Traditionally, U.S. universities have shied away from education and research in the area of industrial maintenance and reliability. While many institutions have developed excellent capability in statistics, probabilities, and other mathematical approaches to the science of reliability, most have largely ignored the more practical areas of industrial reliability and maintenance, much to the detriment of the manufacturing and service sectors. (However, it should be noted that a handful of universities have been active in this area—some with educational pursuits and some with significant research pursuits.)

Whether maintenance and reliability has been deemed "unworthy" of consideration by university faculties or has simply been overlooked in the constant review of which important subject matters to include in an already compressed educational curriculum, academia generally has missed emerging opportunities to deliver in the area of good, practical maintenance and reliability know-how and education.

**Change is not occurring fast enough**

We have all heard of the various unofficial studies that indicate U.S. industry spends hundreds of billions of dollars (most say between $300 billion and $500 billion annually) on direct maintenance-related issues, and this does not include the resultant losses of production throughput followed by both profit and business loss. Further, industry practitioners suggest that at least one-third of those direct costs are wasted due to the performance of improper maintenance.

Surprisingly, and alarmingly, that percentage of wasted effort appears to not have changed significantly over the past several years, despite advances made both in production methodologies and in advanced maintenance and reliability tools and technologies. It would appear that the advances are being utilized only in small amounts or in narrowly focused applications. Thus, industry's view of maintenance has generally remained characterized as "a necessary evil" or "a necessary cost drain." Unfortunately, today's engineers, business leaders, and other decision-makers have learned their view of maintenance and reliability on the plant floor from a culture that did not value it or realize its potential for strategic advantage.

A major factor in the inertia holding back the maintenance and reliability advances is the lack of appropriately educated engineers, business majors, and others entering the workforce. Typically, U.S. engineers and business majors have little contact with maintenance and reliability concepts during their undergraduate years. While engineers will see a bit of reliability statistics and probabilities in one or two of their courses, it is normally delivered in a

very theoretical format that leaves students wondering why they are even studying it. Business majors may be taught that maintenance is considered a "controllable cost," but hear little or nothing more about it.

Often, the new graduate's first introduction to the real world of maintenance and reliability is "on the job" in a plant where the activity is led by and reinforced by the old guard's philosophy of "maintenance is a necessary evil." Thus, the opportunity to utilize their creative and energetic minds is immediately diminished and misled by their environment.

**Industry is the "customer"**

Universities should recognize that industry needs qualified graduates to bring about change in the workplace. Universities should recognize that improved reliability and maintenance is absolutely key to the long-term survival and health of our industrial and services base.

Universities should accept their responsibility to deliver graduates who can enter today's business world and make a difference—and that includes modernizing and optimizing the approach to maintenance and reliability. Concepts, systems, and tools already exist to significantly improve present maintenance practices. Concepts, systems, and tools already exist to radically improve the reliability of equipment and processes. What does not exist is a large-enough pool of graduates educated in these areas to make the critical difference.

Universities also need to recognize and seize upon the opportunities that exist for doing research and technology assessment in these fields. Many of today's advances have been brought about by practitioners in industry applying concepts and tools developed in other fields for other applications. While great strides have been made, the speed and amplitude of progress could be greatly increased by appropriate research and technology development directed toward maintenance and reliability. Understanding the fundamentals of vibration analysis, eddy current testing, signal conditioning, etc., could lead to further development of tools and systems directly applicable to industry.

**Industry must play its part**

Too often, industry takes university graduates "as they are," assuming it will have to educate them in the "real world" after they graduate. And to a degree, that is true. You cannot put a lifetime of experience into a four-year university curriculum. Nor can you cover the specifics of every industry during the university years. But industry can influence what universities put into their programs. Industry can assist in introducing basic concepts of technologies and

systems into university curricula.

Universities operate under the same universal law of supply and demand that industries do. As jobs and career opportunities change, so do university offerings. As industry demands students with knowledge and skills in the areas of maintenance and reliability, university programs will grow and improve to meet those demands. Industry needs to seek out and participate in dialogues concerning the future improvements to university curricula and programs. Industry can make a difference.

**There is hope**

I have painted a fairly bleak picture so far. However, there are some rays of light. A few universities are addressing some of these issues.

There are several graduate programs in reliability. There are a few undergraduate programs dealing with maintenance and reliability. Several business schools are introducing the theme of reliability and maintenance excellence through their Lean Manufacturing (or similar) curricula. There are several continuing education programs offering professional development through short course work. Several universities do research work that can be applied in this area. Future columns will address some of these programs as examples of what can be accomplished by those who wish to make a difference.

**SMRP support**

The Society for Maintenance & Reliability Professionals (SMRP) is trying to help bridge the maintenance and reliability gap between universities and industry. They have recognized the need for universities and colleges to develop programs supporting maintenance and reliability.

They have supported a SMRP student chapter at one university and provided scholarships at two different universities for students studying in the field of maintenance and reliability. They have given various faculty members the opportunity to present papers at their annual conference. They have agreed to sponsor students at their annual conference. And they have encouraged their members to become active with universities to promote maintenance and reliability programs.

**Individuals can help**

What can you do to make an impact? Actually, you can do more than you probably realize. While there is truth in the notion that academic programs are somewhat rigid, hard to change, and subject to faculty desire, there is also truth in the law of supply and demand.

If industry sincerely raises the demand for graduates with education and training in maintenance and reliability, then universities will respond to meet that demand. Universities—faculty, administration, and students alike—are very aware of and sensitive to market forces and what disciplines are in demand. Make your voice heard—through advisory boards, through personal contacts, and through your hiring practices. You can make a difference.

**The challenge to work together**

A huge gap exists today between universities' offerings and industry's maintenance and reliability needs. This is due both to universities generally shunning this area of educational responsibility and to the general reluctance of industry to address the opportunities in this area. Only a small percentage of companies have truly tried to deal with maintenance and reliability as an investment opportunity.

However, the demands of today's world of manufacturing and services dictate that maintenance and reliability must be treated differently. This is an almost-unparalleled opportunity for universities and industry to move forward together and fill the gap through the right combination of education, research, information exchange, and business support. Step forward and be part of grasping this opportunity. **MT**