

In recent years, no word has caused more debate and concern in the American engineering community than globalization. This word has only been in common use since the 1980s, when it started to replace the term free trade. Nevertheless, an Internet search for globalization on Google now yields about 105 million webpage links. Many trends have been identified as significant concerns for the future of the engineering profession in the United States, yet globalization is repeatedly singled out as the biggest threat. Is this justified? Does globalization present an opportunity as well as a threat? Exactly what is globalization?

The International Monetary Fund defines globalization as:

A historical process, the result of human innovation and technological progress. It refers to the increasing integration of economies around the world, particularly through trade and financial flows. The term sometimes also refers to the movement of people (labor) and knowledge (technology) across international borders. There are also broad cultural, political and environmental dimensions of globalization.¹

Wikipedia defines globalization as:

The worldwide phenomenon of technological, economic, political, and cultural exchanges, brought about by modern communication, transportation, and legal infrastructure as well as the political choice to consciously open cross-border links in international trade and finance. It is a term used to describe how human beings are becoming more intertwined with each other around the world economically, politically, and culturally. Although these links are not new, they are more pervasive than ever before.²

Within the American engineering community, globalization is usually defined in much narrower terms. Engineers are generally



Globalization: Threat or Opportunity?

concerned with two facets of globalization: (1) worker importation, particularly as it relates to H-1B visas, and (2) work exportation, typically referred to as outsourcing or offshoring.

Historical Perspective

Globalization has been around almost since the advent of civilization. Alexander the Great, Julius Caesar, and many other early historical leaders actively promoted globalization. So did Marco Polo, by opening trade routes between Europe and Asia. While trying to develop better trade routes, Christopher Columbus inadvertently discovered the Western Hemisphere. The United States was subsequently settled and developed by Europeans who took risks and overcame hardships to pursue economic opportunity, providing a glorious testament to the power of globalization. On the other hand, many centuries of widespread slavery

provide an ugly testament to that power.

With the exception of slavery, the first form of globalization was the international exchange of goods. During the 17th and 18th centuries, the American economy was based on agriculture and society was mostly rural. American commodities were traded for European manufactured goods. Beginning in the middle of the 19th century, much of the population shifted to America's burgeoning cities, spurred by rapidly expanding industrial development and improved transportation networks. Manufacturing was king by the late 1800s. Then, beginning in the middle of the 20th century, the economy shifted again. This time, in large part due to globalization, massive numbers of manufacturing jobs and substantial capital investment moved overseas. The basis of the U.S. economy transitioned from products to services by the late 1900s.

Now, as we enter the 21st century, another shift is underway. Advances in technology have facilitated further "shrinking" of the world as we know it. Globalization of many services has become both viable and attractive. This should not come as a surprise. Rather, it is the natural evolution of a phenomenon that has been around for centuries. The root of globalization is capitalism (to some, this amounts to greed). Capitalism is also the root of Western civilization. Consequently, globalization has become an integral part of the modern world. Despite the wishes of some, it is unstoppable and irreversible. In fact, aided by ever-advancing technology, globalization can only be expected to grow.

Sooner or later, all American engineers will be affected by globalization. Specifically, I believe that all consulting engineers will be affected within the next 20 years. Those working for large firms (ENR Top 500)³ will

be affected in 5-10 years, and those working for huge firms (ENR Top 100)³ have been already affected. It is not a matter of if, but rather of when. How American engineers cope with globalization will determine their future and that of their firms. Collectively, it will determine the future of the engineering profession in the United States.

Worker Importation

There are a variety of visas available to temporary immigrants in the United States. The two that are of primary interest to engineers are the Student Visa (F-1) and the Specialty Worker Visa (H-1B). While consulting engineering firms hire many more immigrants with F-1 visas than with H-1B visas, it is the latter that generates the most media attention.

Immigrants with F-1 visas are allowed up to 12 months of practical training beyond their education. Thus, many are able to

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enter the workplace for a full year following graduation. Unless they obtain another type of visa during that period, however, they must return to their country of origin when their F-1 visas expire. Employers have no extraordinary requirements related to their employees that have F-1 visas.

Immigrants seeking H-1B visas must be individually sponsored by a specific employer. The employer must go through a due diligence process to demonstrate that the position cannot be filled with an American citizen. Employers must also certify that they will be paying the immigrant at the prevailing rates appropriate for the position. If granted, the H-1B visa is valid for a period of three years and can be renewed for one additional three-year period, for a total of six years. If the immigrant is actively seeking a Permanent Resident Card (a.k.a. Green Card) at that time, his/her H-1B visa might be renewed annually. Otherwise, the immigrant must return to his or her country of origin.

Although many consulting engineering firms hire temporary immigrants with F-1 and H-1B visas to address their short-term production needs, in my opinion, they do so at considerable risk. Due to differences in language and culture, most of these employees will initially be less productive than their American born counterparts. It will take time to develop their knowledge, skills, and confidence to the point where they can function as effective engineers. Meanwhile, the clock is ticking toward the expiration of their visas. Many temporary immigrants are forced to return to their country of origin within one to three years. Most of the rest must return after six years because there are no guarantees of obtaining Green Cards. Consequently, engineering firms that hire temporary immigrants generally pay them well beyond their value and invest further resources in their training, only to say goodbye just as they start to become productive employees.

Perhaps my opinion is skewed by personal experience, but I do not believe that hiring temporary immigrants makes much business sense. In the short term, most temporary immigrants are not very productive; in the long term, most must return to their country of origin. The smarter path, especially for consulting engineering firms with a long-term perspective centered on quality, is to focus recruiting efforts on top notch students that (1) were born, raised, and educated in the United States, or (2) are immigrants that have already gained Permanent Resident status in the United States.

Work Exportation

Exporting work is certainly not a new concept. When working in new geographic areas, consulting engineering firms normally seek local partners. On public sector projects, firms have traditionally teamed with others to better meet all anticipated technical requirements. In recent decades, most public sector projects have also required substantial minority participation. Any work produced by more than one firm can be considered to be a form of outsourcing. These traditional and noncontroversial outsourcing efforts have typically been made to improve service to existing clients as well as to build new business.

The new and highly controversial trend is outsourcing engineering work overseas for the express purpose of cutting costs. Once again, this is a natural outgrowth of capitalism. In recent decades, many emerging regions have been producing quality engineers in higher numbers than the United States and Western Europe. In particular, Japan, China, and India have been prolific. In the case of India, most of these engineers are fully literate in English. Even a number of "Third World" countries have developed credible engineering schools. With the exception of cutting-edge innovation, the argument for the vast technological superiority of the United States no longer holds up.

I long believed that consulting engineers had nothing to fear from lower-priced foreign competition as long as they focused their businesses on providing services rather than products. However, there is now an undeniable trend of project owners increasingly valuing low cost over quality service. These owners are buoyed by their fleets of attorneys, who promise to remedy any quality problems at the courthouse. With recent



advances in communications and transportation, the belief that firms can indefinitely fend off international outsourcing by offering top quality services is losing validity.

When all else fails, there is always good old-fashioned protectionism. For nearly a century, American engineers justifiably felt that they were protected by state licensing laws and regulations, especially with respect to "direct supervision." For example, the Texas Board of Professional Engineers (TBPE) traditionally published and enforced very strict rules to prohibit "plan stamping." The June 2005 version of the TBPE Rules defines direct supervision as:

Critical watching, evaluating, and directing of engineering activities with the authority to review, enforce, and control compliance with all engineering design criteria, specifications, and procedures as the work progresses. Direct supervision will consist of an acceptable combination of: exertion of significant control over the engineering work, regular personal presence, reasonable geographic proximity to the location of the performance of the work, and an acceptable employment relationship with the supervised persons. Engineers providing direct supervision of engineering work under the [Texas Engineering Practice] Act shall be personally present during such work.⁴

Active enforcement of the last sentence of this definition effectively precluded the legal outsourcing of engineering work on projects based in Texas. That abruptly changed when the TBPE Rules were revised. The March 2006 version of the TBPE Rules defines direct supervision as:

The control over and detailed professional knowledge of the work prepared under the engineer's supervision. The degree of control should be such that the engineer personally makes engineering decisions or personally reviews and approves proposed decisions prior to their implementation. The engineer must have control over the decisions either through physical presence or the use of communications devices.⁵

The last six words of this revised definition now provide an effective loophole that will permit worldwide outsourcing of engineering work on projects based in Texas. All state licensing boards actively watch each other and tend to follow new regulatory trends, such as mandatory continuing education and registration of engineering firms. Thus, it will only be a matter of time before

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other states start to follow Texas and relax their definitions of direct supervision.

Turnabout Is Fair Play

Free trade works both ways, or as my mother used to say, "What's good for the goose is good for the gander." English, French, and Italian engineering firms have been working internationally for decades. American engineering firms have traditionally been somewhat reluctant to pursue international work. The reason most commonly given can be summed up in a famous quote from Paul Newman, "Why go out for hamburger when you can have steak at home?" In an ever-changing world, this view is extremely shortsighted. As a result of globalization, American engineering firms are now more able than ever before to pursue attractive projects all over the world. These opportunities are not limited to large engineering firms. They are limited only by the vision and perseverance of engineering firms' leaders.

Once again, Texas provides an example. The North American Free Trade Agreement (NAFTA) has been heavily criticized as destroying American jobs, but actual experience in Texas has been just the opposite. In response to NAFTA, TBPE negotiated and signed a Mutual Recognition Document⁶ with its counterparts in Mexico and Canada in 2002. Under the provisions of this agreement, professional engineers in Texas have reciprocity with the states and provinces of Mexico and Canada in much the same manner that they have reciprocity with other American states. Similarly, Mexican and Canadian engineers have reciprocity with Texas. The result to date has not been an influx of foreign engineers working on projects in Texas. To the contrary, Texas engineers can now be found actively working on projects throughout Mexico and (to a lesser degree) Canada.

My firm has fewer than 500 employees and is based in Dallas, Texas. More than a decade ago, we learned how to prepare construction documents with Spanish text and metric units. Since then, we have

enjoyed a steady stream of Mexican projects. Much of our work has been for American clients, but a number of projects have been undertaken directly for Mexican interests. Although some engineers travel to meetings and conduct site visits in Mexico, all of the production work is undertaken by our staff in Texas. For several years, we also partnered with a Mexican developer to jointly own an architecture firm in Mexico City. Our ongoing experience with Mexican projects has generally been quite positive, both financially and professionally. Consequently, we now selectively pursue projects in a number of countries.

Your Decision

Hugh Miller wrote⁷, "Problems are only opportunities with thorns on them." I believe that this succinctly describes globalization, an opportunity disguised as a thorny problem.

Globalization is not a trend. Like death and taxes, it is firmly established as an integral part of the modern world. Moreover, it will inevitably grow with further advances in technology. Over the next few years, all American engineers will be affected by globalization. This presents both a threat and an opportunity. Some engineers and engineering firms will undoubtedly resist change. Like auto and textile manufacturers, they will suffer when the changes brought about by globalization are thrust upon them. Other engineers and engineering firms will view the shrinking world as an expanding market for their services and will proactively seek ways to benefit. Many of them will excel by embracing the changes brought about by globalization. Which path will you follow? ■

RECOMMENDED READING

On coping with change: Johnson, Spencer, M.D. (1998). *Who Moved My Cheese?* New York: G. P. Putnam's Sons.

On the speed of globalization: Friedman, T. L. (2006). *The World Is Flat: A Brief History of the Twenty-First Century*, Release 2.0. New York: Farrar, Strauss and Giroux.

References

- ¹<http://www.imf.org/external/np/exr/ib/2000/041200.htm#II>
- ²<http://en.wikipedia.org/>
- ³http://www.enr.com/people/topLists/topDesignFirm/topdesign_1-50.asp
- ⁴Texas Board of Professional Engineers (2005). Texas Engineering Practice Act and Rules Concerning the Practice of Engineering and Professional Engineering Licensure, Effective June 2005, Austin.
- ⁵http://www.tbpe.state.tx.us/downloads/law_rules306.doc
- ⁶<http://www.tbpe.state.tx.us/comity.htm>
- ⁷Miller, H. (1987). *Snow on the Wind* (fiction). New York: St. Martins Press.

About the Author

Stan R. Caldwell earned BSCE and MSCE degrees at the University of Wisconsin and has gained 36 years of experience as a structural and architectural engineer, including more than 30 years as a manager. He is a licensed professional engineer in 6 states and has supervised the analysis and design of more than 700 projects, including buildings, bridges, and special-purpose structures. He has served as project manager for an industrial corporation, branch manager for a structural engineering analysis firm, and founder of a structural engineering design firm. Since 1988, he has been a principal at Halff Associates, a multi-discipline design firm in Texas. His professional experience has included numerous leadership positions in ASCE, AEI, BSC, NCSEA, SEAoT, CEC-T, and TBPE. He founded the Architectural Engineering Institute in 1998 and the Building Security Council in 2005. Also in 2005, he was elected as the first Technical Region Director on the ASCE Board of Direction.