

## Standards and Trade -- Who Really Cares?

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Good afternoon, and thanks for being here. I must admit that I was mildly concerned that I might be speaking to an empty room. Here's why. After arriving on campus this afternoon, I overheard somebody's shorthand description of this afternoon's lecture: A standard talk by some guy from the government. That's hardly marquee-quality material.

I hope to do better than that. But, again, thank you for coming.

What I'd like to do this afternoon is talk to you about standards and the processes used to develop standards--topics that, like Rodney Dangerfield, haven't gotten the respect that they truly deserve, at least not in the United States. This is beginning to change, for a number of reasons that I intend to enumerate.

But before I do, I'd like to thank our host, the Stanford University U.S.-Japan Technology Management Center, for coordinating this lecture series on "Technology Standards and Standardization Processes". We at NIST are hopeful that this series will help to raise awareness of standards as a business issue and as an economic issue. We also are proud to be a co-sponsor with the Japanese External Trade Organization.

And by the way, NIST is auditing this course. We think we can learn a lot from the people who will be speaking over the next several weeks and from the discussions that they are sure to stimulate.

### **Pick Your Vantage Point**

Today, I'd like to give a brief tour of the voluntary standards world. It's a confusing world with many portals of entry. Depending on the industry you are in, the market you compete in, or the nation in which your business is based, the portal of choice could be any of the formal standardization bodies. And there

are many. You can sort these by geography--national, regional, or international--or by industry or technology focus. Government is another entryway. Governments in many countries--the United States not included--play a very active role in supporting the development of standards, which may then become the basis for regulations. In the United States, the government participates as a stakeholder, contributing technical expertise during the development of standards.

Industrial consortia are yet another portal, one that is being used increasingly in the information technology industries. Finally, there is the all-important marketplace, which can confer the status of *de facto* standard on the technology or product that wins the favor of consumers. Intel microprocessors, Microsoft windows, VHS videocassettes are obvious examples of products that have gained the mantle of *de facto* standard.

For another perspective on standards, you can look at the different types of standards. There are:

**Test and measurement standards**, which are the technical forte of the National Institute of Standards and Technology. Measurement standards are generic tools. They are "infra" technologies, if you'd like, that are widely used by industry and support efficiency in the marketplace and all other stages of economic activity .

Sounds pretty cut and dried, doesn't it? After all, a nanometer is a nanometer, a watt is a watt, and two parts in a billion is just that. Who could argue the point? Well, for one, our trading partners can and, on not so rare occasions, they do. My nanometer may not be the same as the nanometer measured by a product certification laboratory in the country that I am exporting my products to. Or, the way I test to demonstrate compliance with a standard on electromagnetic compatibility -- or EMC -- may not be same way that a European lab measures for EMC. Differences in measurements and lack of equivalency among national measurement systems can delay--and sometimes block--entry into foreign markets.

Now, let's run down a list of what are referred to as **product, process, and management standards**. These are embodied in written documents and are promulgated by Standards Development Organizations--or SDOs for short. Other names for these standards are documentary or normative standards. Examples include:

Standards that establish the *fitness of a product for a particular use*. These standards may address product features, performance, quality, compatibility, or other product attributes. Examples are specifications for:

- the dimensions of lumber,
- the design and characteristics of gas cylinders or roofing materials,
- the arrangement of keyboard characters,
- the threads for light bulbs,

- rules for the construction and care of steam boilers and pressure vessels, and
- specifications for film speed.

There also are documentary standards that set specifications for the *function and operation of a device or system*, which cover everything from elevators and refrigerators to handicapped access.

Then there are process or management standards. Examples are ISO 9000 and ISO 14000 -- quality and environmental management system standards produced by the International Organization for Standardization, or ISO, which is based in Geneva.

There are thousands upon thousands of standards like these that are invisible to most consumers, that are *not* produced by government regulatory agencies, and that are governed by a web of national, regional and international organizations. In short, it is an extraordinarily complex system.

So large and so complex, in fact, that there are two World Standards Days -- today and October 12. Talk about a need for standardization.

## Why Do We Need Standards?

The vast number of standards alone suggests that the world needs standards. Without question, we do. In industry -- when widely adopted by companies -- ***good standards***:

- Promote market efficiency and expansion.
- Foster international trade.
- Encourage competition and lower barriers to market entry.
  
- Diffuse new technologies.
  
- Protect consumers against unsafe or substandard products.
  
- And--especially in electronics and information technology -- good standards enable interoperability among products. This is a standards-enabled capability that users are clamoring for.

But standards are not unequivocally good. ***When standards work poorly***, they can:

- Raise transaction costs and barriers to trade.
- Constrain innovation and entrench inferior technologies.
- And hinder the development of interoperable systems.

From the perspective of individual firms, poor or indeterminate standards can raise their costs, compromise their quality, and constrain their market position. Sometimes, the distinction between "good" and "bad" standards is not clear. Consider the impact of standards on the electric power industry, an industry that I know quite well.

[case description]

Let me provide a more prosaic description of what standardization should accomplish. It's a statement that was made by Ralph E. Flanders, an engineer who served two terms as a U.S. senator from Vermont. In his earlier life, Flanders was active in the standardization of screw threads. You may find this hard to believe here in the Silicon Valley Region, but, right now, fasteners and screw threads are an especially contentious area of standardization and regulation.

Anyway, Flanders once said that:

"standards should relegate the problems that have already been solved to field of the routine, leaving the creative faculties for the problems that are still unsolved."

In other words, good standards are solutions to recognized needs and they are platforms on which to innovate. I think these two features are useful criteria for judging the usefulness and effectiveness of a standard.

But Flanders' description suggests that standards are only retrospective in nature -- that they are, in effect, consensus picks from among candidate solutions that already have been developed. Today, however, there also is need for prospective standards. This is especially the case in the information technology area, where forward-looking standards can facilitate the evolution of technologies and the advanced capabilities that they are expected to create.

In fact, some in the information technology community look upon standards as a primary driver of market dynamics in the "new economy". Look at the definition of "standards" in *Wired* magazine's *Encyclopedia of the New Economy*:

"Companies used to compete by making things and selling them. In the new economy, the game is often over by the time the first product emerges from the factory. Sometimes it's because a ...first entrant effectively sets...the standard. In other cases, winners (and losers) emerge from backroom bargaining over the technical details that enable complex technologies to work together..."

Increasingly, industrial consortia are being formed to foster agreement on these types of technical details--sometimes well before a technology is ready for the market. The Object Management Group--or OMG--serves as an example of what have been called "anticipatory consortia". It was created to develop standards that would speed the evolution of an embryonic software industry that is now coming of age.

In 1989, when OMG began, there were very few object-oriented programming products on the market and, therefore, few vested proprietary interests. About five years later, workable implementations of OMG's architecture specifications began to appear on the market.

In the United States, about 150 industrial consortia develop standards. It's fair to say that many of these consortia were formed because traditional voluntary standards organizations are too slow. Procedures for ensuring broad representation and achieving consensus agreement could not keep pace with needs stemming from rapid advances in technology.

To be sure, there are a variety of other reasons for forming standards consortia. Sometimes, companies band together to advance a technology that they already have in hand. Standards consortia also may be a response to a shared competitive threat.

So the success and effectiveness of standards consortia vary. Nonetheless, these organizations have introduced a new element into the standardization process. That is, "publicly available specifications". Because events are so fluid and technologies are changing so rapidly in some areas, more time and experience may be needed before a consensus standard can be developed. Publicly available specifications are first approximations of prospective standards. In effect, vendors and users can test drive these "specs". Their feedback then guides refinements that can be incorporated into a more formal, final standard.

## **The Process**

Up to this point, I've talked about the "good" and the "bad" of standards. Now, it's time to move on to the sometimes "ugly" process of developing standards. Here, I'm going to confine my comments to bodies traditionally recognized as "standards developing organizations". These are generally referred to as SDOs and do not include standards consortia.

Consortia are excluded largely on the basis of procedural grounds. SDOs develop voluntary consensus standards, which means any interested party can participate in the development process and the outcome is the product of general—though not necessarily unanimous—agreement. Most consortia, but not all, tend to be more exclusive, so their specifications do not satisfy the definition of consensus standard.

By one estimate, made in 1996, there are 93,000 standards available in the United States. Another 100,000 are available from the rest of the world. The official from Caterpillar who reported these figures used the word "*available*" advisedly. As the old joke about standards goes:

*"The nice thing about standards is that there are so many to choose from."*

This sums up the dilemma facing companies --a dilemma that is becoming more acute in this era of globalization. Companies must choose which standards to adopt and which ones to ignore. They also must be alert to standards that are in the pipeline. They must determine which standards-development

activities warrant their participation and investment because of anticipated impacts on the business.

Most small and medium-sized firms do not have the option of deciding whether to participate. This is especially true for the activities of international bodies based overseas, such as ISO, which I have already mentioned, and the IEC, the International Electrotechnical Commission. As a rule, smaller firms cannot afford to participate, except, perhaps, as members of trade associations or professional societies.

But regardless of size, firms do not want to be surprised. They do not want to be caught unaware by the emergence of a new standard that affects the marketability of their products--at home or in other countries and regions. If this happens, firms may not have the luxury of choosing which standard to use, and they may be forced to follow a path of technology evolution set by others.

Today surprises are quite common, with the result that companies can be locked out of markets until they modify their products to conform to new specifications. Sometimes, however, companies will abandon markets rather than incur the costs of making changes to satisfy requirements peculiar to certain markets.

Such non-tariff obstacles to exports are called technical barriers to trade. According to U.S. Department of Commerce estimates, these non-tariff barriers impede the export of \$20 billion to \$40 billion in U.S. goods annually.

U.S. companies--indeed, companies around the world--would like to see these barriers leveled. For example, the TransAtlantic Business Dialogue, which includes the chief executives of more than 100 North American and European businesses, describes technical barriers as – quote -- "one of the most significant barriers to increased transAtlantic trade."

The TransAtlantic Business Dialogue, which also includes representatives of national governments, advocates creating a single, U.S.-European Union marketplace. A guiding principle for market unification, according to this organization, should be "one standard, one test".

This, I think many people here would agree, is an objective worth supporting. But it may be very difficult to accomplish with the standards-making machinery in place today. And it would have to be done carefully so that less-than-optimal solutions are not codified in standards that would then become obstacles to innovation.

## **The U.S. System**

Turning to the domestic side, the U.S. standards system has its roots in the private sector. Over the last 100 years, it has successfully met domestic marketplace needs on a sector-by-sector basis. It also has developed rules for consensus, transparency, openness and due process -- all of which have found their way into the World Trade Organization as bedrock principles for developing good and fair standards.

Yet, the same open, competitive system for developing standards creates major issues for us in the global market. There are currently about 600 U.S. standards developers, including the approximately 150 consortia now developing "standards". Unlike many other nations, the federal government is not involved in the activities of these organizations, although its technical experts may participate as members of committees that develops standards.

Our standards developing organizations tend to represent unique sectors, such as mechanical engineering, telecommunications, automotive, heavy equipment, pharmaceuticals, medical devices, building products, and materials. As one would expect, there is some confusing overlap in spheres of technical and industrial interests. But each sector develops its own standards--because it knows best what standards are needed for particular products.

About 20 of the some 400 U.S.-based SDOs generate the vast majority of standards in the United States. Here's a representative list of these organizations:

- ASTM (formerly the American Society of Testing and Materials)
- U.S. Pharmacopeia
- Association of Official Analytical Chemists (AOAC)
- American Petroleum Institute (API)
- Cosmetic, Toiletry and Fragrance Association (CTFA)
- Society of Automotive Engineers (SAE)
- Aerospace Industries Association (AIA)
- Association of American Railroads (AAR)
- American Association of State Highway and Transportation Officials (AASHTO)
- American Society of Mechanical Engineers (ASME)
- Electronic Industries Association (EIA)
- Institute of Electrical and Electronics Engineers (IEEE)
- National Fire Protection Association (NFPA).

Many have produced standards that are used internationally. And most welcome participation by foreign technical experts. However, these experts do not participate as formal national representatives, a distinction that has become significant in light of a recent trade agreement that I will mention.

Now insert into this very heterogeneous mix the American National Standards Institute. It goes by the acronym ANSI. ANSI is a federation of some 1,400 organizations. Its membership includes users of standards--that is, companies and government agencies. It also includes a substantial fraction--but not all--of the U.S.-based standards developing organizations.

ANSI does not develop standards. Rather, it serves as a central clearinghouse and a coordinating body. For example, ANSI publishes guidelines for managing the development of voluntary, consensus standards, and it accredits SDOs. About 250 U.S.-based SDOs are ANSI-accredited, meaning that they have demonstrated adherence to the rules of consensus and due process.

Standards developed by accredited organizations can be submitted to ANSI for approval as American National Standards. Today, there about 43,000 American National Standards. Many U.S.-based SDOs do not seek this designation, however.

As the U.S. representative to ISO--that's the International Organization for Standardization--and to the IEC--the International Electrotechnical Commission--ANSI also is responsible for convening U.S. technical experts to serve on ISO and IEC committees that develop standards. With some 600 standards organizations to choose from, ANSI faces a difficult job in assembling the most appropriate and--from a national perspective--most effective group of U.S. participants. If a prospective ISO or IEC standard is likely to impact more than one industrial sector--as is frequently the case today--this responsibility becomes all the more challenging.

In summary, there is no single responsible entity or point of contact in either the private or public sector. Up to this point, coordination of domestic standards activities has been nearly impossible, and, today, finances for U.S. representation in international standards activities are a major point of concern. A National Research Council report on Standards, Conformity Assessment and Trade for the 21st Century concluded that the highly decentralized U.S. standards system is not adequately serving U.S. industry and government needs in the global market.

Another interesting assessment was offered by a British standards official who wrote to NIST after our director, Ray Kammer, testified before a congressional subcommittee on technical barriers to free trade. Here's an excerpt from his letter:

The U.S. has joined the international standards community in name only. . . . The USA suffers from having a plethora of standardizing bodies, whose efforts are seen as protectionist . . . and which waste the efforts of American engineers who could otherwise be participating in international activities. Further, by the time a national standard has been developed, it is often the case that large companies have committed huge budgets to building products that comply, and [they] are not interested in modifying the specification to achieve an acceptable international standard.

That's not a ringing endorsement of our system, but hold off on making your own judgment. For now, suffice it to say that our highly decentralized collection of SDOs is struggling with its role in international standards and that the world is aware of our logistical challenge.

### **International Standards: Cure or Placebo**

Globalization has made international standardization something of a holy grail, and its pursuit has been taken up in regional and world trade agreements. The most significant of these agreements, perhaps, is the Technical Barriers to Trade Agreement, which is part of the World Trade Organization Treaty signed in 1994. Among other things, this agreement--known as the TBT Agreement--commits the governments of more than 130 signer nations to give preference to *international* standards as a basis for their

technical regulations. In addition, the agreement encourages national and regional standards developers to defer to international standards in their activities.

Exceptions are permitted. If using an international standard would be ineffective or inappropriate, a nation can choose to set a different standard. The TBT agreement also states, however, that imports should be treated no less favorably than products of national origin.

The motivation for this agreement is the goal of free trade, worldwide. If trading partners were to adhere to identical, or equivalent, standards, then the costly problem of satisfying technical requirements peculiar to nations or regions would be reduced substantially. Remember this is conservatively estimated to be a \$20 billion to \$40 billion problem for the United States. Undoubtedly, it is a costly problem for other nations as well.

Harmonization of national and international standards is a positive complement to other global trends and developments. The volume of world merchandise trade has increased sixteenfold since 1950. In recent years, it has grown at double-digit rates, faster than most national economies. And, today, 60 percent of world trade is conducted between countries committed to regional free trade arrangements. Examples are the North American Free Trade Agreement, the Asia Pacific Economic Cooperation, the European Union, and Mercosur (which includes Brazil, Argentina, Uruguay, and Paraguay).

Among U.S. companies, the strategic importance of thinking -- and operating -- globally is illustrated by the increasing use of international standards. According to one estimate, international standards now account for about 45 percent of the standards used by U.S. industry. That's up from about 10 percent in 1970, when the vast majority of standards were in-house, corporate specifications and guidelines. The call by the TransAtlantic Business Dialogue for "one standard, one test" is yet another indication of the push for a worldwide system of harmonized standards.

Now, I've used the term "international standard" repeatedly. But what does it really mean? For standards to be truly "international", procedures must be followed to ensure adequate international representation during their development.

Are such procedures in place today?

The TBT Agreement does not define the term "international standard", *per se*. It does define the sources of international standards. These are international bodies or systems "whose membership is open to the relevant bodies of a least all members." The agreement does not specify organizations that qualify as international standards bodies or systems.

Many nations have chosen to adopt an operational definition of "international standard". Canada, Mexico, Japan, and members of the EU, for example, presume an international standard to be one promulgated by ISO, the IEC, or by international treaty organizations that set standards or establish technical regulations. In the commercial sphere, the International Telecommunications Union (ITU) may

be the most significant of these treaty organizations, since it is concerned with the worldwide standardization of telecommunications.

Is this simply a matter of semantic details? Or should it be the object of national concern? I submit that it is the latter. If the United States does not attend to the challenge of interfacing effectively at the international level, then it will jeopardize its position as the world's leading exporter and its success as a market innovator. As Robert Mallett, the deputy secretary of commerce, warned yesterday, we might discover someday in the future that the "devil truly was in the details" of standardization procedures and conventions.

Consider the strategy successfully put forth by the European Union. To promote integration of its large internal market, Europe has set out to harmonize the standards of member nations. This goal is similar in intent to what the United States, Canada, and Mexico are working to accomplish under NAFTA, the North American Free Trade Agreement.

For exporters, the good news is that there should be only one set of regulations and standards to follow when doing business in the 18 countries of the European Economic Area. The bad news is that new or revised European requirements may go well beyond those specified by individual nations. This may necessitate changes in product design or manufacturing process, and it may result in more testing for product certification.

Responsibility for developing regional standards that meet the requirements set forth in sector-specific European Directives has been assigned to three regional standards bodies:

CEN--the European Committee for Standardization;

CENELEC--the European Committee for Electrotechnical Standardization; and

ETSI--the European Telecommunication Standards Institute

These three organizations give preference to international standards. There's that term again. For example, if an ISO standard already addresses a European Directive requirement for, say, medical devices then it would be adopted as a European standard.

But there's also a kind of reciprocity agreement between two of the European standards bodies and ISO and the IEC. To continue with my example, if no ISO or IEC standards exist for particular aspects of medical devices covered by a European directive, ISO or IEC can defer the task of developing the specifications to CEN or CENELEC. ISO and IEC will then submit the resulting European standards for fast track approval as--quote, unquote--"international standards".

No other region or nation enjoys this type of relationship with ISO or the IEC--the two organizations that many nations are recognizing as the primary promulgators of international standards. There is

concern that ISO and the IEC are, in effect, delegating some standards-development activities to the European bodies. At the same time, non-Europeans are finding it difficult to participate in the development of European standards. As a result, there is some friction.

If a European standard is considered disadvantageous to U.S. industry, there is opportunity to mobilize opposition against its adoption by ISO or the IEC. In both these organizations, however, the United States has one vote, which is cast by ANSI, the U.S. representative. In contrast, within ISO, member nations of CEN--the European Committee for Standardization--have a total of 18 votes.

While Europe is clearly interested in integrating its regional market and in reducing standards-related barriers, it also recognizes other benefits to be gained. For example, a European Community report released earlier this year commented on the significance of standards being developed in information technology and other high-technology sectors covered by the European Directives.

"These standards," the report notes, "are very important to the competitiveness of industry and services in that they give preference to the European approach at the world level."

So the questions of who makes international standards and under what procedures loom as very important issues.

### **Cause for Alarm or Mild Amusement?**

Depending upon the industry you are in, you may view this state of affairs with alarm or with mild amusement. In segments of the microelectronics and software industries, the activities of formal standardization bodies are far, far less important than the dictates of the market. Microsoft, Intel, Adobe, Cisco, SAP and other companies have succeeded in establishing their technology and products as *de facto* standards. Through their success in the market, these and other firms have been able to influence the evolution of the market and the direction of product development.

Regardless of what happens at the international level, firms in many industries will continue to look at the market as the final judge on standards. But developments in the international standards arena can strongly affect this competitive dynamic. While U.S. firms slug it out in our large domestic market, for example, the decision to adopt a standard by a regional or international body in another part of the world could have serious consequences.

An example is Europe's decision to formally adopt a common digital standard for cellular phone systems. As reported recently in *Business Week*, this decision provided European manufacturers with a "vast unified home market." Meanwhile, according to the magazine, the U.S. market was splintered among three competing cellular formats, leaving "Europe and the growing digital markets in Asia largely" to firms in other nations. As a result, the market fortunes of Nokia and Ericsson have risen sharply, while Motorola is working to regain its once sure footing in the marketplace.

No firm--no matter how dominant in the market today--can ignore standards developments in other arenas. Creation and widespread adoption of an international standard could pre-empt products containing non-compliant technologies from export markets. Manufacturers of these products might not have any recourse, given the priority accorded to international standards in the Technical Barriers to Trade Agreement.

In many industries, the world market can be segmented on the basis of standards, especially interface standards that are so essential for achieving complementarity and interoperability among products, as well as subsystems and systems of technologies. Regardless of their source, new standards can have market-shaping implications.

In short, companies and countries can use international standards not only to eliminate technical barriers to trade but also to advance their competitive standing and their economic interests.

## **The Role of Government**

Before concluding, I should pause to qualify my description of unfolding events and issues in international standards. I have attempted to provide you with a snapshot of the current situation. My remarks should not be interpreted as a criticism of the European Community. In fact, I admire the European Community. It has had a standards strategy for more than a decade, and it is meeting with success.

Not so for the United States, at least not in the arena of formal international standards. Our disparate and decentralized U.S. standards community needs to squarely face the issue of adopting and developing international standards. After all, this is what the users of standards--businesses, governments, and consumers--want. In fact, industries in all countries want standards that enable companies to build products which are accepted worldwide.

The U.S. standards community needs, in many cases, to work together more effectively. It needs to tackle the challenge of devising either a unified U.S. approach in the international standards arena or crafting a decision-making process that ensures that emerging standards are thoroughly evaluated for their potential impact on U.S. industry and other national interests. We need to prevent unwanted surprises that impede U.S. exports.

What role can--or should--the federal government play? Or as one author has posed the question, Should government lead? Follow? Or get out of the way?

The short answer, I think, is "yes". The situation and need will dictate the appropriate response.

One of NIST's major goals is "ensuring that measurement capabilities and standards are in place to support full U.S. participation in global markets". We believe that the U.S. voluntary standard system must continue to be industry-led. We also believe, however, that government can play an instrumental

role as a convener, facilitator, and a catalyst. As a partner, we can help to initiate and sustain efforts, first, to strengthen our nation's private-sector standards system, and, second, to make sure that it interfaces effectively with the rest of the world.

Getting organized is an immediate need for our peculiarly American standards system. Yesterday, we took a step toward that objective by convening a national meeting to weigh prospects for developing a national standards strategy geared to global needs and realities. About 300 people attended this forum to learn and exchange ideas. A wide range of opinions was expressed, but the majority view is that the United States faces a serious international challenge and that an effective response will require a portfolio of strategies is needed. There is no one-size-fits-all approach to international standards.

Yesterday's meeting was constructive and productive--and not without disagreement. With ANSI, which was a co-sponsor of the meeting, and with a broad cross-section of SDOs, and industry representatives, we have begun to chart our next step. Stay tuned.

Actually, NIST and other parts of the Department of Commerce are working on many fronts to achieve the overall goal of eliminating technical barriers to trade. For example, we are providing technical support to speed implementation of the recent U.S.-European Union trade agreement. This agreement calls for mutually recognized testing, inspection, and certification procedures for five categories of project that account for \$50 billion in trans-Atlantic trade. Standards and conformity assessment are pivotal to the ultimate success of the agreement.

The NIST Measurement and Standards Laboratories are spearheading efforts to achieve international uniformity of measurements. A seamless international measurement system is integral to world trade. This is not the case today. A measurement made here and referenced to NIST may not be directly comparable to a measurement made in another country and referenced to that country's national measurement institute.

There's more to talk about, and much, much more to be done--with and without the government's participation. But I think I'd better stop here. I invite your questions. Thank you for your attention.