes in engineering practice are expected to continue through upcoming decades. Industry, business, academia and professional associations now focus strategically on global competitiveness, collaboration, innovation, and the entrepreneurial spirit. International collaborations, with teamwork and systems thinking, are an integral part of our processes. Charles M. Vest, president of the National Academy of Engineering, has said that engineering is about systems "as large as the earth itself and as small as living cells." The key to produce world-class engineers lies in our educational institutions where our mechanical engineering educators must believe systems engineering should be a priority and reform their curriculum.

Technologies that have created wealth and economic growth will continue to offer engineers exciting opportunities. But great challenges and opportunities for engineers will be driven by social needs for improving our standard of living for people around the world without compromising the environment and doing harm to our planet. Furthermore, progress in nanotechnologies and biotechnologies may not be common to today's engineers but they will be part of almost all future design solutions. Technology will continue to raise complex social and ethical challenges. Examples already can be seen in transgenic food supplies, privacy issues, and nuclear technologies. Engineers must be prepared to help the public understand and resolve these dilemmas.

To meet the challenges of the future, we must address four urgent issues:

First, build a flexible workforce. The future mechanical engineers must be able to adapt and change in order to produce globally competitive engineers that will contribute to the growing needs of our profession over the next two decades. We need to harmonize the professional requirements and educational levels that vary so greatly around the world. An understanding of educational challenges and the need for key curriculum reform in

complex systems and multidisciplinary coordination are important.

Second, develop sustainability through new technologies and techniques, to be responsive to the global environmental pressures brought by economic growth. To be truly innovative in solutions, especially in areas such as water management, energy, manufacturing, healthcare and agriculture, will require new business models and new design approaches.

Third, adopt systems thinking, which enables engineers to look at design differently, with broader parameters for social and environmental priorities. This means engineers adopt a greater understanding of multiple cause-effect relationships. Greater technology knowledge must be matched by more depth in management and problem-solving capacity, as well as the ability to coordinate across greater distances and timeframes.

Fourth, infuse innovation in our business models and designer's mind as key to staying competitive in global markets. Creative skills are perhaps the key competitive advantage for engineers.

ASME is focusing on these major patterns, evident today, that will help the profession understand what can be expected in the future, just 20 years from now. Many of these trends show incremental changes, rather than revolutionary breakthroughs. For many industries, the race for economically feasible and environmentally neutral solutions is swift and full on. For educators, the next generation is seated before them with high expectations of making a difference in the world. For all engineers, of any discipline or specialty, the need for innovation networks and collaborative approaches is a shared vision. As a convener of innovation networks, ASME helps engineers make connections, offers a world view of opportunities and speeds progress of initiatives in many key areas. We are all part of leadership that fosters an engineering culture that is innovative and responsive.

Sam Y. Zamrik
ASME 126th President 2007–2008
Professor Emritus, ESM Dept.
The Pennsylvania State University