Preparing the Manufacturing

BY KHALIL S. TARAMAN

Manufacturing has a new face—and the future it offers is exciting. But in order to take advantage of what it offers, you need a plan and you have to know how to execute it. We have both. Our mission to transform and advance manufacturing education has received considerable support from major industry, corporations, and an amazing contingent of grassroots organizations and passionate volunteers. You can't defend what you don't revere, so it has become very obvious to us that those who do support us—respect manufacturing. When was the last time you heard someone say, "I want to be a manufactur-

Next American Workforce

ing engineer?" You haven't? Why not? We think the problem might be that manufacturing as an industry has been dialoguing with itself rather than advancing its message to the general public, including our easily influenced next generation.

When young people become aware of innovative technologies that are generating cleaner power, be it wind farms, solar panels or underwater turbines, or observe digital technology and nano-medical devices saving lives—do you think they associate these advancements with manufacturing? If not, we may have to come to realize that the future of manufacturing and its career potential are being compromised. Education has finally become a critical issue, all due, we think, to the financial structures of our economy being shaken, the cross-industry loss of jobs, and rapid advancements in emerging technologies. All of these scenarios have generated highly vocal opinions from government, private industry, educators, parents, students and of course, the media.

Many have opined on how best to address the loss of jobs in the U.S., the transfer of manufacturing plants and jobs to markets in China, Japan, Brazil and Mexico, the unforgiving shortfall in our skilled labor force and the resultant unmet need for skilled workers. In the cacophony of ideas, some well-thought out, others not, we have been able to successfully address the needs of industry to transform manufacturing education and have been able to secure critical support.

The Society of Manufacturing Engineers Education Foundation

The Society of Manufacturing Engineers (SME) Education Foundation has, for more than 30 years, connected to an impressive and diverse cross-section of the economy. We continually expand our efforts because decisive decisions are made, not by the self-interest of the business and academic communities, but made on the frontline with broader input coming from aeronautical engineers to inventors and innovators, medical and pharmaceutical practitioners and a host of others. We are all working toward a common goal—influencing and encouraging young people to pursue manufacturing engineering careers by focusing on science, technology, engineering and math (STEM) education. If we are successful in reaching them, we think they will be better able to align themselves with emerging technologies and the skilled, high-demand jobs that industry has told us it will need.

With too few students considering manufacturing as a career and entering STEM fields, it is critical that support and opportunities be provided to those showing career potential. Beginning in elementary school, let's give them a career advantage by inspiring them with the big picture. They need an educational roadmap—showing them where to stop, focus their attention, and hone interdisciplinary learning. Young people, unaware of how engineers apply the principles of science and mathematics to develop economical solutions to technical problems, need to be introduced to the sustainable careers it provides. They also need direction. And so, when counseling and offering encouragement, their parents, educators and mentors should include basic economics in a way that makes it relevant to their age, personal experience and level of knowledge.

The ability of this country to research, design and develop innovative manufacturing technologies is critical in our ability to increase productivity in durable goods, which increases employment and provides economic and social well-being.

Here's why: manufacturing creates wealth but is seldom the subject of discussion. Characteristically, money and an opportunity to establish financial worth are great motivators, especially for young people. If you ask, "Who creates wealth?" We think it unlikely they would answer, "Manufacturing!" That message has to be reinforced. The ability of this country to research, design and develop innovative manufacturing technologies is critical

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in our ability to increase productivity in durable goods, which increases employment and provides economic and social well-being. They might be surprised to learn that buying the latest iPod or digital camera creates wealth.

On the average, technology has been found to be the leading contributor to productivity improvements. SME provides technology that can boost productivity and provides access to a vast well of information and technology helping manufacturers become more productive; and through our SME Education Foundation, we provide access to programs designed to help young people focus on the critical STEM basics of their education. But how can these young people be excited about the future if they don't have any idea of where they're going or what it is going to take to get them there? Saying, "study and work hard" is non-defining and hardly inspirational.

Worker Shortages Predicted

Today, nearly 30 percent of workers with science and engineering degrees are age 50 and older. As a result, our future technical workforce is at risk and U.S. manufacturing is being lost to overseas markets in Japan, China, Korea and Brazil. As industry demands on the workforce increase, so must student knowledge of 21st century skills. The Bureau of Labor Statistics predicts the U.S. will face a skilled-worker shortage of 8 million by 2010, up to 14 million by 2014. Take notice of the word, "skilled." As a result, preparation of our future technical workforce is more important than ever.

In order to be an integral part of this new world, two major components are critical to a successful career, the first is having an education which provides you with transferable skills and the second component is being personally flexible. Today, advanced technologies are being researched, developed and launched at an accelerated rate and educators at all levels are faced with a parallel challenge: educating themselves while concurrently tracking the development of emerging technologies, and developing curriculum that will respond to the needs of educating our future workforce.

In our infancy, the SME Education Foundation fostered and promoted manufacturing engineering curricula in colleges and universities through the administration of various award programs totaling $6.9 million in cash grants and more than $59.8 million in equipment and software gifts to 357 college and universities. But it wasn't enough. By the mid-1990s, we had a reality check. Decades of research by prominent organizations in industry, government and education pointed to the competency gaps between industry's manufacturing needs and educational programs offered. Our mission had become all too clear, competencies weren't there, the gaps had to be identified and a remedial educational process put into place.

A Manufacturing Education Plan

In late 1996, SME announced the formation of a steering committee for our Manufacturing Education Plan, to be co-sponsored by SME and the SME Education Foundation. To assure its success, SME gave the foundation $3 million to fund a grant program that would address industry's needs. Our aim was to work with industry and education to transform manufacturing education to better prepare tomorrow's engineers and meet the new technical and business demands of the 21st century. Industry-based workshops served as a prime gathering place and brought together manufacturing professionals from automotive, aerospace, heavy equipment, consumer goods and process industries, machine tools and electronics manufacturing. Each industry identified competency gaps in their respective segments which included personal characteristics and skills—and on the technical side, concerns about hiring graduates who understood issues related to quality and continuous improvement, the proper use of new material and the importance of hands-on experience.

Armed with an investment of $1.7 million in its first year, our Manufacturing Education Plan initiative targeted three audiences: K-12 and its postsecondary career and technical education programs, lifelong learning processes, and colleges and universities where funding educational programs required them to leverage matching funds from local industry. For the K-12 audience, we created the *Manufacturing is Cool!* Web site providing students, parents, teachers, guidance counselors and volunteers with information on scholarships, summer camps and assistance in curriculum development. For manufacturing engineers, we designed a professional competency system

which identified required competencies and a course of remedial study. For our third audience, colleges and universities, we invited them to submit proposals for new curriculum addressing one or more competencies required by industry.

Our validation process resulted in a large number of awards which included cash grants, equipment and software. Now, nearly 13 years later, the benefits of the plan are being realized and we are now laying the groundwork for preparing the skilled workforce that will be needed in the next 10 years—2020.

The plan provides a critical schematic for manufacturing education. Innovative grants to 26 colleges and universities have supported exceptional manufacturing curriculum in microelectronics, optoelectronics, semiconductors, aerospace, distance learning, laboratories, certificate programs, real-world manufacturing facilities and outreach programs providing hands-on learning experiences. Most recently, we provided funding for a virtual medical device laboratory for education of medical devices, a comprehensive training factory and laboratory system for manufacturing education and a program specifically designed to prepare manufacturing technologists for the future.

Preparing the Next Generation

In collaboration with Project Lead The Way, a nonprofit that creates innovative pre-engineering curriculum, we have organized more than 237 Gateway Academies in 36 states where talented secondary students explore careers in STEM. Our concentrated focus on STEM education continues to successfully impact middle and high school students in programs offered through our Gateway Camps, Gateway Academies, and sMe (Summer Manufacturing Experience) Institute.

These youth programs are unique. For example, one of our Gateway Academy programs for fifth- and sixth-graders included the basics of computer design, fuel cell engineering and robotics which complemented an introduction to aeronautics. We think that by having young people excited about participating in solar energy science projects, studying the basics of hydrogen to understand how fuel cells are made, or the importance of mathematics in the investigation of water quality—they cannot help but be motivated and want something more for themselves.

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Our next generation is exploring the world to find their place in life and doing so with great confidence, excitement and the spirit of adventure. No longer limited to the predictable venue of the textbook/classroom, young people, in most instances, are already more tech savvy than their would-be instructors. A percentage of our young people are able to continually expand the boundaries of their academic and social learning experiences with online learning, or they travel social networks and set up their own Facebook pages with blogs and tweeting, connecting them to friends and family. We would like to see young people enthralled and challenged with the idea that they might be able to take their highly adaptive computer abilities and look at education in a new way; perhaps they may consider applying their knowledge to molecular sciences or biomedical manufacturing.

Do you think they have ever been able to visualize being a part of a Web-based management system that embraces supply chain systems between complex multi-manufacturers? Or, have they imagined that their aspirations can be realized in the aerospace and defense industry? The economic decline in manufacturing over the past five years has increased the visibility of the manufacturing industry—with concern in the United States about the nation's ability to maintain its defense capability. The need for engineers is great, and industries are being very specific when they describe the challenges of their new technologies, and the skills that will be required of their workforce.

The Time is Now

According to a recent article published in *Manufacturing Engineering* magazine, General C. Robert Kehler, commander, U.S. Air Force Space Command, Peterson AFB, Colorado, says, "We're going to need better propulsion, better power, better plug-and-play technology. There is a crisis in the workforce with estimates projecting a shortfall in experienced scientists and engineers who support space science and technology development. At the event of the next space age, we must take all these challenges into account." Our youth programs, scholarships and awards need the support of donations to protect and continue our ability to showcase and introduce young people to life's career possibilities. The benefits of donating exceed description, but most importantly, it helps to protect manufacturing as an industry in our country. T

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