Creating a Better World Through Engineering

SMT Prospects and Perspectives

by Dr. Jennie S. Hwang, CEO, H-TECHNOLOGIES GROUP

What is the role of an engineer? In my definition, an engineer plays a crucial role in bridging science and society. In this spirit, The National Academies of Engineering (one of the triad Academies of The National Academy of Science, Engineering, and Medicine) recently initiated a video interview series with the theme, "Today's Engineers—Creating a Better World." I was invited to be one of several interviewees for the series. What follows are excerpts from that conversation.

Q ***What inspired you to become an engineer?***

A I would not be where I am today without the encouragement and support of my family; at home, as the emphasis was on learning, excelling, and reaching for the stars. Education was of ultimate importance. During my formative years, I was fortunate to spend abundant time with my grandfather, who showered me with his intellect and wisdom. I am eternally grateful and cherish what I was given.

In a nutshell, I was not a kid who gravitated to one subject. During my school days, girls who pursued science and engineering were considered "smart." I wanted to be smart, so I pursued science. At the same time, I was also intrigued by what felt like "the other side of the world," namely fashion, dancing, and singing.

Three of my four academic degrees are in science: chemistry, liquid crystal science, and physical chemistry. The exciting part was moving into engineering. I was recruited by Case Western Reserve University as the first woman

PhD candidate in Materials Science and Engineering. When I informed my chemistry dissertation professor at Columbia University about my plan to transition into engineering, he said, "Jennie, I have known so many female students who never finished their PhD once they left there. After you receive your PhD from there, you could do very well." The rest is history.

The practice of the Engineering School at Case at the time was to have a master's in engineering or physics as a prerequisite for PhD candidacy. However, my condition on coming to Case Engineering School was to go directly to the PhD without any delay. Having been a student in both chemistry and engineering, my experience was that chemistry curricula was quite different from engineering curricula; because of that, I was quite nervous. There was only one way to tackle that difficulty, and that was to study hard. Luckily, l was able to get top grades in all my graduate engineering courses.

With my background in chemistry, I found engineering to be extremely interesting, particularly in how engineering creates things. Looking back, I appreciate how tremendously beneficial my engineering training has been in every endeavor in my career of 40+ years, in everything from technology enterprise to manufacturing operations to business.

Q ***How has your background strengthened your engineering experience?***

A My engineering training has facilitated my engagements in many areas, including in technology, manufacturing, and business.

To me, life is a progression of three stages. The first stage is schooling, when we prepare for the future by building a foundational education into a solid platform from which to grow.

The second stage is intellectual growth and "seasoning," wherein we develop our career, establish ourselves in our field, and learn how to contribute meaningfully to that field.

The third and final stage, which I consider the prime of my life, is a valuable time where we can use what we've learned to contribute the most to our field and the world, while continuing to learn and experience things. This is where I am now.

After completing formal education, deciding whether I wanted to go into academia or into industry was a huge and difficult decision. Once I decided to enter industry, my first job was with Lockheed Martin Corporation (then Martin Marietta Corporation), where I was swiftly put on the fast track toward an executive position. My time at Lockheed was such an intense learning journey; I was like a sponge. I started to truly appreciate the value of a solid education. I realized that the environment of one's very first job is a pivotal component for future career development.

Working in an intellectually challenging environment is always a joyful and rewarding experience.

I often thought of my grandfather's teaching—the mindset to "reach for the stars." That ethos guides me constantly in my search for wisdom. To that end, perhaps it's worth sharing something I learned recently. I made a point to attend the Berkshire Hathaway shareholders annual meeting in person to listen to the legend of legends, Warren Buffett, and to observe the dynamic of all the aspiring people present. During the Q&A session, attendees kept asking the same question, although they articulated that question in different ways. In essence, they wanted advice on what to invest in and, more importantly, how to succeed in life in this unprecedentedly uncertain time of high inflation and a draconian increase in the price of goods and services in our daily life, not to mention the widespread geopolitical issues. Mr. Buffett shared this wisdom:

Invest in yourself to gain rewards even when inflation bites. The abilities you have can't be taken away from you—they can't actually be inflated away from you. The best investment, by far, is anything that develops yourself, and that's not taxed at all. The best thing you can do is to be exceptionally good at something. You want to be the best at what you do—be the best engineer, the best doctor, the best dancer.

I thought this was truly powerful advice for all of us.

Some of this wisdom relates to women engineers. During the last four decades, as we know, women have made substantial strides in all professions, including engineering. Yet there is more progress to be made, especially in industry sectors such as the microelectronics/electronics industry. Women engineering professionals still need encouragement and support. For example, as of my recent professional development lectures to the industry, I've noticed that attendees are still predominately male professionals. I made the same observation in the 1990s, and today, in 2022, the same dynamic prevails.

Q ***What does being an engineer mean to you?***

A I see engineering training as unique in a way that can be useful to all professions: as an engineering practitioner, a CEO leading a company, a venture capitalist investing in new business, or serving in the government.

As an engineer, the ultimate goal is to inspire by demonstrating results. In the grand scheme of things, being an engineer means creating for the betterment of society and human life; engineers need to enable, to do, and to lead. The ability to lead comes with the ability to inspire and get the best outcome in any environment or in any situation.

Leadership has great impact outcomes, from the war room to the boardroom to the engineering profession. There are different definitions and variations of leadership. I would define "leadership" as the ability to influence the outcome, not necessarily to command and control. In contrast to some opinions on this, I believe that leadership can be learned and nurtured. In any case, wanting to learn to be a better leader is always rewarding, especially for engineering professionals.

As an engineer, sharing knowledge and insights is a fulfilling experience. Outside my day job, I am invested in both writing and teaching; serving as an editorial columnist for two global industry magazines has been a meaningful endeavor to me. These publications disseminate timely information to readers who are mostly engineering-trained professionals. I have taken on this weekend employment for over 35 years. When it comes to speaking, I have delivered professional development courses, lectures, workshops, and webinars over the years to tens of thousands of engineers, researchers, and executives interested in continuing professional education in the workforce. This experience has allowed me to interface with engineering practitioners and executives, which helps me relate my engineering education to the workforce.

Teaching, like writing, has helped me develop and clarify my own thoughts; to that end, it is a self-fulfilling task as well.

I am happy to be helpful to younger women engineers; being helpful and being able to contribute is a good feeling.

In one of my speaking engagements, the president of the Society of Women Engineers (SWE) Cleveland wrote to me after the event:

Dear Dr. Hwang, on behalf of SWE, I would like you to know how much I appreciate your illuminating speech at the SWE. Because of this successful event, SWE has plans for expanding our mentor program. I was inspired by your journey to success. I plan to attend graduate school and your story of balancing professional accomplishments with a rewarding personal and family life encourages me to pursue all my dreams.

It is tremendously humbling to read letters like this from budding young women engineers.

Another experience that has been formative for me is my advisory capacity to the U.S. Defense Department's ManTech program. In the late 1980s, the Defense department's ManTech program set a goal to reduce cost and to enhance the reliability of electronics weapons on a national scale. The Army Materiel Command was searching for advice, not only academic scientific expertise but also manufacturing know-how. After my first book was published in 1989—in which I related microelectronics/electronics technology to manufacturing—I was invited to be an advisor to help advance that goal.

Looking back, it was an efficacious and satisfying task. Certainly, working in this capacity meant putting my engineering background to work. This is also another manifestation of the substantial role of engineering to national defense and security.

Distilling from my commencement speech at Ohio University, a few points on this topic are perhaps worth sharing:

- Keep a broad perspective to develop a world view—this is especially applicable to engineers.
- Always acquire new knowledge and skills, and learn fast.
- Meet a challenge head-on and go for creativity and innovation.
- Prepare to deliver more than what is expected in any task.
- Keep in mind that the best preparation for tomorrow is to do today's work well.
- When opportunity knocks on your door, you will be able to open the door. If a door does not exist, build one.
- Success is a journey—a long, steady journey, made of many, little, daily victories.
- Nothing can replace hard work. **SMT007**

Dr. Jennie S. Hwang—an international businesswoman and speaker and a business and technology advisor—is a pioneer and long-standing leader to SMT manufacturing since its inception as well as to the development and implementation of lead-free electronics technology. Among her many awards and honors, she was inducted to the International Hall of Fame–Women in Technology, elected to the National Academy of Engineering, named an R&D Star to Watch, and received a YWCA Achievement Award. Having held senior executive positions with Lockheed Martin Corp., Sherwin Williams Co., and SCM Corp., she was the CEO of International Electronic Materials Corp. and is currently CEO of H-Technologies Group, providing business, technology, and manufacturing solutions. She has served on the board of Fortune-500 NYSE companies and civic and university boards; the Commerce Department's Export Council; the National Materials and Manufacturing Board; the NIST Assessment Board; as the chairman of the Assessment Board of DoD Army Research Laboratory and the chairman of the Assessment Board of Army Engineering Centers; and various national panels/committees and international leadership positions. She is the author of 600+ publications and several books and is a speaker and author on trade, business, education, and social issues. Her formal education includes four academic degrees, as well as the Harvard Business School Executive Program and Columbia University Corporate Governance Program. For more information, visit JennieHwang.com. To read past columns, click here.