INTERNATIONAL TECHNICAL STANDARDS - AN OVERVIEW

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ABSTRACT

The growing globalization of industry is stimulating a growing emphasis on international standards. Standards are important because they provide significant economic benefit. They are also costly and much of the benefit is broad-based, i.e. it does not accrue preferentially to those who incur the cost. Finally, there is a highly disaggregated international standards system and at least two very different basic philosophies as to how standard systems should operate. The effect of the individual cost-benefit analysis by organizations may produce hybrid system that produces both global standards in which each country participates in the development as well as less costly technical and consortium standards.

INTRODUCTION

Several factors are driving change in the system that develops and promulgates the technical standards on which much of our trade is based. It is likely that the most significant has been the globalization of trade that has grown since the end of the Cold War [1]. The Cold War fragmented the world into trading blocks and standards tended to be largely national or harmonized among trading partners when such harmonization was appropriate. The end of the Cold War has produced a growth in global trade along with government and industrial actions, influencing the standards system, which will be discussed below.

A second factor putting stress on the standards system is the rate at which new technology is being introduced into new products. This technology growth leads to rapid obsolescence, in some cases. This rapid growth and short life cycle challenges the traditional standards system [2].

Another important factor has been the growth of the Internet. The Internet has made possible new ways of developing standards that may help shorten the consensus process. At the same time, the Internet provides a dissemination mechanism that threatens a revenue stream of standards developing organizations.

Finally, global competitiveness has sharpened the focus on benefit capture at many companies. This sharpened focus has led companies to carefully assess the benefit they receive from the standards process. This assessment has led to a variety of responses ranging from increased emphasis on participation in the standards process [3], to the development of strategies to bypass the standards system [4,5], to withdrawal from active participation.

As these global activities have been occurring, there has been a regional activity that has also significantly influenced changes in the standards system globally. This has been the development of a common market within the European Union. The common market has prompted the move to a common currency and a common base of measurements and standards. Consequently, the European Union had a structure in place to normalize national standards at the same time there was growing pressure to replace national standards with global standards. Thus, they have been in a leadership position in the redefinition of the standards system.

With these factors stimulating change in the standards system, it is worthwhile to examine the benefits and the costs of the current system. Such an examination will be useful in understanding the evolution of today's system

BENEFITS OF STANDARDS

The benefits of standards in a modern economy have been classified into four categories [6]. This classification is summarized in Table 1. An examination of this classification shows that the benefits accrue to the buyer, the seller, and the technology developer. All of these can and do participate in the standards development process. The relative participation generally is set by the ability of various groups or individuals to capture the benefit from participation. Large consumers, e.g. original equipment manufacturers or governments, purchase goods and services in accordance with a wide range of standards. Typically, they would participate in a standard development process only when existing standards not meet

their needs. This is a necessary, but not sufficient condition. Large consumers typically try to negotiate changes directly with suppliers. If this approach fails to produce the desired outcome in a timely manner, standards participation is a way to gain the assistance of other buyers to get the suppliers to make the needed changes in the product, i.e. to compensate for too aggressive of an effort in variety reduction.

Table 1. Summary of the benefits of standards

Benefit Class	Explanation of Benefit
Quality and Reliability	This refers to the function of standards to define an acceptable level of performance
Information	This refers to the function of standards to provide evaluated information.
Compatibility/ Interoperability	This refers to the function of standards to provide interfaces so systems may operate with parts from different manufacturer.
Variety Reduction	This refers to the function of standards to limit the number of variants of a product or process.

Smaller buyers frequently find it more cost effective to affect the modifications of standards through negotiations with their suppliers than through participation in the standards process itself. They may also take the existing set of standards as an externally imposed part of the business environment and adapt their products or processes to the existing standards set.

Sellers frequently find it cost effective to participate in the standards development process. Standards that affect quality, reliability, interoperability, or variety reduction can impact a particular suppliers market share. So there can be a direct link between a standard and the seller's profitability.

Technology developers have an incentive to contribute to standards development. In the various construction codes, for example, the standards provide technical information in a form that can be readily assimilated by the construction workers. Thus, the standards can be an effective transfer of information from the laboratory to the market, if they can be produced in a timely manner.

Information standards are not limited, however, to scientific or technical standards. The recent decades have given rise to major international standards in areas such as quality and the environment. These standards have the potential for affecting a wide range of companies.

It should be noted that the same standards process develops standards for a wide range of industrial activity. Consider, for example, something as straightforward as a nut and bolt. There are quality and information standards that specify manufacturing and testing processes. There are compatibility and variety reduction standards that assure the threads fit. There are quality standards that specify, for example, the level

of process documentation required. Finally there are environmental standards for disposal of waste and broken products. These were all developed by specifically constituted groups who came to an agreement as to what the specific wording of the standards should be through discussion and voting. All of these standards affect, and generally are expected to improve, the profitability of the companies involved with this industry.

With this broad impact and broad potential benefit, it follows that there is a significant number of standards that have been developed. The estimated number of existing standards is approximately 200,000 [7].

COST OF STANDARDS

While there is a significant benefit to standards, there is also a significant cost. While there has been no definitive study of the costs of these 200,000 standards, it is clear that the development of a standard can be expensive. The cost of major international standards in the information technology field has been estimated between \$1 – 10 million [8]. Another indicator is that the budgets of the key standards developing organizations in the major industrial countries are more than about \$20 million each [7]. This sum does not include the industrial efforts that are volunteered. Because this cost is significant, those who fund the activity expect to receive a commensurate benefit.

GLOBALIZATION OF STANDARDS ACTIVITIES

As the geopolitical barriers to global trade were removed, industry moved to compete in and profit from a global market. In addition, many governments worked with domestic and global companies to assure domestic benefit from global trade. Because standards are directly related to trade, these activities had implications in the standards arena. Among the early activities, the Transatlantic Business Dialogue was established in 1995 "to reduce barriers to transatlantic trade and investment" [9]. This organization brought together leaders of companies with headquarters in Europe and the United States to work closely with government officials to remove trade barriers. In the area of standards, a guiding principle became, "approved once, accepted everywhere." The implication of that principle is that for products traded in the U.S. and in Europe, there should be common standards. The implication for standards developers is that those accepting the standard should not be in just the U.S. or Europe, but should be in both. In fact, it would be best if the standards were accepted worldwide.

This bilateral E.U. – U.S. activity built on the momentum that had been generated by the Technical Barriers to Trade Agreement [10], concluded during the 1994 Uruguay round of multilateral trade negotiations under the auspices of the World Trade Organization. A specific motivation for that agreement was to "encourage the development of... international standards... systems." Being a treaty signed by governments, it specified government actions. Two sections of this agreement have particular significance for standards development. First, in Section 2.4, the signatories agreed to use international standards as the basis for regulations whenever possible. Second, in Section 2.6, the World Trade Organization signatories have also agreed to become participants in the

preparation of international standards by “appropriate international standardizing bodies.” This last term was undefined. In 1994, many organizations had defensible claims to be appropriate international standardizing bodies for various industries, technologies, or classes of products or processes. The same situation exists today.

CURRENT STANDARDS DEVELOPMENT STRUCTURE

As background for understanding how the standards development system may evolve, it is useful to review the current structure. Worldwide, there is a variety of structures to develop the required level of standardization. There are three organizations:

1. International Telegraphers Union (ITU)
2. ISO
3. International Electrotechnical Commission (IEC)

that develop standards in which the adoption is done by each participating nation having one vote. Traditionally, the ITU dealt with telecommunications, IEC with electrical and electronic products and services, and ISO (named for the Greek prefix meaning “equal”) dealt with mechanical systems. As the technologies are merging, joint projects are being developed.

One significant structural difference between the ITU and the other two is that governments are the representatives to the ITU while private sector organizations are the representatives to the other two. For all three organizations, there is continuing discussion as to whether one vote per country continues to be a sensible approach to setting standards with significant economic impact. This approach takes no cognizance of the disparities in size of the economies or differences in interest in and development and application of the underlying technologies.

In the U.S., the organization that coordinates appropriate representation in the deliberation of ISO and IEC standards is the American National Standards Institute (ANSI). This is historically a private sector organization that is funded by the companies who are members. The Technical Barriers to Trade Agreement has raised the possibility of greater government involvement in ANSI and there has been growing Federal investment to support ANSI.

In addition to participation in ISO and IEC activities, ANSI also accredits organizations that develop standards in the U.S. Today, there are approximately 250 accredited standards developing organizations in the U.S. The standards they develop can be put forth for possible modification and eventual adoption within the ISO or IEC.

In addition to the accredited standards bodies, there are, at any given time, several hundred to a few thousand non-accredited standards developing organizations in operation. These are generally established and funded by industry groups to develop a set of standards needed by the participants. Cooperative research and development consortia were given great antitrust leeway in the U.S. under the National Cooperative Research Act of 1984 (amended as the National Cooperative Research and Production Act of 1993). Under the Act, certain types of activities likely including the development

of standards [11] are protected from the risk of treble damages and liability for a plaintiff’s legal fees. So, it is possible legally for an industry group to develop what it perceives as important standards without being affiliated with any other standards developing organization.

Europe’s standardization approach, however, is significantly different from that in the U.S. Rather than the hundreds to thousands of organizations that are in the U.S., the integration of its economic activities has led to the development of two coordinating bodies: 1) the European Committee for Standardization (CEN) and 2) the European Committee for Electrotechnical Standardization (CENELEC). Both of these organizations, which trace their roots to the 1960s or earlier, harmonize standards throughout Europe. With the development of a common market within the European Union, harmonization became crucial to eliminate internal standards-related trade barriers. This importance is underscored by that fact that about 40% of CEN’s budget is funded by the European Union [12]. CEN and CENELEC are transnational, but not international, standards organizations. As such, they have made agreements designed to minimize redundancy within the standards development process. The Vienna Agreement [13] and the Dresden Agreement [14] provided a mechanism for European harmonization to proceed nearly concurrently with international harmonization through the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

Other transnational organizations have developed special relationships with the three major international organizations, again to minimize redundant efforts. The Institute of Electrical and Electronics Engineers, for example, develops some of the world-leading standards in information technology. It has an agreement with the IEC that should make the harmonization of the standards of the two organizations faster and easier.

There are also transnational organizations that have determined they have no need for the additional structure. They have a process in place that is providing the standards needed by their industry or area of technology worldwide. These tend to be in rapidly changing areas like computers and semiconductor manufacturing. Frequently, standards are developed by the broad technical community rather than by companies.

These examples underscore the fact that there is not a single international process for the development of standards. Nor is there a single international standards body. Rather there is a growing interest in global trade that is influencing the evolution of a highly disaggregated, sometimes competitive, set of standards development approaches.

CONFLICTING PHILOSOPHIES

In addition to different methods for implementing standards development, there appear to be two opposing views on the best fundamental philosophy for standards. Simply put, these are [5, 8]:

1. Agree on a standard first. Then let companies compete to develop the best products according to the standard.

2. Permit, or possibly encourage, alternative standards. Let both the standard and the products be determined in the market place.

According to Moore [5], Japan and Europe prefer approach #1. The rest of the world recognizes the advantages of approach #2. He asserts that approach #2 rewards invention and captures the advantages of rapid innovation. Approach #1, however, focuses on societal outcomes and protects local industry.

CONTINUING NEED FOR TECHNOLOGY-BASED STANDARD DEVELOPMENT ORGANIZATIONS

The previous sections have emphasized that there is growing globalization of industry that is stimulating a growing emphasis on international standards. Standards are important because they provide significant economic benefit. They are also costly and it is not clear that the benefits accrue to those who incur the cost. Finally, there is a highly disaggregated international standards system and at least two very different basic philosophies as to how standard systems should operate.

The current situation appears to be unstable and evolution will continue possibly at a somewhat faster pace than in the past. In an attempt to guide and manage the effects of that evolution, ANSI developed a national standards strategy for the United States [15].

However this evolution continues, it appears that three important major trends are emerging. First, there is continued growth of in the significance ISO, IEC, and ITU. For global trade, they have a structure that can involve all stakeholders. The process has flaws and each organization is working to compensate for the flaws it identifies. But global corporations, serving global markets, will want and get global standards.

Global standards, however, are expensive. Unless there is a large global market, or significant government support, it is very unlikely that global standards will be developed. Even with a large global market, it is clear that these standards will be primarily supported and developed by large corporations that operate through out the world. The development process is a one-country one-vote process. Typically countries establish a committee, largely from local industries and occasionally with domestic university support, to determine the national position on a proposed standard. Within this process, a large company, with participation on several national committees, has a good opportunity to influence the choice of standards to be considered and outcome of the standards process. A small company, operating from a single country, has significantly reduced influence.

Government support is active today. As stated above, the European Union is funding the normalization of historical national standards across Europe to form the basis for a common market. As a byproduct, they are also funding the development of global standards. Similarly, the U.S. has increased its funding of ANSI to help standards development. This government support can help consumers and small businesses be heard in the standards process.

It is, however, unreasonable to assume that government funding will increase significantly beyond the current levels. Rather it is more likely that as the historic national standards within the European Union become consistent, the funding level for standards will decrease which would likely precipitate a government funding decline in other countries. Consequently, less expensive suitable alternatives are needed. Evidence of what these may be exists today.

An example may well be the current situation in the testing of the oil in power transformers. Worldwide, there was a significant investment in transformers in the 1950's through the 1970's to support the economic growth after World War II. Those transformers are now part of the infrastructure of industrialized nations. Many of those nations are privatizing their electric utilities, changing the basis on which these multimillion power transformers can be replaced. Thus, life extension is a major focus around the world. Consequently, there is a growing effort to test the transformer oil to determine precursors to failure.

This international needed has stimulated the revision this year of three IEC standards for the testing of gases in oil, i.e., IEC 60296, 60422, and 60599. These revisions are based on the results of large amounts of testing done primarily in Europe and Japan. The owners of the transformers funded much of the investigation as they could see a significant economic benefit of knowing when transformers might fail.

At the same time, however, there is an occasional need to measure the electrical breakdown strength of the oil. This test has poor incipient fault protection ability. It is a routine and infrequent quality control test. There are differing standards for this test, ASTM D877, ASTM D1816, and IEC 156. There also appears to be no economic incentive to develop a single global standard. Rather, equipment manufactures have found it more cost effective to design their test instruments to test according to any of the three standards [16]. Whereas IEC standards require international participation and attendant high cost for adoption, ASTM can assemble technical experts and promulgate a standard that is technically useful worldwide for a significantly reduced cost. This is likely a role that technical standards setting organizations will fill as long as they can provide affordable technical quality.

Finally, it is likely that consortium standards will continue to fill a market niche for industry-specific standards, particularly in rapidly evolving industries.

CONCLUSIONS

The globalization of trade is stimulating the evolution of the international standards system. It is clear that truly international standards with truly international participation are expensive. Many markets and problems are appropriate for such standards and the benefits of the standard justify the cost.

Two other types of standards are showing their usefulness, however. One is the technical standard that can be developed by a small number of experts for a more modest cost. Since the benefit is generally small and diffuse, covering even the more modest cost remains challenging.

The other is the consortium standard. These can require little continuing infrastructure while stimulating progress in rapidly changing fields.

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REFERENCES

- [1] R. Marks and R. Hebner, "Government Activity to Increase Benefits from the Global Standards System," Proc. 2nd IEEE International Conf. On Standardization and Innovation in Information Tech., Boulder, CO, USA, pp. 183-189, Oct. 2001.
- [2] D. Rhoden, "Real-Time On-Line Standards, the Ever Changing JEDEC, and other Standard Topics," *Technology Standards and Standardization Processes. Their Impact on Innovation & International Competitiveness*, pp. 32-41, Stanford University Press, 1999.
- [3] B. Hjelm and k. Long, "Standards, Strategy, and Wireless Network Planning," Proc. 2nd IEEE International Conf. On Standardization and Innovation in Information Tech., Boulder, CO, USA, pp. 50-55, Oct. 2001.
- [4] D. Robinson, "Standards – Help or Hindrance," *Technology Standards and Standardization Processes. Their Impact on Innovation & International Competitiveness*, pp. 43-53, Stanford University Press, 1999.
- [5] G. Moore, "Standards and the Gorilla Game: The Dynamics of Setting Standards in High-Tech Markets," *Technology Standards and Standardization Processes. Their Impact on Innovation & International Competitiveness*, pp. 118-134, Stanford University Press, 1999.
- [6] G. Tassey, "The Economics of R&D Policy," Quorum Books, Westport, CT, USA, 1997.
- [7] R. Hebner "Standards and Trade – Who Really Cares?" *Technology Standards and Standardization Processes. Their*

Impact on Innovation & International Competitiveness, pp. 3-16, Stanford University Press, 1999.

- [8] K. Jakobs, "A Broader View on Some Forces Shaping Standardization," Proc. 2nd IEEE International Conf. On Standardization and Innovation in Information Tech., Boulder, CO, USA, pp. 133-143, Oct. 2001.

[9] Transatlantic Business Dialogue, <http://www.tabd.com>

- [10] "Agreement on Technical Barriers to Trade" The World Trade Organization, http://www.wto.org/english/docs_e/legal_e/17-tbt.pdf

[11] A. Updegrove, "Forming and Representing High-Technology Consortia: Legal and Strategic Issues," *The Computer Lawyer*, March 1994.

- [12] "Annual budget for the CEN Management Centre (1999), European Committee for Standardization <http://www.cenorm.be/aboutcen/whatis/corporate/budget.htm>.

[13] "Agreement On Technical Cooperation Between ISO and CEN (Vienna Agreement)," 1995 <http://isotc.iso.ch/livelink/livelink/fetch/2000/2123/SDS_WE_B/sds_dms/vienna.pdf>.

- [14] "IEC - CENELEC Agreement on Common Planning of New Work and Parallel Voting," European Committee for Electrotechnical Standardization, 1996 <<http://www.iec.ch/cenelec.htm>>.

[15] *National Standards Strategy for the United States*, The American National Standards Institute, 2000 <<http://web.ansi.org/public/nss.html>>.

- [16] G. Fodor and M. Baur, "Progress of AC Breakdown Voltage Test Devices of Insulating Liquids" Proc. 14th International Conf. On Dielectric Liquids, Graz, Austria, pp. 333-336, 2002.