

The Strategic Value of Standards Education

By

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In 1975 I left my position as an antitrust attorney at the U.S. Federal Trade Commission to become the in-house counsel at the Outdoor Power Equipment Institute, a manufacturing trade association that, among other things, managed the standards setting activities of the industry pursuant to the procedures of the American National Standards Institute. At the time, I had no knowledge or awareness of the strategic significance of technology standards. After assuming my new duties, the President of the association asked me to work with the Technical Director who supervised the standards setting activities of the association. The President requested that I use my best efforts to assist the Technical Director in development of technology standards necessary for the industry to grow and develop, and at the same time, help the standards setting committees to avoid any potential pitfalls concerning public policy or legal issues.

After attending a few standards setting meetings, it became obvious to me that the engineering participants were collectively creating the future technology foundation for virtually all of the industry's products. I concluded then that standards setting committee activities were as important as any association Board of Directors meeting. I continue to hold to that view today.

In 1977, I left OPEI to become the President of the Portable Power Equipment Manufacturers Association. The primary purposes of the Association were to manage the private sector and public sector (regulatory) standards activities of the industry. For the next 22 years, I traveled with the Association's standard setting committees throughout North America, Europe and Asia as an advisor on the industry's technology standardization programs. In 1999, I left PPEMA to teach at the Catholic University Schools of Engineering and Law, conduct research, and write about the strategic value of technology standards and the process of strategic standardization.

Current State of Standards Education Programs

At the present time, the overwhelming state of standards education programs depends almost entirely on programs developed in the private and public sectors, e.g., firms, corporations, standards setting organizations, government departments and agencies. That is true not only for the United States, but all other nations actively engaged in the development of technology standards. It should be noted that of the 180 nations in the world, it is estimated no more than 40-50% of the nations are engaged in technology standardization in a meaningful way.

When considering the academic sector, the following countries have universities which offer standards education programs: China, Germany, Holland, Japan, South Korea, and the United States. At the present time, the countries leading the field of academic programs for standards

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education include China, Japan and South Korea, for example, South Korea has more than 40 universities and 7,000 engineering students enrolled in a standards education course.

China has more than 30 universities engaged in standards education. At least one university, Jiliang University, has developed a comprehensive standards education program where some of the best and brightest Chinese engineering students attend an extensive course on the development of technology standards (http://www.iso.org/iso/iso_focus_nov_2007_-_article_prof_song_mingshun.pdf).

In the United States, there are more than 2,500 universities and colleges. And yet, only 3 university schools of engineering currently offer a standards education course at the graduate level: (1) the Catholic University School of Engineering (<http://engr.mgmt.cua.edu/curriculum/CMGT-564.cfm>), (2) the University of Colorado (Boulder) (http://telecom.colorado.edu/sites/default/files/docs/TLEN5834_Syllabus_Standards.pdf), and (3) the University of Pittsburgh (<http://www.sis.pitt.edu/~spring/courses/is2560syl1074.htm>). To the best of my knowledge, there are no standards education courses currently offered at any university school of business, public policy, economics, international trade or law in the United States.

In 2012, the U.S. National Institute of Standards and Technology (NIST) issued five grants to US universities to create a new standards education course (Georgetown University, Michigan State University, San Jose State University, Northwestern University, Purdue University and SES, jointly). In 2013, it is expected NIST will issue an additional five grants to other US universities to create a new standards education course. In brief, there should be at least 13 universities in the United States offering standards education programs in the near future.

In the United States, the private and public sectors continue to offer most of the standards education programs that exist, for example, the American National Standards Institute (ANSI), the Society for Standards Professionals (SES), ASTM International, IEEE, American Petroleum Institute, and several global companies such as Microsoft, IBM, Intel, and Oracle are exceptionally active in the field of standards education. In the public sector, NIST and the U.S. Department of Defense offer some excellent standards education programs. The educational content among standards education programs in the United States varies widely depending on the needs of the individual organization.

In addition to universities in Holland and Germany, several non-profit organizations in Europe such as the European Academy of Standardization (<http://www.euras.org>), the International Electrotechnical Commission (http://www.iec.ch/etech/2012/etech_0612/wld-3.htm); and the International Organization for Standards (<http://www.iso.org/iso/home/standards/standards-in-education.htm>) are exceptionally active in the creation of standards education programs. For example, ANSI and ISO are sponsoring a conference on “The role of standardization in strategy, innovation and entrepreneurship” in Washington during June 2013.

To significantly improve standards education opportunities at the university graduate level, it is recommended that standards education courses be offered at part of the curriculum for undergraduate students, and, if possible, included in high school curriculums. However, the

principle challenges in creating standards education programs at either the university undergraduate level, or in high school, are that only a very limited number of faculty, if any, have experience with standardization. In practical terms, it is not possible for any university to create a standards education course unless there are experienced faculty members who have actual experience in the field of standardization.

Strategic Standardization

The purpose of the course for *Strategic Standardization* (CMGT 564) at the Catholic University of America School of Engineering is to create a level of awareness among graduate engineering students concerning the strategic value of standards and standardization. Since 1999, approximately 175 students have taken the course, however, only 3 graduate students had any experience with standardization.

In a world dominated by technology, science and globalization, it is of critical importance that practicing engineers have a fundamental understanding of these concepts. To the best of my knowledge, this course is the only course in the United States that covers fundamental principles associated with the development of technology standards as well as public policy and legal issues associated with standardization. To review the curriculum for this course, see www.strategicstandards.com (strategic education page). Although the focus of the course at the present time is engineering students, the course would be suitable for university schools of business, public policy, economics, international trade and law.

In order to participate in the field of standardization effectively, practicing engineers need to develop a multidisciplinary perspective, the ability to analyze complex engineering, scientific and technology issues in a multidisciplinary environment, and the ability to communicate their analysis effectively. Typical sources of a multidisciplinary perspective include a background or experience with engineering, scientific, technology, economic, business, international trade, public policy, legal and/or strategic planning issues.

The Fundamentals of Strategic Standardization

Set forth below is a slide that I have used in all my presentations since 2005. I first used this slide in a presentation to the Chinese Information and Technology Industry at a conference held in Beijing. This slide is a summary of everything I have learned about the strategic value of technology standards and the process of standardization since 1975. In short, it is my *Elevator Speech* and contains all of the fundamental principles of strategic standardization if I had to give a presentation in a 3-5 minute period. Everything else in this article, and most other articles and books on standardization, is merely detail.

In the center of the slide is a bridge. On the right hand side of the bridge are *all* of the technologies available in Commerce. On the left hand side of the bridge are *all* of the markets for the technologies. The only way a technology can get to market is to cross the bridge. The bridge represents a standard. The bridge was developed and is being maintained through the process of standardization. In effect, the bridge is a critical link between technologies and

markets. The key sentence in the slide is, “*Whoever controls the bridge controls the future...*” The remainder of this article attempts to further explain this slide.

Strategic Value of Standards

Standards are a bridge between markets and technologies

Markets:

- Consumer
- Commercial
- Government



Technologies

Whoever controls the bridge controls the future...

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Definitions of Standards, Standardization and Strategic

My favorite definition of Standards is contained in the 1992 report to Congress, (*Global Standards – Building Blocks for the Future*):

Standards govern the design, operation, manufacture, and use of nearly everything that mankind produces. There are standards to protect the environment and human health and safety, and to mediate commercial transactions. Other standards ensure that different products are compatible when hooked together. There are even standards of acceptable behavior within a society. *Standards generally go unnoticed. They are mostly quiet, unseen forces, such as specifications, regulations, and protocols that ensure that things work properly, interactively, and responsibly. How standards come about is a mystery to most people should they even ponder the question.* (Emphasis added)

Standardization is the process of developing and agreeing upon technical standards. Some standards are developed by a *de facto process*, meaning a norm or requirement which has an informal but dominant status (e.g. company, industry and/or consortia standards). Some standards are developed pursuant to a *de jure process*, meaning formal compliance requirements for private sector and public standards (e.g., ANSI, IEC, ISO and government standards). Finally, some standards are created by governments at various levels. (Note that it is possible for *de facto* standards to morph into *de jure* standards, including government standards.)

The term “strategic” can be defined as: “A strategy is a long term plan of action designed to achieve a particular goal. Strategy is about choice which affects outcomes. Organizations often survive, indeed do well, for periods of time in conditions of relative stability, low market

turbulence and little competition for resources. *Virtually none of these conditions prevail in the modern world for great lengths of time for any organization or sector, public or private.*

Strategic Issues and Need for Awareness

There are several strategic issues that require a need for awareness of the strategic value of technology standards and the process of standardization, consider, for example:

- (1) Globalization is rampant and will remain so for the foreseeable future. See *The World is Flat*, Thomas Friedman (2005); <http://www.thomasfriedman.com/worldisflat.htm>
- (2) Standards directly affect more than 80% of global trade with an estimated value exceeding \$13 trillion (US). (Joe Bhatia APEC Keynote speech, Feb. 2011) see <http://publicaa.ansi.org/sites/apdl/Documents/News%20and%20Publications/Speeches/2-28-11%20-%20Bhatia%20-%20APEC%20Standards%20Education.pdf>
- (3) Standards influence everything we do. (UK Standards Strategy (2003); <http://publicaa.ansi.org/sites/apdl/Documents/Standards%20Activities/NSSC/UK%20NS SF.pdf>
- (4) Standards control markets. (German Standards Strategy (2005); http://www.din.de/sixcms_upload/media/2896/DNS_english%5B1%5D.pdf
- (5) Standardization is one of the best sources of competitive intelligence available. (European Academy for Standardization). See <http://www.euras.org/uploads/2009presentations/bousquet-standardization.pdf>

Competitive Intelligence

In the contemporary globalization environment a growing number of companies and nations treat competition like an economic war. Competitive intelligence has become the “latest weapon in the world of economics”. Standardization is akin to competitive intelligence and standardization can be conceptualized as a “weapon” in economic and strategic competition of nations.

Global Perspectives on the Strategic Value of Standards

Among nations engaged in strategic standardization, there is a growing consensus on the strategic value of standards, consider, for example:

- (1) “*Standards have become the new [international] battleground.*” [Phillip J. Bond, Undersecretary of Commerce for Technology Policy, *New York Times* article, “China Poses Trade Worry as It Gains in Technology,” January 13, 2004; emphasis added]
- (2) “The technology standard has become the source of a core competitive edge for industrial development. To some extent, a technology standard is a kind of development order and rule. *Whoever controls the power of standard making and has its technology as the leading standard, commands the initiative of the market. Technology standards have become an important means of global economic competition, and directly influence the competitiveness of an industry, region or country.* Therefore, as for Chinese enterprises, possessing the successful standard is a

strategic choice to seize the leadership of the future industrial development.” [Program, Conference on Information Technology, Beijing, China (May 2005); emphasis added]

(3) In the 2008 article *Education is the Key to the 21st Century*, Professor Shiro Kurihara, Hitotsubashi University, Tokyo, Japan, offers the following comments on a survey by The Center for Global Standards Analysis that established an urgent need for standards education programs:

The national economy of every nation depends upon its ability to develop and maintain an effective international standards system best suited to its needs. Given that standards are the essential building blocks by which every nation develops and maintains a competitive national economy, the challenge is to develop international standards education programs which meet the specific needs of a particular country in their private, public and academic sectors. For decades, private corporations, government departments and agencies have carried the burden of standards education by preparing their best and brightest employees to work in the complex field of international standardization [in the form of “on the job” training]. There is no question that international standards education programs offered by private corporations and government departments must be continued and expanded where ever possible. But in today’s fast-paced and highly competitive world, are these efforts enough? A key question we must now address is whether nations need to make significant investments in creating academic opportunities for their best and brightest students to study the complex field of international standardization. (emphasis added)

Current Global Technology Base

A few years ago IEEE estimated 500,000 standards exist in the world today that forms the technology foundation of the global marketplace. IEEE estimated that it costs at least \$1.5 billion (US) annually to maintain these standards. Imagine a world in which the global marketplace will be significantly transformed by technological advancement in the next few years, requiring the revision of thousands of existing standards and potentially affecting trillions of dollars (US) in international trade.

Standards Issues

Participants currently involved in the complex world of global standardization must have multi-disciplinary skills, including language skills, to address complex issues. Among the issues considered in today’s standards setting activities are the following: Health, Safety, the Environment, Sustainability, Performance v design, Trade & competition, Language & symbols, Security, Testing, Certification, Conformity Assessment, Legal and Public Policy issues. In addition, private sector standards must be reviewed and amended, as necessary, on a regular basis. In general, private sector standards must be reviewed within a five year period.

Standardization Issues

Standardization requires the consideration of several critical issues, consider, for example: Effectiveness & relevance (need), Scope of standard (national, regional or international),

Standardization forum (national, regional or international), Fairness & impartiality (credibility) Transparency & openness, Consensus process & stakeholders, Trade & competition, Reconciliation of conflicting standards, Security, Social responsibility & technical assistance, Government regulatory reform (alternatives), Technological change & internet, Education & awareness, Information and knowledge transfer, Resources & funding. *In particular, due process and procedures play a critical role in standardization. If participants do not believe in the credibility of the process, the resulting consensus, the foundation for private sector standards, is practically meaningless.*

“Voluntary Consensus Standards”

What is voluntary about “voluntary consensus standards”? The term “voluntary consensus standards” is a very popular term applied to the development of private sector technology standards. It can be found in many speeches, policy papers, websites, government regulations and statutes. Nevertheless, to the best of my knowledge, “voluntary consensus standards” do not exist in the marketplace. The marketplace demands compliance with private sector technology standards. Firms that elect to not comply with marketplace technology standards simply have no access to the marketplace. In order to better understand this global method of compliance in the marketplace, a review of the following book is recommended: *The New Global Rulers*, Tim Buthe & Walter Mattli (2011), see <http://books.google.com/books?id=LDYV15Ym3-oC&printsec=frontcover&dq=the+new+global+rulers&hl=en&sa=X&ei=UZkvUczHPMLi0QG FzIGoAw&ved=0CDgQ6AEwAA>

Engineering Ethics

On occasion, private and public sector technology standards fail to meet expectations. The following websites contain many case histories of failed expectations concerning technology standards. Participants in private and public standards setting programs for technology standards and management of technology standards activities are invited to review these case histories when making standards decisions that reflect “best practice” or “best available technology” goals and objectives:

- (1) *Ethics Education Library (Case studies)* <http://ethics.iit.edu/eelibrary/?q=node/2395>
- (2) *National Academy of Engineering* <http://www.onlineethics.org>
- (3) *National Society of Professional Engineers* <http://www.nspe.org/Ethics/index.html>
- (4) *BP Criminal Indictments* http://www.huffingtonpost.com/2012/11/16/bp-criminal-plea-indicted_n_2147070.html

Public Policy and Potential Legal Issues

In the United States, there are several public policy and potential legal issues associated with development of private sector technology standards. In short, the United States private sector standardization system is a public policy and potential legal issue minefield. Participants in private sector standardization programs do not need to become either a public policy expert or lawyer to address these issues, however, a minimum level of awareness of these issues is a good,

practical idea. For example, participants in United States private sector standardization projects may want to consider the issues discussed in the following websites:

Public Policy Issues

- (1) *Consumer Product Safety Act, as amended* (2008), Section 7(b), reliance on voluntary consumer product safety standards, <http://www.cpsc.gov/PageFiles/105435/cpsa.pdf>
- (2) *Fair Packaging and Labeling Act* (1967), Section (d) <http://www.ftc.gov/os/statutes/fpla/fplact.html>
- (3) *National Technology Transfer and Advancement Act* (1995); Section 12(d), Utilization of Consensus Technical Standards by Federal Agencies <https://standards.gov/nttaa/agency/index.cfm?fuseaction=documents.PL104113>
- (4) *Standards Development Organization Advancement Act* (2004) <http://www.gpo.gov/fdsys/pkg/PLAW-108publ237/pdf/PLAW-108publ237.pdf>
- (5) *Trade Agreements Act* (1979) <http://www.law.cornell.edu/uscode/text/19/chapter-13>

Potential Legal Pitfalls

- (1) *How Due Process In the Development of Voluntary Standards Can Reduce the Risk of Antitrust Liability*, David Swankin (1990) <http://gsi.nist.gov/global/docs/GCR%2090-571.pdf>
- (2) *The Consequences of Silence* (2009) <http://www.strategicstandards.com/files/TheConsequencesofSilence2009.pdf>
- (3) *Trade Associations and Public Safety*, Margaret Elias (2007)
- (4) *Damned For Their Judgment: The Tort Liability of Standards Development Organizations*, Robert H. Heidt (2010) <http://ssrn.com/abstract=1579005>

Summary and Conclusions

The most important questions concerning the strategic value of standards education are: (1) what is the value of standards education programs?, (2) why make an investment in standards education programs, and (3) are the most effective standards education methods in the private, public and/or academic sectors? Set forth below are some potential answers to these questions.

- (1) **Globalization.** Globalization has made significant changes in the global economy since World War II. For globalization to succeed in the future, national, regional and global standardization systems need to be managed in a very significant manner. In short, globalization will not succeed in the future unless private, public and academic sectors make a significant investment in standards education programs.
- (2) **Need for Multi-disciplinary Skills.** The world of global standardization is a complex environment that typically involves engineering, science and other significant technology issues. There are however other important issues involved in global standardization, for example, economic and business considerations, global trade, health, safety, the environment, sustainability, public policy and legal considerations such as intellectual property. Being a good engineer, therefore, is not good enough to succeed as an active

participant in the complex world of global standardization. Multidisciplinary skills are necessary in order to be effective.

Even current participants with decades of experience in global standardization are struggling to maintain and further enhance their standards development skills. In short, the world of global standardization is under considerable stress to effectively deal with increasingly complex issues based upon a standardization process that requires openness, transparency, fairness, excellent administration and communications, and that gives due consideration to the needs of developing nations. Moreover, global standardization is increasingly expensive. Demands for a more effective global standardization system have become a world wide chorus.

- (3) **Market Access.** Technology standards control access to markets. A firm cannot compete in the marketplace if it fails to comply with a relevant technology standard.
- (4) **Competitive Intelligence.** One of the best and most important forums in the world for individuals, firms, corporations and government agencies to gain an understanding of technology's future is a standard setting group discussing future technology standards. No consulting firm in the world can match the significance of such discussions.
- (5) **The Future of Strategic Standards Education.** For several centuries, the primary platform for standards education has been "on-the-job" training. This education system continues to provide at least 98% of standards education programs in the world today. Although there has been a noticeable increase of standards education courses in the academic sector since the 1990s in the following countries: China, Holland, Germany, Japan, South Korea, and the United States, all of the standardization courses in these countries, when combined, still do not provide more than 2 % of standards education programs in the world.

It will be difficult for the academic sector to increase standards education programs in the future, and provide an important contribution to an understanding of strategic standardization, because most university and college faculties around the world simply do not have any practical experience with or understand standardization systems in a comprehensive manner. Nevertheless, the academic sector will have significant opportunities in the future to make a significant contribution to the creation of standards education programs if the sector is able to establish meaningful partnerships with the private and/or public sectors, e.g., the current NIST funding program for universities to create standards education programs.

In the final analysis, international competition will be the driving force in the creation of standards education programs. In order for a nation to develop growth in its national economy, it must engage in international trade in a meaningful way. Because technology standards control access to the market, the growth of a national economy cannot take place unless a nation manages the development of its standardization systems in a very effective manner. The creation and enhancement of existing standards education programs are increasingly important because standardization systems become more complex with each passing year. Nations that make a significant investment in the creation of standards education programs can look forward to a bright future. Nations that do not make such investment can look forward to a problematic future. (Note: This article was published by The Society of Standards Professionals (SES) in the 2013 July/August issue of their Journal, *Standards Engineering*.)