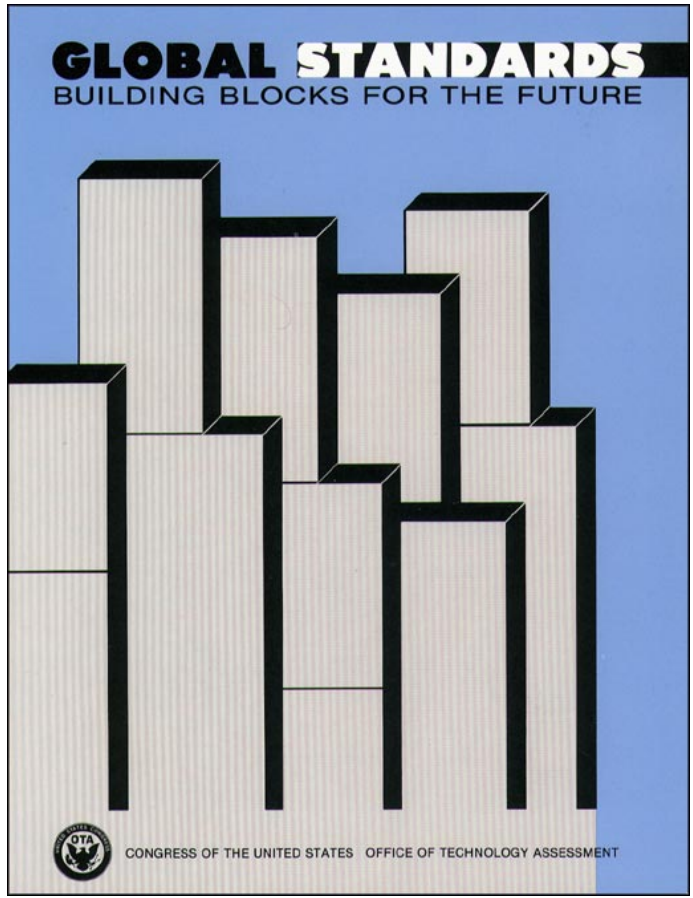
Global Standards: Building Blocks for the Future

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Foreword

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.

With the evolution of global markets, standards are even more important to facilitate international trade. Unfortunately, they may also be used as trade barriers or to gain advantage over foreign competitors.

The United States has been fortunate to have a pluralistic, industry-led standards setting process that has served us well in the past. Whether it will continue to do so in the future in the face of bruising international economic competition is uncertain.

This study considers the U.S. standards setting process in light of the changing economic and technological environment. Looking across industry sectors, the study compares the U.S. system with those of other countries, particularly the European Economic Community (EEC). Where remedies seem to be warranted, OTA suggests alternative strategies and options that the United States might pursue.

OTA gratefully acknowledges the contribution of those who participated in interviews, reviewed and commented on drafts, and provided information, advice, and assistance. However, OTA bears the sole responsibility for the contents of this report.



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Chapter 1

Summary, Findings, and Policy Options

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Chapter 1
Summary, Findings, and Policy Options

Introduction

Standards affect our lives in many ways. Food and drugs must comply with health standards; cars use standardized, interchangeable parts; workplaces have safety standards; clothing comes in standard sizes; jobs are evaluated according to performance standards; telephones have standard interfaces; and bed sheets are sized to fit standard mattresses. Even our lives have become standardized through our reliance on technology.

How standards are set is a matter of some concern because the economic and social stakes in standards are so large. The standards development process must be fair to prevent any single interest from dictating the outcome. Standards have major public policy implications, but the government has avoided taking a direct role in the process. Thus, in the United States, almost half of all standards are set by the private sector as part of a voluntary consensus process, in which all or most of the key players—including government-participate. The system reflects American political culture, and the general preference for market-based, pluralist solutions.

Many in the standards community contend that this private sector, voluntary consensus process has historically worked well.[1] However, a number of structural changes in the economy have recently occurred, which raise the question of whether the system can continue to be effective in the future. These include the development of a highly competitive global economy, which the United States no longer dominates; the emergence of regional trading blocks; the growing importance of multinational corporations and other translational nongovernmental institutions; and the rapid advance of technology.

Some people question whether the U.S. standards development process, which was designed to meet the problems of an industrial era, can continue to perform well in this radically new environment.[2] They are concerned, moreover, that other countries are better organized and better able to influence the international standards setting process, to the detriment of U.S. trade. In particular, they fear that the harmonization of European trade laws, scheduled for completion in 1992, will not only make it harder for U.S. companies to trade in Europe, but will also

[1] See proceedings, National Institute for Standards and Technology Public Hearings, "Improving U.S. Participation in International Standards Activities," Apr. 3,1990. Satisfaction is not so great among user groups, environmental and consumer safety organizations, industries experiencing rapid technological change, as well as those heavily dependent on exports. For a discussion of standards development problems in the fast moving information and telecommunication industries, see National Research Council, Crossroads *of Information Technology Standards (Washington* DC: National Academy Press, 1990). See also, J.L. Berg and H. Schumy (eds.), *An Analysis of the Information Technology Standards Process* (Amsterdam Elsevier Science Publishers B.V., 1990); Jeff Mead, "The Standards Process Breaks Down," *Datamation*, Sept. 15, 1990, pp. 24-32; Dennis Gilhooly, "A Standard Line," *Communication Week, Nov.* 12, 1990, pp. 67-69; John W. Verity, "Complete Confusion: A Jumble of Competing, Conflicting Standards is Chilling the Market," June 10, 1991, pp. 72-79; and Irwin Dorros, "The Standard Slowdown," *Telephony,* Feb. 26, 1990., pp. 46-49.

For a discussion of problems in the area of safety standards, see Mary Ellen R. Fise *CPSC: Guilding or Hiding From Product Safety* (Washington DC: Consumer Federation of America, May 1987). Among the problems cited are: 1) voluntary standards entail excessive time delays, 2) voluntary standards are often inadequate, 3) voluntary standards do not conform sufficiently to the consensus process, 4) agency reliance on nonexisting voluntary standards, and 5) inadequate monitoring of implementation of voluntary standards.

[2] This is not an entirely new concern. It was raised, for example, as early as 1974 in a Congressional Research Service study prepared for Congress. As this study pointed out:

> Participation involuntary international standardization has been spotty and uneven, with effective participation for some industries, such as automatic data processing, while others have provided little support. . . . A second undesirable consequence is that the impact of international standards upon small firms, consumers, and U.S. foreign policy objectives may often receive insufficient attention.

Voluntary Industry Standards in the United States: An Overview of their Evaluation and Significance for the Congress, Report to the Subcommittee on Science, Research and Development CRS, July 1974, p. 4 (Hereafter referred to as CRS, 1974).

allow the Europeans to take the lead in setting international standards.[3] Pointing to the active role that foreign governments play in the international standard setting process, some have called on the U.S. Government to assume greater responsibility in protecting U.S. interests.

This study addresses these concerns. Looking across industry sectors, it evaluates the U.S. standards setting process in the light of its changing economic and technological environment, and compares it to processes in other countries. In cases where specific problems can be identified, it suggests alternative strategies and options that the Federal Government might pursue.

Request for the Study

This study was requested by the House Committee on Science, Space, and Technology. Noting that standards are increasingly being used to ease or block trade throughout the world, the Committee requested OTA to:

1. **assess the** effectiveness of U.S. representation in the international forums that develop standards and evaluate the impact international standards setting is having on the U.S. ability to export;
2. review the roles played by the governments of other industrialized nations in their international standards setting activities and;
3. consider whether the U.S. Government should play a greater role in funding international standards development and standards assistance to developing countries.

The Scope of the Study and Method of Approach

While standards have much in common, they are not all the same. Standards serve a number of purposes, having evolved at different points in history in response to distinct social and economic problems. In the past, for example, standards were set only after a product had been developed. Today, in the face of rapid technological change, many standards are being set before a product is fully developed.[4] Standardization processes and stakeholder interests also differ, depending on the nature of the standard and the structure of the market. Where a dominant producer or supplier exists, for example, standards may be set on a de facto basis, in the market place. But compromises and negotiations among key players may be required when economic leverage is more evenly distributed.[5] Moreover, when there are safety or environmental hazards involved, government is more likely to become directly involved.[6]

Because standards and standards processes differ, it is difficult to generalize about them. What works well in one set of circumstances may fail in another. But comparisons over time, across industry sectors, and among countries can be useful to identify the important variables that lead to success or failure. The following analysis is based, therefore, on a comparison of the U.S. standards development process, as it has evolved over time, with those of Europe, as well as comparisons of how standards are set across industry sectors.

A series of interviews, conducted in both the United States and Europe, complement the research

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[3] See for a discussion, "Standards, Testing, and Certification," *The Effects of Greater Economic Integration Within The European Community on the United States: First Follow Up Report,* USITC Publication 2288 (Washington, DC: United States International Trade Commission, March 1990, ch. 6). As noted in the USITC report:

> Some began to worry that the growing influence of environmentalists, consumers, and unions would lead the EC to "harmonize up" regulatory requirements, putting in jeopardy U.S. access to the entire EC market. It became apparent that, because of their lack of direct representation and uneven access to information, some U.S. suppliers had limited influence over the private standards bodies entrusted by EC authorities with drawing up voluntary standards. . ..The EC's systematic updating of technical regulations posed the prospect that standards developed as part of the 1992 program might become de facto or de jure world standards. Some claimed that the state-of-the-art standards being developed in areas like machine tools could give European competitors an upper hand, not only in the EC, but in third country markets.

Ibid.,, pp. 6-12,6-13.

[4] These standards are referred to as anticipatory standards. These standards are written before a product has been developed; they specify how products must perform, but allow producers to independently develop their products to meet these specifications. For a discussion see Carl Cargill, *Information Technology Standardization: Theory, Process, and Organizations* (Cambridge, MA: Digital Press, 1989).

[5] Marvin Sirbu and Kent Hughs, *Standardization of Local Area Networks,* mimeo, Department of Engineering and Public Policy, Carnegie Mellon University, April 1986.

[6] David A. Garvin, "Can Industry Self-Regulation Work?" *California Management Review,* vol. 25, No. 4., summer 1983.

for this study.[7] They are intended to help fill the gap between the theoretical understanding of the standard setting process and how it works in practice. Most standard setting literature is theoretical. It attempts to identify the conditions under which "optimal" standards might emerge. This literature, which is aimed at the microlevel of the firm, views the producer, or vendor, as the primary actor in the standards development process. Few studies have examined how standards evolve through the voluntary consensus process in institutions such as the American Society for Testing Materials (ASTM) and the Institute of Electrical and Electronics Engineers (IEEE). And more often than not they have ignored key players such as user groups, or the standard setting institutions themselves.[8]

What Is Meant by Standards

The choice of definitions has major policy implications. How the term "standards" is used in this study, for example, determines the terms of the debate and the range of government options developed for dealing with problems in the standard setting process.[9] The role for government may differ, for example, depending on whether one's reference is product standards or safety and environmental standards.

Broad definitions used in every day speech are generally not helpful. They are too vague to guide analysis. Precision is sacrificed for the sake of comprehensiveness. This is clearly the case for standards definitions. They tend to be exceedingly broad, in order to cover the full range of standards found throughout society. Included among the definitions of standards in *Webster's Dictionary are;*[10]

> . . .something established by authority, custom, or general consent as a model or example,
>
> . . .something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality.

Although these definitions provide an overall notion of what standards are, they do not help focus the analysis. For this reason, researchers formulate their definitions to conform to the specific questions to be asked and the problems to be solved. Economists, for example, generally seek to know how, and under what circumstances, standards are set in the marketplace. They tend to view standards as an agreed upon set of specifications that define a particular product or that allow products to interopcrate. Anthropologists, on the other hand, focus on the question of how individuals relate to their cultures. Thus, they consider standards to be the accepted rules of behavior that facilitate social interactions. Government bureaucrats are likely to view standards as the means to address a societal concern or to achieve asocial end. They often equate standards with regulations.

This study focuses on how U.S. standards and standards development processes might affect U.S. trade. Thus, it must consider all standards and standards processes that influence national economic performance. For this purpose, three different kinds of standards are considered. These include product standards, control standards, and process standards. There are also three different methods of achieving standards: 1) standards can be set through the market, on a de facto basis; 2) standards can be set by government, through the regulatory process; and 3) standards can be negotiated through a voluntary consensus process. These three kinds of standards and three kinds of standards processes can be matched to form a matrix of both the standards universe and the standards setting processes and problems analyzed in this study (see figure l-l). Thus, all three kinds of standards can be established in any one of the three standards processes. The

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7 A few of the people interviewed requested anonymity because they felt their positions and effectiveness in the standards community might be jeopardized were they to make their statements public. OTA decided it was important to include some of this interview material in the report, even though it cannot be directly cited. Because the U.S. standards process is a voluntary process, how well it works depends to a great extent on the attitudes and perceptions of the participants. The conflict within the standards community is a major problem for the U.S. standards system, and its magnitude only became apparent through the course of the interview process. All other interviewees and contributors are listed in app. B.

8 For a description of this literature see app. A.

9 As Ross E. Cheit notes in *quoting* Charles Lindblom and David Cohen

> . . .we do not discover a problem "out there," we make a choice about how we want to formulate a problem. That choice reflects certain values and in turn constrains the realm of possible solutions.

Ross E. Cheit, *Setting Safety Standards: Regulation in the Public and Private Sectors* (Berkeley, CA: University of California Press, 1S90), p. 150.

10 Webster's *New Collegiate Dictionary* (Springfield, MA: G&C Merriam Co., 1977). p. 1133.

Figure I-I—Standards Universe

Type of Standard by Goals

Standarization mechanism	Control	Product/quality	Process/interoperability
De Facto	Warner-amex Database-privacy standards	VCR standards	Language customs Bills of lading Computer interface standards
Regulatory	Auto safety regulations Fuel economy standards	NSA encyption standards Department of Agriculture Product classification standards	Open network architecture standards ETSI standards for European telecommunication standards
Voluntary consensus process	Standards for medical devices Pressure vessel standards Petroleum standards	Refrigerator standards	Map-top protocols for OSI/standards Standards evolving legislation Electronic data interexchange standards

The three kinds of standards and three kinds of standards processes can be paired to forma matrix that scopes the standards universe and the standards setting processes and problems to be analyzed in this study.
SOURCE: Office of Technology Assessment, 1992.

particular process by which standards are established is often the result of historical circumstances and/or political and cultural choice. (For a detailed discussion of these standards and the processes through which they evolve, see app. A).

Evaluating the U.S. Standards Development Process

The analytical basis for evaluating the U.S. standards setting process is poor. There is no objective set of criteria to gauge the standardization process, and little public thought or debate has been devoted to the question of what standards "ought to achieve. Much available information is hearsay and tainted by the narrow perspectives of those involved. Thus, stakeholders are inclined to judge how well the standards process works for each of them, not on the basis of some agreed upon objective criteria. Even among academics, there is a tendency to judge the system from an overly narrow perspective. Whereas economists are likely to focus on the criteria of efficiency, those in political science and public administration generally stress the system's effectiveness in meeting its goals.

Nor is there agreement about who should determine how well the standards development process works. Because standards organizations perform a number of public functions, government has generally monitored the process, intervening when it deemed necessary. For example, assertions of antitrust infringements and unfairness led the Federal Trade Commission (FTC) in the 1970s to investigate the system and recommend that government assume

a greater role in regulating standard-developing bodies.[11] However, many in the private sector contend that it is the participants in the system, themselves, who should be the final arbiters.[12] This position assumes both that 1) the participants know and are willing to pursue their own best interests; and 2) that participants' interests always coincide with the *national* interest. Both assumptions, are certainly open to question, if not clearly refuted by history.[13]

Criteria for judging standards processes also change over time. As circumstances change, so too do the demands placed on the standards process. And different kinds of organizational arrangements may be more effective in meeting some demands than others. For example, during wartime, when speed was essential, government assumed control over standards setting. However, in the postwar period it relinquished the responsibility to the private sector.[14]

From the perspective of Congress, and for the specific purposes of this study, the most important criterion for judging the U.S. standards development process is its impact on the Nation's overall economic performance. The three major questions addressed, therefore, are:

1. whether and to what extent does the U.S. standards process support the growth and competitiveness of the U.S. economy in a rapidly changing global environment;
2. to what extent, and in what ways, are the current set of organizational arrangements a factor in determining the system's performance; and
3. under the current set of circumstances, what kinds of organizational changes, if any, might lead to enhanced performance.

To answer these questions, this report looks frost at the evolution of the standards process in the United States (ch. 2); second, at standardization as it has taken place in Europe (ch. 3); and third at the structural changes taking place in the global standards setting environment and their implications for the United States (ch. 4). Appendix A provides an analytic framework for assessing standardization issues.

Key Findings

Concern about the U.S. standards setting process and recommendations for greater government involvement are based on the notion that the U.S. approach no longer works as well as it should. Before considering what government might do to improve the situation, one needs to identify specific failures and demonstrate why and how government involvement will lead to a better result. OTA identified a number of problems that give cause for concern.

A Growing National Stake in Standards Issues

The government, as the sole representative of the Nation, has a considerable interest in the effectiveness of the U.S. standards setting process. Standards help determine the efficiency and effectiveness of the economy, the cost, quality, and availability of products and services, and the state of the Nation's health, safety, and quality of life. The government's stake in standards setting will loom even larger in the future, given a number of developments.

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11 FTC, Bureau of Consumer Protection, Standards and Certification: Proposed Rules and Staff Report (Washington, DC: Government Printing Office, 1978).

12 This position was stated repeatedly during interviews with stakeholders.

13 For e-pie, although participation in international standards bodies was in the long term interest of U.S. standards organizations, as well as of the Nation as a whole, U.S. standards developers failed to recognize the opportunity, and were late getting involved. Reportedly, ANSI was able to assume the position of national representative body within the ISO, not because of its stature in standard setting, but rather because ASTM-the most prominent standard development organization at the time-made a clear policy decision not to get involved in international standardization.

14 In 1917, product diversity was so great it threatened to hinder the War effort. As a result, the government set Up a Commercial Economy Board of the Council of National Defense, whose task was to simplify the use of labor, capital, and equipment in all industries. Its membership was comprised of businessmen from key industries. In May, 1918, the Board was transferred to the War Industries Board. This Government Board eventually regulated the manufacture of over 30,000 articles of commerce. See CRS, 1974, p. 11. A similar shift occurred during the Second World War. Noting the importance attached to standards the ASA wrote:

> Never before has the country been so standards conscious. Their president—his Director of Economic Stabilization-the Army-the Navy—WPB—OPA—industry—are all using standards as a means of carrying out the stake imposed upon them by war. Standards are being debated on the floor of Congress, which has setup a committee to study their use.

As cited in ibid, p. 17.

As the United States adjusts to a changing global economy, more and more industries are not only dependent on trade but also affected by standards. It was estimated, for example, that for the year 1977, $69 billion of U.S. exports were affected by standards activity. No comparable figure is available today. However, it is estimated that of $83 billion in exports of manufactured goods, some $48 billion is, or will be, subject to European Community (EC) product safety standards alone.[15]

Standards help determine the competitiveness of U.S. industries. Recognizing the relationship between standards and trade, the Europeans are using standards not only to create a common market, but also as a marketing device to sell their products in Eastern Europe and the developing world. If the U.S. standards process malfunctions, or fails to keep pace with standards developments in the rest of the world, American industry will suffer.

Failure to appreciate the implications of international standards can have serious consequences for U.S. industry. The U.S. machine tool industry provides a case in point. For years, the industry was able to thrive without regard to international standards. Industry practices became de facto standards because the U.S. market for machine tools was so large. In a global market, where there is intense foreign competition, this is no longer possible. Not being involved in the development of international standards or experienced in producing products to foreign specifications, the U.S. industry has become much less competitive.[16] The Japanese, on the other hand, have gained considerable ground in the international market, in part by more effectively using standards to improve productivity and add value to their products.[17] Concerned about the fate of the machine tool industry, President Bush recently agreed to approve a 2-year voluntary restraint agreement on machine tools, which limits imports from Taiwan and Japan, to allow time for the industry to become revitalized.[18]

Standards will become more important due to growing reliance on technology. Just as specialization and assembly line production provided an impetus for standardization during the industrial era, so too networked production and computer-assisted work are increasing the demand for standards today. Machines require more precision than human beings, as they are less flexible in adapting to errors and omissions.[19]

Technology deployment can also give rise to unintended health and safety problems and threaten the Nation's environment. Standards can serve as mechanisms for limiting or ameliorating these impacts. Although safety standards were first set early in this century, creation of standards designed to control technological impacts has been growing steadily. At last count, Federal agencies, such as the Environmental Protection Agency, the Food and Drug Administration, and the Occupational, Safety, and Health Administration, had developed approximately 8,500 standards (see table 1-1 on laws affecting standards) .20

The growing pace of technological change will also drive the need for standards. The faster the advance of technologies, the greater the risk in R & D and product development. Standards setting can reduce uncertainty in a rapidly changing technology environment. Participants in the process learn first hand about new technologies. Moreover, by developing reference models and anticipatory standards, such as Open Systems Interconnection (0S1),[21] manufacturers have a general target towards which

15'rhis figure was provided by the Department of Commerce.

16 As the Chief Executive Officer of Cincinnati Milacrom described the situation to members of his industry:

> Your competitors are global, ..Your suppliers, your standards, your designs, your issues, your policies, your strategies-they all must become global. Technology is not a provincial field any more. [Industry must implement] radical measures.

'Cincinnati MilacrcChairman Issues Stem Warning to U.S. Manufacturers,' New *Technology Week, Nov. 18,* 1991, p. 4.

17 Michael L. Dertourzos et.al., Made *in America: Regaining the Productive Edge* (Cambridge, MA: MIT Press, 1989), PP. 241-42.

18 'Bush Approves Limited Extension of Machine Tool VRAs With Japan, Taiwan,' *International Trade Reporter,* Jan. 1, 1992, p. 10.

19 Gerd Wallenstein, *Setting Global Telecommunication Standards:* The *Stakes,* The *Players* & The Process (Norwood, MA: Artech House, 1990), p. 18.

20 Robert Toth, Toth Associates, (cd+), *Standards Activities of Organizations in the United States* (Washington, DC: NIST Special Publication 806, February 1991), p. 3.

210s1 (Open Systems Interconnection) is an architecture for computer networks and a family of standards that permits data communication and data processing among diverse technologies. OSI-based standards anticipate the development of particular applications or products. They provide a reference model that defines and categorizes seven layers of functions that need to be performed in the protocols and services at each layer. OSI-based standards are international in scope and are being developed in international standard-setting bodies.

Table I-I—Legislation: Creating the Need for Government Standards

Safe Drinking Water Act of 1974 (Public Law 93-523)
Child Protection and Toy Safety Act of 1969 (P.L. 91-1 13)
Lead-Base Paint Poisoning Prevention Act of 1970 (P.L. 91 -695)
Consumer Product Safety Act of 1972 (P.L. 92-573)
Mobile Home Construction and Safety Standards, Title VI of the Housing and Community Development Act of 1974 (P.L. 93-383)
Traffic and Motor Vehicle Safety Amendments of 1970 (P.L. 91 -265)
Highway Safety Act of 1970, Title II, Sec. 202 of Federal-Aid Highway Act of 1970 (P.L. 91 -605)
National Environmental Policy Act of 1969 (P.L. 91-190)
Resource Recovery Act of 1970 (P.L. 91 -512)
Clean Air Amendments of 1970 (P.L. 91 -604)
Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500)
Federal Environmental Pesticide Control Act of 1972 P.L. 92-516)
Federal Energy Administration Act of 1974 (P.L. 93-275)
Solar Heating and Cooling Demonstration Act of 1974 (P.L. 93-409)
Medical Devices Amendments Act of 1975 (P.L. 94-295)
Occupational Safety and Health Act of 1970 (P.L. 91 -596)
Toxic Substances Control Act of 1976 (P.L. 94-469)

SOURCE: William T. Cavanaugh, "Needed: A National Standards Policy, ASTM *Standardization News,* vol. *5, No. 6,* June 1977, p. 13.

they can direct technology development. Standards setting, therefore, is an important aspect of any national economic policy aimed at encouraging innovation and economic growth.

Some standards will likely be more important from a national perspective than others. In a global, information-based economy, networking technologies provide a basis for productivity and economic growth. These technologies will become the basis of an infrastructure for all economic activity. If networks fail to interconnect for lack of standards, the Nation could suffer considerable economic loss, and national security might also be jeopardized. Thus, while government may have a relatively small interest in the development of certain product standards, its stake in others, such as standards for interoperability, will be high.[22]

Insufficient Support for Standards Setting

Standards are essential for all human activity, but most people take them for granted. Only when products fail to work, or mishaps occur, does the average person thinks about standards. Even in business, where money is at stake, standards are often given a low *priority. There is a clear need in the United States for greater attention to standards. In an information-based global economy, where standards are not only employed strategically as marketing tools but also serve to interconnect economic activities, inadequate support for the standards setting process will have detrimental effects.*

One reason for the lack of regard for standards is that they exhibit some of the characteristics of what economists call 'public goods. ' '[23] Public goods are those goods whose benefits are available to everyone and from which no one can be excluded, and no one can frilly appropriate the benefits. As a result, public goods are underproduced. Standards often fall into this category.[24]

Other market failures may also weaken standards development processes. If the most efficient standard choices are to be made, all interested parties must have access to accurate and timely information.[25] However, information about standards, like standards themselves, is a public good, and is therefore

22 In the past, achieving adequate interoperability within the communication infrastructure was relatively easy. In telephony, AT&T provided both end-to-end service and system interconnection. However, in a recent study, OTA found that interoperability is likely to become more problematic in the future, from both technical and administrative standpoints. Not only will the need for interoperability become greater, achieving it is also likely to be harder. see U.S. Congress, Office of Technology Assessment, *Critical Connections: Communication for the Future,* OTA-CIT-407 (Washington DC: Government Printing Office, January 1990), chapter 11.

23 Pure public goods will not be produced privately. There are only a few pure public goods, one example being national defense. Other goods, like education and standards, are impure public goods. These combine aspects of both public and private goods. Although they serve a private function, there are also public benefits associated with them. Impure public goods may be produced and distributed privately in the market or collectively through government. How they are produced is a societal choice of significant consequence. If decisions about impure public goods are made in the market, on the basis of personal preferences alone, then the public benefits associated with them may not be efficiently produced or equitably distributed. See Edwin Mansfield, *Macroeconomics Theory and Application (New* York, NY: W.W. Norton, 1970)

24 C. Kindelberger, "Standards as Public, Collective, and Private Goods,' *Kylos,* vol. 36, pp. 377-395; see also Sanford Berg, "Technical Standards as Public Goods: Demand Incentives for Cooperative Behavior," *Public Finance Quarterly,* vol. 17, January 1989, pp. 35-53.

25 For a discussion of market failures due to lack of information, see Joseph Farrell and Garth Saloner, "Coordination Through Committees and Markets," *RandJournal of Economics,* vol. 19, summer 1988, pp. 235-252; and Joseph Farrell and Garth Saloner, "Standardization Compatibility, and Innovation" *Rand Journal of Economics,* vol. 16, spring, 1985, pp. 70-83.

likely to be underproduced. Even when standards-related information can be packaged for sale like other commodities, thus yielding an adequate return, its price may limit distribution so that people have insufficient information to make sound decisions.

Some kinds of technologies are subject to greater market failures than others. For example, networked technologies-e. g., information and communication technologies-often have large installed bases, making it particularly costly for users to shift to a new, more technologically advanced standard. Thus, they may fail to adopt a superior standard, due to what economists call ''excess inertia. ''[26] At the same time, these technologies also exhibit "increasing returns to adoption," a situation that occurs when the benefits to the user of a technology increase with the number of users. Under these circumstances, the wrong standard might be chosen due to ''excess momentum.' Not wanting to be left off the network when a major user moves to a new standard, other users may rush too quickly to jump on the bandwagon.

These market failures help to justify the role of government. Sometimes, public interest and involvement in standards can only be sparked by some form of government action or major national event. The rise of the standards movement in the United States, for example, grew out of wartime production and a national campaign to reduce waste. With an effort made to reach everyone, standards became a household word.

The same thing is happening today in Europe, where standards are seen as a tool for unification. The European Commission (EC) estimates, for example, that by 1993 the Community will need at least 1,000 European standards.[27] Viewing standardization as a priority task, the European Council adopted a new approach for developing European standards in May 1985.[28] As described by one member of the French standards community: "Standards are bound to lead to unification. Not since the French Revolution has there been such a significant movement.

How far, and under what circumstances, the U.S. Government should, itself, become involved in standards setting is problematic. It is hard to measure the societal benefits to be derived from standards, or the costs of low participation rates. The costs associated with government involvement must be taken into account in any calculation. If standards are produced prematurely, they can retard innovation. If they do not accurately reflect the market, they will send out false signals and favor some firms over others.

The situation is further complicated because standards problems differ by industry. In industries such as telecommunications, for example, the incentive to participate in standards setting will likely be high. If communication systems fail to work together, there can be no services to sell. Support for standards setting will also be greater in industries comprised of a few large companies. They are more likely to see a return on their investments, since there are fewer to share the benefits.[29] This has been the case, for example, in the automotive and petroleum industries. Industries subject to Government regulation are also likely to be actively involved in standards setting, if only for preemptive reasons.[30]

There are, however, cases where greater government involvement can easily be justified. Some

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26 Joseph Farrell and Garth Saloner, 'Horses, Penguins and Lemmings,' H. Landis Gabel (cd.), ***Product Standards and Competitive Strategy (North*** Holland, Elsevier Science Publishers, 1987), p. 11. As the authors note:

> "Excess inertia arises when not enough users are willing to go out on a limb by adopting the new technology. This is most likely when network externalities are strong and there is a great deal of uncertainty about whether a lead would be followed," p. 11,

27 Since 1986 approximately 30 standardization mandates related to European Economic Community (EEC) legislation (calling for about 800 European standards) have been given to the two main European standardization bodies Comite' Europeen de Normalisation (CEN) and Comite' Europeen de Normalisation Electrotechnique (CENELEC), which are to be completed by 1992. With more mandates being prepared, the total is likely to be over 1,000. Commission on the European Communities, ***Commission Green Paper on the Development of European Standardization: Action for Faster Technological Integration in Europe,*** Brussels, Oct. 8, 1990, COM(90) 456 final (hereafter referred to as ***Green Paper on European Standardization).***

28 See ch. 3. The number of Technical Committees and working groups has doubled between December 1987 and December 1989, and the number of draft European Standards in CEM rose from 220 in 1986 to 950 in 1989. ***Green Paper on European Standardization,*** op. cit., p. 9.

See for a discussion Lucy Kalloway, 'Technical Standards Machinery Grinds Exceeding Slow," ***Financial Times, May 14,*** 1990, p. 4.

29 Mancur Olsen, The ***Logic of Collective Action: Public Goods*** and ***the Theory of Groups*** (Cambridge, MA: Harvard University Press, 1971),

30 For example, flammability standards in upholstered furniture industry were only developed by the industry trade association after a notice of proposed rulemaking appeared in the ***Federal Register. See*** Harvard Business School, ***The Upholstered Furniture Flammability Issue*** (Boston, MA: Intercollegiate Case Clearinghouse, 9-680-084, 1980). See also David Garvin, op. cit., foomote 7, and Ross E. Cheit, op. cit., foomote 10.

standards-such as health, safety, and environmental standards- will have consequences for the whole Nation apart from their market values. Moreover, since technological impacts transcend national boundaries, standards setting in these areas will likely require intergovernmental negotiations.

When the divisiveness in the standards community becomes intense, and its effectiveness is questioned, the government may also need to step in. Thus proposals to expand the Federal role have often come from the government acting in response to dissident claims. In 1979, for example, assertions of antitrust infringements and unfairness led the Federal Trade Commission (FTC) to investigate the system and recommend that government assume a greater role in accrediting standards setting bodies.[31]

Government involvement could similarly be called for to assure that U.S. producers and manufacturers have access to foreign markets. This is particularly important today, when standards are critical to the development of regional trading areas. For example, Secretary of Commerce Robert Mosbacher, concerned about U.S. access to the European market, recently initiated discussions with the Vice President of the European Commission, Martin Bangemann to work out some of these issues.[32] However, this action was not without controversy; a number of people in the standards community felt that the government had usurped the private sector's role.[33]

Government support for standards setting can be most clearly justified in the international arena. Although much future standards work will take place in the international arena, it is not clear that the United States will bean effective presence there (see ch. 4). The United States has been slow to appreciate the growing importance of international standards. Some say, for example, that U.S. standards bodies lost a tremendous opportunity in the early post World War II years, when European standards institutions were still in a state of disarray .34 Europeans, themselves, complain about the failure of the United States to make a real commitment to international standards. Some even suggest that U.S. involvement in the past was counterproductive. Americans, they say, were playing for much lower stakes than the Europeans, since standards implementation in the United States is voluntary, but compulsory in Europe. To the Europeans, therefore, U.S. participation has sometimes appeared perfunctory, if not at times obstructionist.[35]

The United States may also have considerably less influence than in the past to determine the character of international standards institutions.[36] That the United States was able to play the dominant role in defining the post-war international economic order was due to factors, many of which no longer exist, such as American economic and military preeminence, the threat of a common enemy, as well

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31 FTC, op. cit., footnote 12.

32 See, "Commerce Department and EC Move Closer to Testing and Certification Agreement," *Business America,* July 15, 1991, pp. 7-9.

33 Unpublished memo from ANSI to the Office of Management and Budget (OMB).

34 Three was little incentive to consider international standards, so long as national economies were independent of one another. Writing in 1928, K. H. Conduit explains the attitude of the time. He notes:

> Very little has been accomplished in international standardization. . . for obvious reasons. The manufacturing arts are different at different stages indifferent countries, and what is acceptable in the advanced countries is not in the backward ones. Until international trade is conducted on a basis less strongly flavored with nationalism, and industrial education has made more progress than it has yet, there will apparently be little economic justification for extensive standardization.

K.H. Condit, "The Economic Aspects of Standardization" *Standards in Industry (The American* Academy of Political and Social Science, Notes from the Annals, 1928), p. 40.

35 Reacting to these Cements during the OTA review process, some members in the American standards community say that these comments are self-serving, and thus not to be taken too seriously.

36 Explaining U.S. hegemony in the past, Gilpin notes:

> For the first time ever, all the capitalist economies were political allies. American initiatives in the area of trade led to successive rounds of tariff liberalization. The dollar served as the basis of the international monetary system, while American foreign aid, direct investment, and technology facilitated the rapid development of advanced and certain less developed economies. American hegemony provided the favorable environment within which supply and demand forces created an era of unprecedent growth and an increasingly open economy.

Robert Gilpin, *The Political Economy of International Relations* (Princeton NJ: Princeton University Press, 1987), p. 5.

as relatively steady economic growth.[37] To affect standards processes in an international environment in which economic and political resources are now both more balanced and dispersed, the United States will need to exert greater effort and resources, as well as negotiate and compromise, more than ever before (see ch. 4).

Rallying sufficient resources for such a task will also be difficult. The potential for market failures at the international level is very high, since many American companies, especially in the small business community, have yet to recognize the implications of international standards in a global economy. By the time they come to appreciate the potential consequences, the damage to the national economy may have already been done. Initial research suggests that a key factor determining outcomes in standards development bodies is the amount of resources and skills that participants bring to bear.[38] And whereas American participants must pay their own way, participants from other countries are generally supported, at least in part, by their national governments.[39]

The cost of international standards development, and of participating actively in the process, is also a limiting factor. It has been estimated, for example, that the development of a major international telecommunications standard may require in the range of 1,000 person-years of experience, 20 person-years of actual effort, and $3 million.[40] Distributing standards information across national boundaries, when it requires cultural and political as well as linguistic translation, can also be very costly.

If sufficient resources could be brought to bear in the international arena, the payoff would likely be great. U.S. companies, which are no longer dominant in the market, and hence no longer able to set de facto standards, will benefit from a standards setting arena where influence is not based solely on market power.[41] Equally important, signatories of the General Agreement on Tariffs and Trade (GATT) Standards Code[42] have pledged to adopt any international standards that already exist. Thus, if the United States supports the timely development of standards in international standards bodies, it may preclude the Europeans and others from using regional standards to restrict trade.

The Need for Cooperation Rather Than Conflict

The voluntary consensus process requires cooperation and trust to succeed. There is little bureaucratic structure to otherwise hold it together. Unresolved disputes and disagreements not only distract from the main purposes of setting standards; they also undermine the legitimacy of the system, both in the opinion of its members as well as in the eyes of the rest of the world. Such is the case in the U.S. standards world today.

The outpouring on behalf of the present standards development system hides some deep-seated divisions within the standards community itself. Although most members firmly believe in the voluntary consensus process, they differ about what ''opemess' means. The American Society for Testing Materials (ASTM) insists that true consensus requires the participation of *all* interested parties,

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37 As described by Gilpin:

> The United States emerged from the Second World War as the dominant or hegemonic economic and military power in the international system. This unchallenged American preeminence was partially due to the wartime destruction of other industrial economies. From this perspective, the commanding nature of American leadership in the early postwar period was "abnormal" and would one day decline with the recovery of other economies. This artificial situation, however, caused false and extraordinarily high economic expectations among the American people that continued into the 1990s and made adjustment to economic and political decline extremely difficult.

Ibid, p. 344.

38 See. Martin B.H. Weiss and Marvin Sirbu, ''Technological Choice in Voluntary Standards Committees,'' Op. cit., footnote 9, pp. 111-132.

39 See ch. 4, for a detailed discussion.

40 Dr. Odo J. Struger, "Impact of International and Foreign Standards on a Company's Operations," Presentation Aug. 20, 1991, p. 6.

41 Lehr, op. cit., footnote 9; and Farrell and Saloner, op. cit., footnote 9.

42 Article 2.2, Agreement on Technical Barriers to Trade. The Standards c& attempts to ensure that ''technical regulations and standards are not prepared, adopted, or applied with a view to creating obstacles to international trade.'' To accomplish this it lays out principles that guide the development and application of standards and the use of conformity assessments procedures. These principles include using international standards unless inappropriate for certain specific reasons and to not develop or apply standards in a way that poses an unnecessary obstacle to international trade. In the draft text, which is almost complete, countries pledge to use the least restrictive measure to accomplish a legitimate objective. In general these principles also apply to conformity assessment procedures (that is, the methods by which a body assures that a product conforms to a particular standard).

even if this requires subsidizing some groups. On the other hand, the American National Standards Institute (ANSI) as well as others, argue that due process requires only that the process be open so all have an opportunity to participate. They contend that willingness to pay is an essential measure of interest in the process.

Members of the standards community also disagree about which organizations produce the "best" standards. For instance, many professional societies claim that their standards are technologically superior, since their members participate not as representatives of any group or interest, but rather as individual engineers.[43] Some industry groups argue the opposite. Standards set by professional societies, they contend, do not reflect market forces, and they are often insensitive to industry competitive issues. "Unaccountable to industry, they often do more harm than good," OTA was told.

Standards setting bodies also compete to sell standards, which is another important source of contention. Many of these organizations resemble publishers; they orchestrate standards setting in exchange for the right to sell standards and other value added, standards-related services. Sales from standards, for example, account for 80 percent of the income of ASTM, and 28 percent that of ANSI. Competition and turf battles among these and other standards setting bodies often revolve around these sales. These struggles are likely to become even more intense and convoluted in the future with the growth of a world market for standards and the emergence of new global competitors.

This economic competition is compounded by personality conflicts in the standards setting community, some dating back a number of years. There is little trust or respect among the leadership. People characterize one another in highly acrimonious terms.[44] As one industry representative, who is otherwise highly supportive of the U.S. standards system, described to OTA "This situation is sheer madness. It has truly gotten out of hand and no longer serves our needs."

The interests of some standards setting organizations are also beginning to diverge from those of manufacturers. In a highly competitive global economy, for example, it is important for manufacturers to have their standards adopted on an international basis. They may even want to 'give' their standards away in an effort to develop new markets. However, such a policy is not in the interest of those standards setting organizations, whose livelihoods generally depend on standard sales. In addition, manufacturers may want to speed up standards development and implementation, but standards setting organizations often hesitate to put their standards electronically online due to copyright concerns.

Conflicts in the standards community weaken the U.S. position internationally. Aware of these disputes in their most minute detail,[45] European standards makers use them to their advantage. Even so, Europeans would prefer that the United States presented a united front to the rest of the world. "The United States," they say, "is a major economic power, and it must play its role in international standards setting accordingly. " Europeans emphasize how difficult it is to negotiate with one body speaking authoritatively for the United States, "when you are unclear about its actual power, and who it really represents. " They complain that one moment they are told that ANSI speaks for all the United States; but the next, ASTM is knocking at their doors.

Internecine warfare in the standards community also raises questions about the ability of the voluntary standards organizations to carry out the public trust delegated to them.[46] In a recent public display of these problems, ANSI-which is recognized internationally as the official member body to represent the American standards community in international standards organizations-charged before the Office of Management and Budget (OMB)

43 For a descriptions of the American standards org animations and the rules that govern them, see ch. 2.

44 Among the terms used during the OTA interviews to describe members of the community were "scum ball, " "liar," and "sleaze," to name a few. OTA interviews.

Some reviewers of the OTA draft believe that it is inappropriate to use such terminology in a government report. However, many of these same people, argue that OTA has exaggerated the turf battles and personaMy conflicts within the standards community. Because these words illustrate the intensity of feeling and negative tone of the competition among standards organization, OTA chose to retain them in the final document.

45 For example, the word for scum ball in French, OTA was told, is "l'eau du merde. "

46 Although a voluntary, private sector activity, standards makin g in the United States is a public trust. The income that standards bodies derive from sales of standards documents and from member dues is tax deductible.

Table 1-2—Standardization Systems

U.S.	Other industrialized nations
Distributed	Centralized
Pragmatic	Systematic
Reactionary	Anticipatory
Inch-pound	Metric
Entrepreneurial and individualistic	Tools of industrial policy
Maximize role of private sector	Standards development responsive to government direction and national policy
Tolerated; implementation questioned	Acceptance; immediate implementation
International standards often only guides	Direct adoption of international standards
Open and transparent	Often closed, negotiated standards development
Appeals mechanisms exist	Appeals procedures are exception
Self-certification and warranties	Type approval and third party testing

SOURCE: R. B. Toth, Toth Associates, course material from "Establishing and Managing a Company Standardization Program."

that certain parties in the Department of Commerce are underminingg ANSI's authority through their actions. However, three other major U.S. standards setting organizations quickly took exception to this charge, claiming that they fully support the Department of Commerce's actions.[47]

The Need To Strike a More Appropriate Balance Between the Public and Private Sectors

Failure to bring American standards setting organizations together, and to work out their relationship with government, is a real and very serious problem in dealing with other nations. A solution requires afresh perspective that objectively considers both the problems of the system and the ways in which all participants can join to resolve them.

Standards serve both public and private functions; this raises a fundamental question about the appropriate roles of government and the private sector. Nations differ in the way they assign responsibility (see table 1-2). In Europe, many functions, which in the United States would typically be considered private sector tasks, are carried out by national governments. Standards setting is no exception.[48] From the European perspective, standards setting bodies perform a number of "public" functions. Accordingly, all European governments routinely support national standards setting to some degree and in one form or another. Moreover, whereas the private sector in the United States tends to view such support with suspicion—if not alarm—Europeans are comfortable accepting it. As one member of the French standards community told OTA "Americans are somewhat paranoid about government. If our government gives us financial support, it simply gets what it pays for. This certainly does not mean that the government has control.'

The U.S. standards setting process reflects a strong political and cultural bias in favor of the marketplace, a preference that has its origins deep in American history.[49] Although government provided at the turn of the century the first impetus for national standards, it gradually relinquished much of this responsibility to private standards setting organizations,[50] which had already begun to emerge as

47 See, for one discussion, "ANSI Complaints to OMB Underscore Tensions in Private Sector," *Laboratory Regulation News,* vol. 2, No. 12, June 25, 1991.

48 See ch. 3 for a discussion,

49 Gabriel Almond and Sydney Verba, *The Civic Culture: Political Attitudes and Democracy in Five Nations* (Boston, MA: Little, Brown and Company, 1965); See also, Robert Wuthnow (cd.), *Between States and Markets: The Voluntary Sector in Comparative Perspective* (Princeton, NJ: Princeton University Press, 1991).

50 Rexmond C. Cochrane, *Measures for progress: A History of the National Bureau of Standards* (Washington, DC: National Bureau Of Standards, 1966). As detailed in ch. 4, this transfer was not without its problems. The standardization movement, under Secretary of Commerce Herbert Hoover, was initially designed to help business. Times change, however, and consumer groups began to press the Bureau to certify product quality. This upset business, which in a period of prosperity was much less in need of the Bureau's services. Given budgetary pressures and competing demands, the Bureau gradually relinquished most of its product standardization efforts.

early as 1820.[51] This private sector tradition remains strong today (see ch. 2). Instead of setting standards for the U.S. private sector,[52] the government focuses its efforts on the fairness and effectiveness of standards setting processes. Uppermost in this regard have been concerns about antitrust infringements, due process and, more recently, international competitiveness. This preference for voluntary consensus standards was reaffirmed in the 1979 Trade Act, which formally recognizes the private sector's role in standards setting, and in OMB Circular A-1 19, which directs Federal agencies to use voluntary standards wherever possible. In both instances, however, the Federal Government retains the right to assume a greater leadership role when it considers it necessary .53

This division of labor between the public and private sectors has strong support in the U.S. standards setting community. At hearings held in 1990 by the National Institute of Standards and Technology (NIST, formerly the national Bureau of Standards, or NBS) to determine whether the government should become more active in standards setting, especially in the international arena, the response of those testifying was an emphatic "NO. "[54]

However, given the growing national stakes in standards, the problems in the standards community identified in this report, and the challenges presented by fast-moving technology and a highly competitive global economy, the governments will need to assume a greater role in the future. An appropriate division of labor between government and the private sector in standards setting must be based on mutual trust and a common recognition of the strengths and weaknesses of each. A positive relationship of this kind is clearly lacking today. Viewing proposals for change as either black or white, each side regards the other with suspicion. Thus, little that is new has been added to the discussion. With government and the private sector increasingly at odds, the basis for trust has deteriorated, and the lines in the debate are becoming more sharply drawn.

Inadequate Federal Coordination on and Policymaking

Paralleling the lack of unity in the private sector standards community is a lack of coordination and policymaking at the Federal level. While this is not a new problem, its consequences will be more serious in the future. As the United States expands its role in a global economy, new trade-offs among standards goals must be negotiated. Free trade objectives are already coming into conflict with environmental and safety goals.[55] Under such circumstances, coordination and conflict resolution among Federal agencies is essential. Moreover, with the growing importance of standards, rapid technological advance, and the shift to a global economy, the Federal Government needs some ongoing organizational capability to identify problems, set goals, and evaluate system performance.

The 1977 Department of Commerce Report[56] on the U.S. standards setting process and the 1965 LeQue Report[57] both called for a unified, national standards policy. They proposed the establishment of some form of government body, where policies could be coordinated. However, this type solution was unpopular--especially in the business community-and nothing came of it.

The problem of coordination was eventually addressed on a limited scale with the establishment of an interagency committee. In accordance with OMB Circular A-119, the Department of Commerce (DOC) was directed to set up an interagency consultative mechanism to advise the Secretary and agency heads in implementing Federal standards

51 The first such organization, established in 1820 to establish uniform standards for drugs, was the United States Pharmacopial Convention. The first trade association to develop standards was the American Iron and Steel Institute, established in 1855. The American Society of Civil Engineers, formed in 1852, is the oldest scientific and technical society to develop standards. U.S. Department of Commerce (Robert Toth, Toth Associates, cd.) *Standards Organizations in the United States NBS* Special Publication 681, p. 4.

52 The U.S. Government traditionally set Pm-merit specifications for all its purchases, a practice that is declining in favor of voluntary standards.

53 OMB Circular A-119; and 1979 Trade Act.

54 See proceedings, National Institute for Standards and Technology Public Hearings, op. cit., footnote 1.

55 See for one discussion, Keith Bradsher, "U.S. Ban on Mexico Tuna is Overruled," *The New York Times,* Aug. 21, 1991, pp. Dl, and D3.

56 Voluntary Standards and Testing Laboratories Accreditation: Analysis of Problems, Issues, and Alternatives for Federal Action (Washington DC: Department of Commerce, 1977).

57 Report on the Panel on Engineering and Commodity Standards of the Commerce Technology Advisory Board. Francis L. La Que, Chairman, 1965. Parts A &B.

policy (as defined in the Circular); to coordinate agency views; and to develop, where possible, a single, unified position. DOC assigned this task to the Interagency Committee on Standards Policy (ICSP),[58] which operates under the direction of NIST.[59] Overall oversight rests with OMB, and the committee is required to report back to it on a triennial basis.[60]

While active during its first year, this interagency committee has reportedly not met for the last year and a half.[61] Meetings focused on implementing the Federal policy to encourage agency use of voluntary standards, as directed in its mandate. The committee also set standards for agency participation in voluntary standards bodies and laid out guidelines for public sector use of private certification bodies. Participants claim, however, that scant attention was devoted to evaluating existing policy or finding ways to improve it.[62] Nor was there much effort to identify future standards issues or to view them strategically as part of the industrial infrastructure.[63] Some members claim that the group is not a useful mechanism for sharing information or coordinating interagency issues. One person noted with some irony that his chance of interacting with agency counterparts was better at private sector meetings of ANSI's Government Member Council.

Some of the problems faced by the Interagency Committee on Standards Policy stem from its organizational form. Interagency committees have a poor record of policy coordination.[64] Among the problems associated with them are that they tend to: bury problems rather than resolve them; make it difficult to get tasks accomplished because too many people with only a peripheral interest become involved; dilute interest in, and commitment to, addressing a problem; and lead to outcomes based more on the distribution of power within a committee than on policy considerations.[65] Such problems are clearly reflected in the Interagency Committee on Standards Policy.

The Office of Management and Budget (OMB) reviews the work of the ICSP on a triennial basis. Although OMB is the ultimate coordinating mechanism in the Federal Government, it can do little more than establish a policy directive.[66] There is little staff support in the area of standards. The Deputy Director of the Office of Federal Procurement Policy is in charge of overseeing Circular A- 119. However, there is no one person at OMB who focuses explicitly on standards.[67]

A second interagency task force was setup under the auspices of the Office of the U.S. Trade Representative(USTR). Although somewhat more active than the NIST committee, its focus is much more limited. Agency members meet when necessary to try to reconcile trade and other agency policies.[68] The committee is not meant to be a forward looking group, or to consider standards in strategic terms. Like the Office of the USTR, it tends

58 The ICSP was established in 1985 to coordinate Federal Agency Standards Policy.

59 The Committee's Charter goes further than OMB *Circular* A-119 in calling for interagency consideration of standards policy.

60 OMB Circular A-119. See ch. 2 for a history of this circular.

61 It should be noted that some subcommittees met more frequently. The Commerce mandate establishing the committee requires that a Ill@.@ be held at least once a year.

62 Annual report t. Secretary of Commerce cited and tracked progress of agencies in using voluntary standards. But the analysis that was provided with the data is minimal.

63 The ICSP Charter Policy, developed by commerce is much broader than the OMB Circular. However, overall support for the Committee was not sufficient to support this broader mandate. John Donalson of NIST suggests that the problem was circular. Because the OMB mandate was narrow, people at higher, policy levels didn't get involved. Without their involvement however, it was impossible to expand the Committee's mandate. John Donalson, NIST, personal communication.

64 Characterizingg this form of arrangement, Harold Seidman notes, for example:

> Interagency committees are the crab grass in the garden of government institutions. Nobody wants them, but everybody has them. Committees seem to thrive on scorn and ridicule, and multiply so rapidly that attempts to weed them out appear futile." But, as Seidman is quick to add: "The harshest critics have yet been unable to devise satisfactory substitutes.

Harold Seidman, *Politics, Position, and Power: The Dynamics of Federal Organization (New* York, NY: Oxford University Press, 3rd. cd., 1980), p. 207.

65 Ibid.

66 Ron C. Moe, "The Hud Scandal and the Case for an Office of Federal Management" *Public Administration Review,* July/Aug. 1991, vol. 511, No. 4, pp. 298-307.

67 David Gold, OMB, personal communication.

68 Susan Troje, USTR, personal communication.

to be reactive on standards issues, responding only when the need arises.

National coordination of communication standards issues is more effective. Because these standards are developed in the Consultative Committee for International Telephone and Telegraphy (CCITT), which is part of the International Telecommunications Union (ITU)--an international treaty organization—the State Department coordinates and presents the U.S. position. Even in this case, however, there are complaints, both in the United States and abroad, about the lack of a unified U.S. position.

The Federal organization of U.S. standards policymaking contrasts sharply with that of other countries. In all other major industrialized countries, governments view standards and the standardization process as part of the industry infrastructure, and they support it accordingly. While national differences exist, in all of these countries standards policies are set nationally and worked out with private sector organizations.[69]

The Need for Greater Attention to How Other Governments Use Standards to Create Markets for their Nations' Industries

Having no comprehensive national standards policy of its own, the United States has tended to disregard or underestimate other governments' efforts to use standards as marketing devices to expand their trading opportunities. This shortsighted approach could undermine U.S. competitiveness. If not addressed quickly, the outcome could be irreversible. There are significant advantages to being the "first" to get a standard accepted. When one standard starts to take hold, more and more companies jump on the bandwagon to adopt it. And once a standard is in place, trading relationships can become locked in.

Most other countries--developed and underdeveloped alike-view standards as part and parcel of their industrial infrastructures. Not surprisingly, therefore, foreign aid programs often focus on standards. This is a mutually advantageous arrangement. Industrialized countries are eager to help developing countries set up their standards programs. If they can influence the choice of standards in the developing world, trade will likely follow. Developing countries also welcome such assistance. Standards can help them create a national market. Equally important, they provide an excellent-as well as unobtrusive-source of technology transfer.

Most U.S. competitors are actively involved in programs of this sort. The Japanese Five-Year Plan for Industrial Standards, for example, calls attention to the role that such technical cooperation can play.[70] In pursuit of this strategy, the Ministry of International Trade & Industry has sent technical experts to five countries to assist them in the development of their standards programs.[71] In the Philippines, for example, the Japanese International Cooperation Agency conducted a 13-person team, 500-person-day study of the Philippine national standardization system and provided a $23.1 million grant to establish 3 regional labs.[72] At the same time, the Japanese Government has paid for 28 people from developing countries to come to Japan for language and technical training.[73]

The Europeans have similar programs.[74] With financial support totaling $16 million from the EEC and Germany, an electronic component test laboratory has been set up in India. The laboratory receives technical support from the German Agency for

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69 *See* ch. 3.

70 According to the plan:

> Standardization and quality control, which are closely related to each other, are a technical infrastructure of industries. It is necessary to propel technical cooperation in this field to correspond to requests from developing countries. From this viewpoint, efforts should be directed to securing human resources in this field. It should be noted that implementation phases of technical cooperation should be designed to incorporate appropriate measures reflecting the developing stage of country cooperation.

As cited in Robert Toth, "Promoting U.S. Competitiveness by Promoting U.S. Standards," unpublished paper.

71 John R. Hayes, "Who Sets Standards?" *Forbes*, Apr. 17, 1989, pp. 111-112.

72 Robert TO@ Toth Associates, personal communication.

73 Ibid.

74 As in the case of Japan, this EEC has adopted a formal policy to this end. As described in the EEC Commission Communication, *Cooperation in Science and Technology with Third Countries* (June 1990):

> Several developing countries have, by virtue of demographic and economic importance, achieved a position which gives them substantial international weight either in terms of international leadership or of potential markets. It consequently behooves the Community, in the area of cooperation to reinforce their position and interests by contributing to integrating them more fully into the various European policies in such areas as commercial relations or the definition of norms and standards."

Technical Cooperation. Specialist training is provided in Germany, the United Kingdom, the Netherlands, and Ireland. The European Commission has also conducted a study of the Association of South East Asian Nations (ASEAN) standardization base and provided a grant of $6 million for an initial effort to implement its recommendations. Closer to home, the European Commission has provided Mexico $1.5 million in consultation and trainingin standardization, testing, and quality system certification. Moreover, the European Committee for Standardization (CEN), the German Institute for Standards (DIN), and the Spanish Standards Institute (AENOR) have each offered to provide a resident expert in Mexico.[75]

The United States has no equivalent programs. Most U.S. aid programs are dissociated from trade issues. In the fall of 1989, a law was passed directing the Department of Commerce to accept invitations from developing countries to provide assistance in developing standards programs. However, funding, which was to come from the private sector, has not been forthcoming. As of the spring of 1989, only $85,000 had been raised. According to one source, German industry raised $5 million for a similar effort in the course of 20 days.[76]

Failure to compete in this arena will make it difficult for the United States to enjoy the benefits of a global economy and the future growth in world trade. The developing world will be a major world market, a fact that the United States cannot afford to ignore. Future trade opportunities are great. In the area of telecommunications alone, for example, estimates are that India will spend more than $40 billion over the next 10 years. Already, the ASEAN bloc is the United State's fourth largest trading partner.[77]

Persistent Due Process Issues

Due process issues are inherent in standardization. Safeguards must be built into the process, because manufacturers and users can use standards to set prices and constrain trade. In a pluralistic society such as the United States, competition and countervailing forces provide such safeguards. It is assumed that no one party can dominate the standards setting process because it is transparent and everyone can participate. *Due process, however, is not a constant. Agreement about what is a fair and open standardization process changes over time and in different circumstances. Today, the rapid advance of technology, the shift to a global economy, the rise of user groups, and the desire to substitute voluntary standards for regulation will likely put the issue of due process into much starker relief.*

The meaning of due process in standards setting has changed throughout American history. Earlier it was viewed narrowly. The first Federal efforts to promote product standards, for example, were taken on behalf of business. Secretary of Commerce, Herbert Hoover, sought to promote product standardization through the National Bureau of Standards, believing that standards would reduce waste and revive the post-war economy,[78] Although business interests were balanced, there was no effort to bring consumers into the standards process. In fact, consumers and their demands for variety were seen as the major source of business' problem.[79] This arrangement broke down, however, when consumers requested that the Bureau rate products according to quality standards. Quick to react, business decided that standards setting should be a strictly private sector affair.[80]

The right of the private sector to determine the extent of due process was challenged in the 1970s with the rise of the consumer movement and

75 Robert Toth, Toth Associates, personal communication.
76 Hayes, op. cit., footnote 78.
77 Robert Toth, Toth Associates, personal communication.
78 Cochrane, op. cit., footnote 65.
79 As described by Hudson in 1928:

> The five years immediately following the World War were marked by a tendency on the part of industry to return to the old uneconomic conditions of over-diversity. Many products which had been simplified by the Conservation Division of the War Industries Board were again offered in a bewildering variety of sizes, types and shapes in an effort to break the "buyers' strike" of 1919 and 1920. In the scramble for sales volume during the industrial depression of 1921 this condition was so aggravated as to suggest a study of the situation with a view to possible remedies.

Ray M. Hudson, "Organized Effort in Simplification," *Standards in Industry, Annals* of the American Academy of Political Science, 1928, p. 1.
80 Cochrane, op. cit., footnote 65.

growing concerns about antitrust. In 1974, the Federal Trade Commission (FTC) investigated the entire private standards setting process.[81] After extensive hearings, at which over 200 people testified, it concluded that the entire standards system should be regulated, and a rule was proposed that would require standards setters to meet a substantive "fairness" criterion. These conclusions were very controversial, however.[82] Under a new administration, the FTC reversed its course. Viewing due process less comprehensively, it decided to enforce standard infringements of antitrust law on a case-by-case basis.[83]

The definition of due process will continue to be subject to debate. In a global economy, questions will arise about who should participate in standards setting, and in which organizations standards activities should be centered. More and more standards will be set at the international level, but the costs of international participation will be higher. Many small companies and public interest groups will be left out. Moreover, if standards decisions are made increasingly at the international level, these groups will be left out of the domestic policymaking processes as well (see ch. 4).[84]

Standards decisions will also be made by regional standards setting bodies. While large translational corporations can gain access to these processes by setting up subsidiaries abroad, most small companies cannot. Governments, themselves, may need to be the standards bearers for due process, seeking access for their nation's industries to international standards processes. Together these governments will have to agree on an international norm for fairness in standard setting.

The speed of technological advance together with the increased complexity of many standards issues may also upset existing notions of due process. Assuring all interested parties a voice in standards processes slows them down. When the system cannot keep pace with technological change, producers and large users seek alternative solutions, which are often less open. In the area of telecommunications and computer technologies, for example, standards setting can take between 4 and 8 years.[85] This lengthy process could undermine the market for some products.[86] To get a quicker response on standards, some producers are setting up standards consortia. Although they have been successful in speeding up the process, their membership is limited[87] (see ch. 2).

Due process issues are also likely to arise if more and more regulatory decisions are based on voluntary consensus process standards. Requirements for due process may vary, depending on economic context and the type of standard in question. Where market share is distributed among competing producers, and users are either large or well organized, the social consequences of limited participation in standards activities may be positive. The social outcome is likely to be negative, however, when users are unorganized and/or there is a dominant firm. This latter situation is most typical in areas such as health, safety, and the environment, which the government has typically regulated. In relying on voluntary standards, therefore, Federal agencies may need to focus greater attention on due process.

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81 The use of standards for anticompetitive purposes is not new. For examples of cases where the courts struck down standards for antitrust reasons, see *Milk and Ice Cream Can Institute v. F. T. C., 152* F.2d 478 (7th Cir. 1946); *United States v. Institute of Carpet Manufacturers,* CCH Trade Reg. Service (9th cd.). par. 52,517 (S.D.N.Y.); *Bon Crown and Cork Co. v. F. T.C., 176* F. 2d 974 (forth Cir. 1949); *Radian Burners v. Peoples Gas Co.;* and more recently, *American Society of Mechanical Engineers v. Hydrolevel Corp. 456.* U.S. 5556 (1982).

82 FTC, op. cit., footnote 12.

83 "Memorandum to the Federal Trade Commission from Amanda B. Pedersen," Aug. 29, 1985.

84 This is a central concern of many health, safety, and environment groups. Mark Ritchie, Institute for Agriculture and Trade Policy, personal communication.

85 The growing complexity of standards issues puts additional burdens on standard setting institutions. This is reflected in the extended period of time required for standards to be formally ratified, and the rapid multiplication of standard setting committees and subcommittees. As one journalist observing international standards meetings has described:

> The content [of the materials] is technical, voluminous, and difficult. . . . the minutes look like telephone books. . . . Readings come to several hundred pages of technical matter each month.

See, Timothy Haight, "Standards-setting and the Limits of Journalism," *CommunicationWeek, Mar. 14, 1988,* p. 14.

86 Providers of frame relay services for example, had only a small time period in which to establish a market for their product. One of its mOSt important selling features was that the product was available to meet an existing market need. Had frame relay providers waited too long, their product might have been superseded by cell relay services such as switched multimegabit data service (SMDS), which were still in the development phase.

87 Garvin, op. cit., footnote 7.

As revised, OMB Circular A-119 virtually eliminated all due process requirements.[88]

Criteria for Evaluating Policy Strategies and Options

Many standards setting problems cited in this report are persistent problems that have been identified before. The inability to deal with these problems reflects the high stakes and significant ideological differences involved. There are no perfect solutions. Stakeholders strongly disagree about what constitutes a perfect state of affairs. Thus, any politically viable solution is likely to require compromises. To lay the groundwork for such a compromise, OTA has identified a number of criteria that a standards policy must meet if it is to adequately address the Nation's standards needs.

Cultural Consistency

Standards setting institutions strongly reflect economic and cultural conditions and constraints. In the United States, organizations have often sprung from the bottom up, formed spontaneously at the grass roots in response to perceived needs.[89] These types of organizations reflect the American preference for market solutions and a strong cultural and political predisposition towards voluntary organizations. Standards policies are likely to be more politically viable to the extent that they build on this tradition. Private sector solutions are also likely to be favored, given the present deregulatory political environment.

Flexibility in Dealing With Different Industry Sectors

Standards setting varies across industry sectors, so standards problems and their solutions will also differ. Rapidly advancing technologies require an especially timely standards process. Regulatory standards merit special attention to due process. Anticipatory standards need to be implemented and certified. And standards critical for trade, or for the national infrastructure, may call for some form of government promotion or involvement. Government can address this whole array of needs with greater precision and less disruption if standards processes allow for a flexible response. To develop an appropriate range of flexible responses, policymakers will need to know more about how product types, market structure, and organizational contexts affect the outcome of standards setting processes.

Capability for Evaluation and Foresight

The factors and conditions that drive standards setting processes are in a state of great flux. Nations are being integrated into a global economy; technologies are rapidly advancing and, in many cases, converging; powerful private sector translational organizations are emerging; and governments are redefining their roles in advanced industrial societies. If standards setting bodies are to perform effectively in such a rapidly changing environment, they must have an ongoing capability to evaluate their performances and to assess and plan for their futures.

Provide for the Most Efficient and Cost Effective Use of Resources

Standards setting will likely be costly in a global economy based on rapidly advancing technologies. Bringing together sufficient economic resources to support standard setting processes is very difficult due to the public goods nature of standards. If standards setting bodies are to have adequate support, new ways must be found to share costs and reduce unnecessary technical and organizational redundancies. Achieving this objective will require the system to have a broad base of legitimacy.

An Incentive Structure Designed to Promote Cooperation

One major obstacle to altering the standards setting process has been the widespread belief that change could only take place at the expense of one party or another. As a result, stakeholders have

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88 Memo to Agency Heads from David Stockman regarding revised OMB Circular A-119.

89 This aspect of the American character was noted early in American history by de Tocqueville. As he described in *Democracy in America:*

> ***Nothing . . . is*** more deserving of our attention than the intellectual and moral associations of America. Americans of all ages, all conditions, and all dispositions constantly form associations. They have not only commercial and manufacturing companies, in which all take part, but associations of a thousand other kinds, religious, moral, serious, futile, general or restricted, enormous or diminutive. . . .Wherever at the head of some new undertaking you see the government in France, or a man of rank in England, in the United States you will be sure to find an association.

Alexis de Tocqueville, *Democracy in America,* vol. 1 & 2 (New York, NY: Harper and Roe, 1966), pp. 110 and 106.

fiercely resisted any tampering with the status quo. If standards setting processes are to be improved, solutions must be developed that will distribute benefits on a broader basis.

Equivalency With International Norms and Procedures

Standards setting in the United States has usually been focused on domestic markets and conditions. Given the size of the U.S. market, there was little need for many industries to become involved in other national or international standards processes. This is no longer the case. In a world economy comprised of regional trading blocs, Americans cannot afford to remain aloof. To benefit fully from the growth in trade, the United States must become a leader in international standards. To play such a role, it must have equivalent-but not necessarily the same-standards setting procedures and institutional mechanisms.

Support of Due Process and Antitrust Prescriptions

Winning a standards battle-whether in a domestic or international market-is often a matter of speed. Thus, when the stakes are high, there may be a temptation to sacrifice due process for speed. Care must be taken to avoid this trade-off. Little is to be gained in the long run. Not only will the legitimacy of the system be questioned; if standards fail to represent a true consensus, they will not survive.

Policy Strategies and Options for Addressing Standards Setting Issues

Government can pursue a variety of strategies for addressing the standards development issues identified in this report. Three are discussed herewith a set of alternative policy options. Together, these strategies address the issues outlined in this report and suggest a variety of ways the Federal Government might deal with them. They are evaluated in terms of the seven criteria listed above. Each option will meet some criteria, and satisfy some stakeholders, better than others. These strategies and options are depicted in figure 1-2.

Strategy 1: Provide more substantial Government support for standards development processes to address market failures resulting from public goods aspects of standards.

Many People--especially in industry-believe that standards development is a private-sector activity, best carried out in voluntary processes that closely replicate the marketplace. According to this perspective, the government is cast in the role of "user." As a user, the government should support the standards process in proportion to the benefits it derives. It need play no larger role; for it is assumed that voluntary processes, like market mechanisms, lead to the most socially optimal outcomes.

The marketplace for standards, however, is an imperfect one. As in the case of other semipublic goods, the standards market and policy arena occasionally fail As a minimalist strategy, the Federal Government might provide support for the standards process, where such failures are likely to occur. Three areas merit attention:

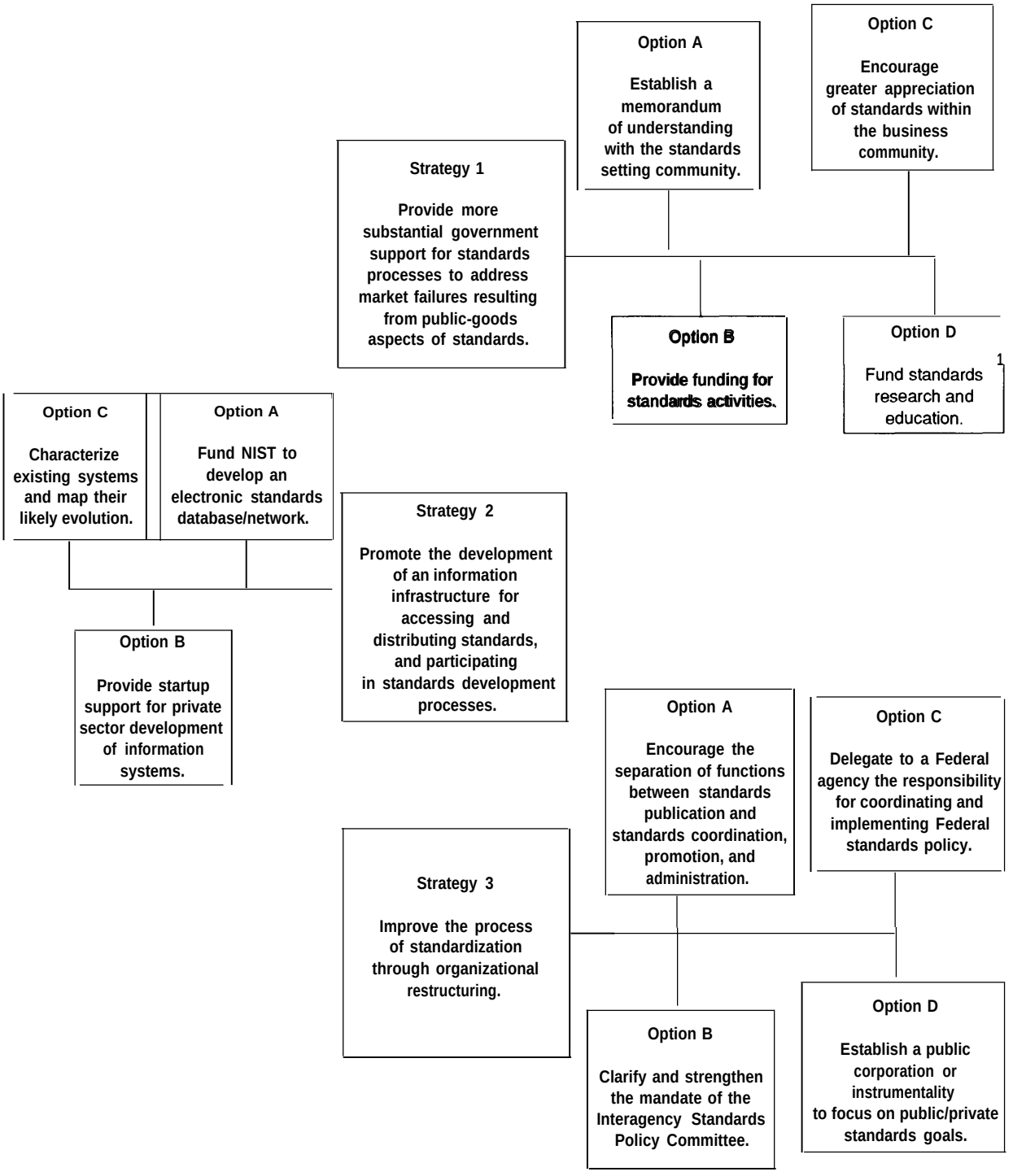
- the lack of government support for standard development, both politically as well as economically;
- the lack of business appreciation for standards; and
- the lack of an information infrastructure to support standards development processes.

Option A: Establish a Memorandum of Understanding With the Standards Setting Community

Most governments support their national standards development processes and provide for official national representation in international standards development organizations.[90] At a minimum, they formally acknowledge the public role performed by private national standards bodies and lay out mutual obligations among the players. Thus the British Standards Institution (BSI) is chartered by the

[90] See ch. 3.

Figure 1-2-Strategies and Options To Address Standards Issues



SOURCE: Office of Technology Assessment, 1992.

government of England,[91] while the Deutsches Institut für Normung (DIN) has a memorandum of understanding with the government of Germany.[92] In similar fashion, the government of Sweden has a contractual relationship between the public and private sectors. A special case is Japan where 205 private sector trade associations and professional societies work with the responsible government ministries to develop sectoral standards. These are in addition to the national standards developed by the private sector and these government ministries under the aegis of the Ministry of International Trade and Industry (MITI) and the Japanese Industrial Standards Committee.[93]

Such arrangements help to legitimize standards organizations both at home and abroad. They also encourage participation in standards development activities, since businesses using nationally approved standards greatly reduce their liability.[94] Joint agreements between the public and private sector are especially useful in international standards negotiations, since they leave no doubts about where authority lies.

The U.S. Government has no similar arrangement with ANSI or other national standards bodies. This situation reflects the history of the American standards movement. In no other country were there so many grass roots standards organizations emerging to compete with one another as in the United States.[95] This history mirrors American political tradition and the predilection for separating the public and private sectors.

Today, ANSI is the self-designated national coordinating body for U.S. standards development organizations, and the self-designated national member body within the International Organization for Standardization (ISO). However, ANSI's status is not fully accepted by major players in the U.S. standards community, and a number of organizations continue to act independently in their international dealings with other national standards organizations. Nor have these organizations been willing to defer to ANSI leadership in domestic standards activities.[96] In fact, in some cases, they have preferred that government, itself, take the lead.[97]

In July, 1991, ANSI proposed that the Government establish a memorandum of understanding with ANSI. Although there have been preliminary discussions, no action has been taken. Creating such a memorandum could facilitate U.S. international standards development activities. It could, more-

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91 The British Standards Institution was first chartered in 1929; an additional Memorandum of Understanding was adopted in 1989 which recognizes the important role that standards play in international competitiveness. The Department of Trade and Industry laid out the rationale for reinforcing the Government's relationship to BSI in its white paper, ***Standards, Quality and International Competitiveness,*** which was presented to Parliament in July 1982. The report states:

> The experience of other countries shows that strong standards systems capable of securing the industrial and trade benefits do not emerge spontaneously; they involve not only a legal structure but aspects of organization and attitude which evolve over a long period. Nor is it just a question of reproducing here the legal and institutional arrangements that have shown themselves successful in other countries. What is needed is to give strength and coherence to the existing national standards system. This requires the full support of manufacturers and purchasers in the private and public sectors and all those in central and local government who are responsible for drawing up technical regulations and specifications.

92 See CONTRACT between the Federal Republic of Germany, represented by the Federal Minister of Economics, and DIN German Institute for Standards (Deutsches Institut fur Normung e. V.) represented by its President.

93 R.B. Toth Associates, ***Transparency and Accessibility of the Japanese Standardization System, November*** 1991.

94 In Ger*many,* for example, the burden of proof shifts to the user, when DIN standards are met. Dr. Helmut Reihlen, Dr. Christian Kaiser, DIN, personal communication.

95 The Europeans are perplexed as to why such an arrangement does not exist. From their point of view, it would be mutually beneficial. The United States would have more influence internationally, if it spoke with one voice, and the Europeans would have a clearer picture of where the power to negotiate and make decisions lies. European interviews.

96 A r$_{ecen}$t $_{memo}$ from the ASTM staff to the Board of ASTM, which outlines ASTM's reasons for not cooperating more with ANSI's international efforts, illustrates the problem. As described in the memo:

> The importance to ASTM, and to ASTM's long range future, of the strategy which this committee endorsed was clear. If the ANSI prescription prevailed-if the U.S. adopted a strategy of committing its standardization efforts to ISO and agreeing to accept and use ISO standards-ASTM, would, overtime, decline from the largest voluntary consensus standards developer in the world to a "bit player' in a system dominated by ISO and ANSI. ASTM would become solely a feeder of U.S. consensus standards and positions into ANSI for blessing as U.S. ''national" standards and into ISO for blessing as "international standards." And, ASTM might not even to be able to play that limited role. If Europe and the U.S. agreed to adopt and require the use of ISO standards in their respective markets, sales of ASTM standards, nationally and internationally, might be so eroded that ASTM could not longer support itself.

ASTM memo to Members of the Board, regarding "ASTM's Public Position,'' dated December 12, 1991.

97 Interestingly enough, German business supports the role of the Federal Government, because they don't want to deal with all the different laender (states). Dr. Helmut Reihlen, DIN, personal communication.

over, improve government cooperation with the private sector.

Even if government were disposed to such an option, it would likely not be politically viable, at least at this time. Competing standards organizations would not support a memorandum of understanding that would officially designate ANSI as "the" national standards organization. A compromise might be negotiable, however.[98] For example, organizations might accept ANSI as the recognized national standards body, so long as it were not a competitor, selling standards or if their markets for standards could somehow be preserved. Thus, if there is to be a more formal relationship between the government and the private-sector standards community, it will likely have to evolve as part of a comprehensive overall resolution of the conflict among standards organizations.

Option B: Provide Funding for Standards Activities

Most governments provide financial support for standards setting activities. In 1990, for example, the United Kingdom provided BSI £4,963,000 in grants; £455,000 for special activities; and £470,000 for technical assistance to exporters.[99] Some of this funding was used to support the attendance of British delegates to international standards meetings. In similar fashion, the German Government provides 15 percent of DIN's expenses. These public funds are used primarily for programs that promote industry, increase competitiveness, and provide protection against the risks of technology, as well as for DIN's membership subscriptions in international and European standards organizations.[100]

Whether or not private standards bodies receive Federal funds can make a significant difference in terms of their resources and the kinds of programs they can support. (Mention has already been made of the aggressive export programs that many foreign governments now support.) Some foreign governments also finance their nationals' participation in international standards proceedings. In addition, many governments support the development and use of electronic media to provide access to standards information. The German Government, for example, has provided a subsidy over a 7-year period of 25 million deutsche marks for the development of a electronic database and standards delivery system. Europeans standards organizations have also developed special programs to assist businesses in accessing and using standards for exporting goods and services. The French standards institute, AFNOR, for example, has set up a U.S. subsidiary (NOREX) to help French businessman negotiate their ways through the U.S. standards maze.[101]

Apart from the membership dues paid by Federal agencies to standards bodies, the U.S. Government provides almost no funds for private-sector standards development. Even the recently established NIST program, aimed at promoting trade through standardization in developing countries, depends heavily on business contributions. Depending entirely on membership dues and the sale of standards, ANSI has insufficient financial and human resources to carry out programs at the same level and intensity as the Europeans. For example, as compared to DIN's 900 employees, BSI's 1,000 employees, and AFNOR's 550 employees, ANSI employs only 110 people. Not surprising, under these circumstances, ANSI currently has no significant education or information programs.[102]

One reason for this lack of Federal support is that members of the private sector have been extremely reluctant to accept *any* support from government for fear of strings attached.[103] They are concerned, moreover, that such support, once given, might be withdrawn at any time, given a budget crisis or change in political climate.[104] Moreover, many in the U.S. standards community would be uncomfortable being cast in a semipublic role. Most Europeans have little problem in this regard.

As the costs of standards activities increase, however, members of the community may become

98 See footnote 103.

99 BSI Annual Report and Accounts 1989-1990, nd.

100 DIN, *One World, free trade, free standards,* p. 4, nd.

101 Europeans have a long tradition of supporting export activities that goes back to the first standardization efforts. (See ch. 5.)

102 ANSI does publish a newsletter, and has begun developing electronic retrieval systems. ANSI has also begun to move in the area of education, but its resources are, by necessity, spread very thin.

103 NIST hearings, op. cit., footnote 1.

104 Ibid.

more receptive to Federal support. Ideally, from their point of view, Federal contributions should carry no obligations. Preferably, they would take the form of tax credits or simple grants. Funding of this sort, however, might have a low pay-off from the government's point of view, since it could not be targeted to achieve Federal policy goals.

Option C: Encourage Greater Appreciation of Standards Within the Business Community

The Federal Government could also support the standards development processes indirectly, by educating business and the public about the important role of standards. Increased awareness could lead to increased support for, and participation in, national and international standards activities. Moreover, using standards effectively within industry can also improve productivity, and hence American competitiveness.

This option accords well with a free market approach. It is user-driven, and aims merely to fill an information gap. By generating an awareness of standards, it seeks to stimulate a demand for them. Thus, it is unlikely to distort the marketplace.

Currently, the Federal Government does very little to promote standards. Whereas in its early years the National Bureau of Standards organized business groups to convene for discussions of standards issues,[105] NIST has only limited outreach and/or educational programs except for the publications of standards directories and reports. Business concerns about standards are generally channeled to the Federal Government through the Interagency Federal Advisory Committee (IFAC),[106] but there is no information flowing in the opposite direction. Although government agencies, such as the Office of the International Trade Administration (ITA), or the United States Trade Representative (USTR)[107], respond to business queries and concerns about standards, they make little effort to educate businesses as to the value and use of standards in trade.[108] Even within the Small Business Administration (SBA) there is no standards education or awareness program. The most elaborate promotional event in which the government is involved is National Standards Week.[109]

This situation is greatly different from that in other countries. In Great Britain, for example, the British Standards Institution is viewed as an organization that not only sets standards, but also services industry.

The business community would likely welcome a government initiative of this sort. Some might prefer, however, that it come from the private sector. Private standards organizations, for example, could view this option as an usurpation of their roles. On the other hand, because standards organizations are in competition with one another, some might prefer that government perform this kind of function to provide a neutral forum.[110]

Option D: Fund Standards Research and Education

National competence in dealing with standards issues could be greatly enhanced through Federal support of academic programs and research relating to standards. Few schools of engineering or business

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105 Cochrane, op. cit., footnote 65. Moreover, during this phase of American standard setting, it was the chief executives Of American business and top leaders in science and education who were involved. In 1939, the members of the American Standards Association Advisory Committee included: Lammont du Pent, President, E.I. du Pent de Nemours & Co., Walter S. Gifford, President, American Telephone & Telegraph, J.H. McGraw, Jr., President, McGraw-Hill Publishing Co., A.W. Robertson, chairman of board, Westinghouse Electric & Manufacturing Co., Alfred P. Sloan, Jr., chairman of the board, General Motors Company, E.R. Stettinius, Jr., chairman of board, U.S. Steel Corp., and Walter C. Teagle, chairman of board, Standard Oil Company of New Jersey, to name a few. See for a discussion, Edmund A. Prentis, "Leading Executives for ASA Advisory Committee," Report, Annual Meeting ASA, June 1939; See also, Edmund A. Prentice, "Democratic Methods Widen ASA Influence, Bring Agreement Between Diverse Groups," Report Annual Meeting ASA, January 1940.

106 The Industry Functional Advisory Committee on Standards for Trade and Policy Matters was established on Mar. 21, 1979, and extended on Mar. 11, 1982, Mar. 6, 1984, Mar. 7, 1986, and Mar. 8, 1988, by the Secretary of Commerce and the United States Trade Representative pursuant to the authority delegated under Executive Order 11846 of Mar. 27, 1975. The Committee consists of approximately 40 members, with approximately 20 members from the Industry Sector Advisory Committees and approximately 20 from such private-sector areas as to provide expertise on the subject of standards.

107 The USTR coordinates trade policy between the President, Congress, and the private sector. It manages the private sector advisory system, consults regularly with Congress, aud chairs the interagency committees which develop trade policy with the Executive Branch. 1991 *Trade Policy Agenda and* 1990 *Annual Report of the President of the United States on the Trade Agreements Program.* p. 103.

108 Don Mackay, National Association of Engineers, and Bob Toth, Toth Associates, personal communications.

109 Although S.J. Res. 291 would have designated the week Oct. 14, 1990 as "National Standards Week," it failed to pass. Don Mackay, National Association of Engineers, personal communication.

110 This point came up a number of times during interviews with stakeholders.

schools provide course materials or sponsor research projects focusing on standards. Even in those cases where research is being conducted, there is little cross fertilization of ideas from one circle of scholars to another. Most research takes a relatively narrow economic perspective, and fails to take into account a number of factors affecting standards outcomes:

- the role of standards organizations themselves, and their relationships to one another and the industry community;
- the full range of motivations for corporate participation in standardization[111]; and
- the impact of a global economy and the globalization of the standards process.

Moreover, most ongoing research focuses on existing problems; there is almost no current work being done to anticipate future standardization problems or standards needs.

Federally sponsored research about standards processes is sporadic, at best.[112] The National Science Foundation has funded some economic research on standards, specifically in the area of networking technologies. But it is not typical of the projects NSF is likely to fund. Much of the general policy oriented research at NSF has been cut back, so funding would have to be provided at the program level.[113] As one NSF program director pointed out: "From a philosophical perspective, standards are the last thing that we would look at. That's applied research; we are interested in science. '

Research on standards could also be generated through the National Research Council (NRC), which undertakes 80 percent of its research at the behest of Congress. The NRC has already undertaken an investigation of information technology standards.[114] Because NRC research is organized on a committee basis, it could help to bring a multidisciplinary approach to the study of standards processes. However, such projects are generally one-time efforts, so they are unlikely to stimulate ongoing research.

Strategy 2: Promote the Development of an Information Infrastructure for Accessing and Distributing Standards, and Participating in Standards Development Processes.

Information and communication technologies can play a critical role in the standards development and implementation processes. Online systems connecting standards developers and users across the globe can help standards organizations keep pace with technological change and improve the efficiency and effectiveness of all standards activities. Standards developers and users can be apprised of standards activities and access standards on a real-time basis. Shared, distributed information systems allow standards developers to reduce costs through interactive online participation at a greatly reduced cost. Access to such systems can facilitate the implementation of standards in business and industry.

Much of the technology needed to create such systems is already--or will soon be—available.[115] Existing services such as CompuServe and Internet, for example, can be used to develop standards through electronic mail exchanges. Off-the-shelf technology is also available to create online distributed libraries, which could be designed to house standards-related information.[116] In addition, databases can be automated to notify parties of standards-related subjects and activities of interest to them.[117] In the near future, personal computers will be equipped to perform this function on a personalized basis. With the deployment of high-capacity networks and the development of standard interchange

111 Most economic literature look at the strategic use of standards to achieve competitive advantages in the marketplace. More attention needs to be given to the use of standards to improve the production process, and the role that standards play in technology transfer.

112 Dan Neulin, Larry Rosenberg, National Science Foundation personal Conversations.

113 Dan Neulin, NSF, also interviews with program directors, National Science Foundation, personal communication.

114 See Crossroads *of Information Technology Standards,* op. cit., footnote 1.

115 There are four basic categories of electronic systems: 1) indexes of standards; 2) delivery of full-text; 3) announcement of new standardization projects and the provision of drafts for review; and 4) conferencing to develop and revise standards. Some of these systems are already underway; others will require additional work. R. B Toth (R.B.Toth Associates) Lee McKnight (MIT) Anthony Rutkowski (ITU) and Carl Malamud (Carl Malumud Consultant), personal communications.

116 Marvin Sirbu, reformation Networking Institute, Carnegie Mellon University, personal communication.

117 Selective dissemination of information (SDI) has been available on Dialogue for more than 5 years and these features have been available on standards databases File 92 and File 113 for quite some time.

formats for multimedia electronic mail,[118] more and more kinds of standards activities can be carried out interactively online.[119]

A number of standards groups are already taking advantage of such technologies. Many are beginning to setup standards databases. Some provide bibliographic data about standards; others the full text. In 1981, for example, ANSI created a database of standards as well as a Project Identification Notification System (PINS), which compiles data about new and upcoming ANSI standards projects and activities.[120] ANSI has also undertaken a project to deliver standards using CD-ROM. Eager for the system to be fully functioning, the Member Council of ANSI's Board has recently set up a committee to hasten its development.[121] The Library of Congress is also considering whether to include a bibliographic database on standards as part of its Science and Technology Information Initiative.[122]

Similar initiatives are taking place at the international level. Within the European Community, the Commission has helped to finance a joint database of German, French, and U.K. standards. These standards are cross referenced and available in each language.[12]d In accordance with Resolution 18, passed in 1988 at the Melborne meeting of the CCITT, a group has been set up to promote electronic document handling within the worldwide telecommunications standards community.[124]

Information and communication technologies can also be used to sell standards information and full-text standards in electronic form. Online sales of expanded bibliographic citations are provided through Information Handling Services and Dialogue. Although these services have existed since 1980, they have not been as popular as one might expect; only 2,000 subscribers worldwide regularly use these two standards information services. One major barrier to their use is the need for trained intermediaries to perform searches. Cost is also an inhibiting factor; users are discouraged from spending much time online because the meter is constantly ticking. [125]

CD-ROM is the most cost-effective media for distributing Ml-text standards. CD-ROM databases are also more popular than online systems.[126] They are easier to use and do not require information search specialists. However, CD-ROM full-text standards are expensive, so their market is relatively narrow. The major customers are large companies that can afford the price. Moreover, not all kinds of standards are available in this form. Generally it is the more voluminOUS, complex sets of standards that are published electronically, since they tend to yield the greatest profits.[127]

In the United States, two major companies publish standards in CD-ROM—Information Handling Services (IHS), which accounts for close to 85 percent of all sales, and the National Standards Association (NSA) which covers the rest.[128] These companies do not create standards. They are essentially resellers who sign licensing agreements to sell standards from standards-development bodies.[129] Both have in-

118 See, for a discussion Nathaniel S. Borenstein, "MultimediaElectronic Mail: Will the DreamBecomeaReality,*Communication of theACM*, April 1991, vol. 34, No. 4, pp. 117-119.

119 Bob Smith, Nynex, personal communication.

120 This system is not online. Interested parties contact ANSI for this information which is then made available to them. Stacy Listner, ANSI staff, personal communication. It should be noted that a number of stakeholders claimed that the process works too slowly.

121 Paul Mercer, Boeing, personal communication.

122 Presser Gifford, Director of Scholarly Programs, The Library of Congress, personal communication.

123 Dr. Helmut Reihlen, DIN, personal communication.

124 Bob Smith, Nynex, personal communications. Ironically, one of the problems that inhibits electronic data exchange is that the CCITT and the 1S0 format their documents differently. Thus, there is a need to standardize this aspect of the standardization process.

125 Bob Toth, R.B. Toth Associates, personal communication.

126 Although these databases have been available for only the past year or two, they already have more subscribers than online systems. Bob Toth, Toth Associates, personal communication.

127 Ibid.

128 Online systems are not effective for selling full-text standards. Two major problems are the graphic content, which requires the use Of high COSt imaging technology, and the lack of standards.

129 Deferring to commercial distributors, a number of standards developing org anizations have worked withNSA and IHS to develop effective systems and new products. These distributors perform an important service for them. Not only do they receive substantial royalty checks; they often benefit from greater sales. Distributors open new markets where the standards developer is not well know, or does not have easy access to the developer. Robert Toth, Toth Associates, personal communication.

vested considerable amounts of money testing the market, making false starts, developing and applying appropriate technology, and educating users. A substantial return on this investment will clearly take some time.[130]

Standards processes and related activities can also be conducted electronically. For example, some standards-making organizations use technology interactively to develop standards online. The most well-known case is the Internet Engineering Task Force (IETF), which has responsiblility for the TCP/IP protocol and a number of other internationally accepted networking standards. General Motors is also creating a system to develop standards online, as is the Defense Department with its CALS system. Communication systems are even being used to implement standards. Some companies are beginning to view the implementation and use of standards from a competitive perspective. They use their communication networks to speed up standards implementation and improve the quality of their products. The Boeing Corp., for example, has recently made a major investment in its communication system to this end.

Despite the success of many of these individual initiatives, online standards activities are still the exception rather than the rule. Moreover, most technology efforts are occurring independently of one another. Barriers to extending and coordinating these electronic standards related activities are financial and institutional, not technological. Authoring systems and networking can be expensive. The costs of a conferencing system include, for example: 1) the cost of software for *each* committee member, 2) the cost of online charges, and 3) the cost of storing the working document and ports to users.[131] Among the institutional problems are concerns about copyright protection, lack of expertise and resistance to the use of technology, and competition among standards publishers.[132]

One step the Federal Government might take to promote the use of technology, therefore, would be to explore these problems in greater depth and identify creative ways to address them. Some possible options are laid out below.

Option A: Fund NIST to Develop an Electronic Standards Database/Network

Most developed countries provide financial support for national standards databases and retrieval systems. As noted above, the European Commission also provides such support for a community-wide database. The U.S. Federal Government has no program equivalent in size or scope. At present, NIST does not have a standards database.[133] Although MST used to maintain a computer database of U.S. voluntary engineering standards, called KWIC Index, it stopped maintaining the system for lack of resources.

One option for government, therefore, might be to provide funding for a national electronic standards database/network. Funding would probably need to be targeted as a line item for this project. If funds were provided discretionally from the general MST budget, support for the undertaking would be subject to administrative whim or expediency. Its future would likely depend more on the political ups and downs and internal affairs of NIST than on the national value of the project.

Most people in the standards community agree, in principle, on the value of an information infrastructure for carrying out standards-related activities. Small users would likely favor this option if it would give them greater, more affordable access to standards and standards-related materials. However, many might oppose a greater Federal role in its development, especially if government might compete with private-sector activities. Competition among standards organizations is much more intense in a global economy, so organizations are looking for new kinds of value-added services to provide. In these circumstances, standards bodies are suspicious of possible

130 In addition, other private S,t, organizations such as NIBS (construction and building standards) and CADIS (3-D graphics presentation of standard parts) have pushed the technology and developed the market. One estimate is that between $40 to $60 million has been spent by these four organizations, three or four now-defunct start-ups, and the SAE, ASTM, and IEEE on electronic delivery of standards. Robert Toth, Toth Associates, personal communication.

131 Standards organizations often view the costs for software, networking, etc. as costs that they can't pass onto committee members. Robert Toth, Toth Associates, personal communication.

132 See for one discussion, Tony Rutkowski, ''Networking the Telecom Standards Bodies," unpublished paper, Version 3.0. Aug. 1, 1991.

133 Walter Leight, JoAnne Overman, NIST, personal communication.

government encroachments in their areas.[134] Many in industry, moreover, are unfamiliar with NIST, and might be reluctant to see a database housed there. If this option is to be pursued effectively, therefore, care must be taken to work cooperatively with the private sector and to sort out the complementary roles.

If technology is used interactively to actually carry out standards processes, participation could be greatly expanded. However, at the same time, the balance of power within standards bodies would most likely be changed.[135] Thus, those exercising leadership under present circumstances may strongly oppose the substitution of technology for face-to-face relations, which is their stock in trade.[136]

Option B: Provide Start-up Support for Private-Sector Development of Information Systems

Information and communication systems are often underfunded, especially in their early stages. As previously noted, information exhibits many characteristics of a public good; because it tends to be "leaky," its value is difficult to appropriate.[137] As a result, information systems often fail to attract adequate investment. Communication systems may also be slow to develop until they reach a critical mass. A communication network will-up until a certain point-increase in value as more and more users are interconnected. Given this potential for underdevelopment, government might provide some start-up funding for private-sector projects.

One successful example of such an effort is the OnLine Computer Library Center (OCLC), an electronic bibliographic database developed jointly by university libraries with grants from the Council on Library Resources, the State of Ohio, the Department of Education, and private foundations.[138] These libraries contributed bibliographic information to a central database, which when compiled and put online was made accessible to them. Today, OCLC is a self-sufficient, nonprofit venture, competing with other similar operations.139 To promote the system, the Federal Government did not have to make a major financial commitment, only provide enough support to launch the system and support the development of new innovative programs.[140]

One advantage of this approach is joint funding. Joint funding not only encourages resource sharing; it can also help promote cooperation among highly competitive, or otherwise disparate, parties.[141] In addition, by funding a project jointly, the government is not forced to second-guess the marketplace and pick winners and losers. This option is also appealing because government support can be limited to a certain time period or set of conditions.

An alternative way of supporting private-sector information-based standards activities is to subsidize use. Such an approach allows for competition, and lets the market allocate resources. 142 Moreover, users deemed to have special needs, or whose involvement is considered necessary to the standards process, can be targeted to receive funds. If this approach is pursued, however, efforts will be needed

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134 This position is not surprising since, as Priscilla Regan has pointed out, organizations will likely be threatened by policies seeking to interfere with their information practices, since they are dependent for their existence and autonomy on information. See, Priscilla Regan, "Two Political Approaches to Information Policy,' ch. 3, ***Public UseofPn"vate Information:A Comparison of Personal Information Policies in the United States and Britain, (New*** York, NY: Cornell University, unpublished dissertation, 1981).

135 Communication systems greatly affect power relationships within organimations. As Lucien Pye has pointed out:

> Communications is the web of human society. The structure of a communication system with its more or less well-defined channels is in a sense the skeleton of the social body which envelops it. The content of communications is of course the very substance of human intercourse. The flow of communications determines the direction and the pace of dynamic social development. Hence it is possible to analyze all social processes in terms of the structure, content, and flow of communications.

Lucien Pye, *Communication and Political Development* (Princeton, NJ: Princeton University Press, 1963), p. 4.

136 As William Lehr has shown, the technical outcome of standardizations processes will differ depending upon the organizational structure of standards bodies. See Lehr, op. cit., footnote 9.

137 See for a discussion Of some of the economic characteristics of information, Charles Jonsher, ''Information Economics and Policy I (North Holland: Elsevier Science Publishers, 1983), pp. 13-35.

138 This acronym originally stood for Ohio College Library Center, and was later changed to the Online Computer Library Catalogue System. For a description and history of OCLC, see Kathleen L. Maciuszko, *OCLC: A Decade of Development,* 1984. See also, Anne Marie Allison and Ann Allan, *OCLC: A National Library Network* (Short Hills, NJ: Enslow Publishers, 1979); Also, Richard Van Orden, OCLC, personal communication.

139 David L. Wilson, ''Researchers Get Direct Access to Huge Data Base, " *The Chronicle of Higher Education,* Oct. 9, 1991, pp. A24-A29.

140 Kathleen L. Maciuszko, op. cit., footnote 146.

141 It is important t. note, however, that as OCLC became more profitable, issues of copyright and resource sharing emerged.

142 Martin Sirbu, Carnegie Mellon University, personal communication.

to assure that standards activities are interconnected and widely accessible on an open, and transparent, basis. Otherwise, the emergence of competitive, independent technology-based systems could serve to inhibit access to information and due process. Inefficiencies might also result from the perpetuation of overlapping projects and duplication. Technical architectures for linking decentralized database systems are being developed, which might help alleviate such problems.[143]

Option C: Characterize Existing Systems and Map Their Likely Evolution

One difficulty in developing Federal strategies to promote electronically based standards information activities is the lack of information about existing systems and the directions they are likely to take in the future. With few exceptions, these standards systems are being developed independently of one another. It is only recently, for example, that the three major international standards bodies-the ISO, the ITU, and the IEC—have begun discussing how their information systems might be linked. Thus, innovations are unlikely to be shared, and systems will evolve without reference to the latest technical and institutional developments. There are today, for example, many exciting things happening within the Internet community that are useful in the context of standards. There has been little cross fertilization of ideas, however.[144]

If the government is to develop effective programs to promote online standards activities, it will need to have a better idea of the key players, their plans and competing interests, and the potential resources that they can bring to bear. To initiate such an undertaking the Government might sponsor a major conference or convention, perhaps under the auspices of the Library of Congress, NIST, or the National Academy of Sciences. With a clearer picture of what is already going on, and what is at stake for all players, it will be easier to develop policies calling for complementary, rather than conflicting, roles. If successful, such a conference might lead to more enduring relationships. For example, such a group might be reconvened--or even maintained online-to discuss and debate issues, such as copyright, that have typically stood in the way of the development of online standards systems. Research might also be undertaken to fill in knowledge gaps and raise the level of debate.

Strategy 3: Improve the Process of Standardization Through Organizational Restructuring.

New organizational arrangements are often necessary to address a perceived problem or set of problems, or when old tasks and functions cannot be accomplished by established individual or collective means.[145] This is because organizations often become fossilized and resistant to change; instead of finding new solutions, energies are spent trying to preserve existing practices.[146] Over time, however, failure to adapt can threaten an organization's survival.[147]

Basic changes in the standards environment have already led to a number of organizational changes throughout the standards community. In the United States, ad hoc industry consortia have emerged, bypassing traditional standards organizations. In the United Kingdom, BSI has spawned an offshoot group-DISC-that, operating by somewhat different rules, sets standards for rapidly advancing

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143 Marvin Sirbu, Carnegie Mellon University, personal communication.

144 Rutkowski, op. cit., footnote 140.

145 Harold Seidman, *Politics, Position, and Power: The Dynamics of Federal Organization* (London, England: Oxford University Press, 3rd ed., 1980), p. 15; See also, Harvey C. Mansfield, "Reorganizing the Federal Executive Branch: The Limits of Institutionalization," *Law* and *Contemporary Problems*, vol. 35, summer 1970, p. 462.

146 As Katz and Kahn have pointed out:

> They [the decisionmakers] do not consider all possibilities of problem solution because it is of the very nature of organizations to set limits beyond which rational alternatives cannot go. The organization represents the walls of the maze and, by and large, organizational decisions have to do with solving maze problems, not reconstructing maze walls.

Daniel Katz and Robert Kahn, "The Social Psychology of Organimations (New York, NY: John Wiley & Sons, 2nd ed, 1978) p. *283.*

See also, Mancur Olsen, *The Rise and Decline of Nations: Economic Growth, Stagflation, and Social Rigidities: (New* Haven, CT: Yale University Press, 1982.

147 As Andrew Schotter notes:

> Economic and social systems evolve the way species do. To ensure their survival and growth, they must solve a whole set of problems that arise as the system evolved. Each problem creates the need for some adaptive feature, that is, a social institution. . . .Those societies that create the proper set of social institutions survive and flourish; those that do not, falter and die.

Andrew Schotter, *The Economic Theory of Social Institutions* (Cambridge, London: Cambridge University Press, 1981), pp. 1-2.

information technologies.[148] In the European Community as a whole, new standards organizations—such as ETSI—are being created, and new standardization procedures adopted.[149] Changes are also being made at the international level. The ITU, for example, is completely revising its organizational structure to take account of converging technologies and a changing regulatory environment.[150] Technology convergence has also led to international, interorganizational restructuring; to work on common standards and avoid project overlaps, the International Standards Organization (ISO) and the International Electrotechnical Commission (IEC) established a joint committee, JTC1. More recently, the ISO, IEC, and CCITT met in Tokyo to work out a common approach for developing image header standards.[151]

It is in this context that the U.S. Government will need to consider whether reorganizing national standards procedures are in order. Any reorganization will likely be difficult to execute. Organizational arrangements are not neutral; they define power relationships determining who shall control what, and for what ends.[152] Because organizations are inherently political, their restructuring serves to redefine commitment, influence program direction, and reorder priorities.[153] Many who have an investment in the status quo will resist. Organizational change might be facilitated, however, to the extent that the government and the private sector can, together, develop anew understanding of the role of standards in American life.

Option A: Encourage the Separation of Functions Between Standards Publication and Standards Coordination, Promotion, and Administration

Most standards organizations function to some extent as publishers; they seek to maximize standards sales since their survival depends on them. Competition among standards bodies is fierce and likely to become even more so in the future. Increasingly, standards resemble international commodities. In a global marketplace there will not only be more standards bodies competing with one another for sales, industry restructuring will also likely follow, with business alliances cutting across national lines.

In such an environment, the interests of national governments, manufacturers and users, and standards bodies alike might increasingly diverge. National governments and manufacturers, for example, may view standards implementation as a way of improving productivity and national competitiveness.[154] To this end, they may want to encourage the dissemination of standards information in ways contrary to the needs and interests of standards organizations. Otherwise, competition among standards organizations may become so intense that it precludes the development of national standards goals and policies.

One way of reducing this mounting tension is to separate the functions of standards publication and distribution from those of standards coordination, promotion, and administration. Perhaps the least disruptive approach would be to have ANSI-as the existing national body representative to the ISO-renounce standards sales in exchange for both greater responsibilities and formal government recognition of its coordinating role (i.e., a memorandum of understanding). Federal financial support might also be required if members were unwilling or unable to fill the income gap. Members might agree to increase their support if such a restructuring meant that standards bodies would better serve their needs. Government might also provide incentives for such support through the tax code.

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148 BSI, personal communication; The term DISC stands for "Delivering Information to Customers through International Standards." Legally part of BSI, DISC has substantial autonomy with respect to program and resource development. See, for a discussion, J.L. Bogod, "Information Technology Standardization," Berg, op. cit., footnote 1, pp. 70-73.

149 Frede Axe, Deputy Director, ETSI; personal interview, see, for discussions, M.E. Brenton, "The Role of ETSI in IT Standardization," Berg, op. cit., footnote 1, pp. 49-51; John Williamson, "Raising the European Standard," *Telephony*, June 3, 1991.

150 International Telecommunication Union, High Level Committee, Final Report DOC. No. 145. April 29, 1991 (Geneva, Switzerland.

151 Bob Smith, Nynex, personal communication.

152 field Seidman, *Politics, Position, and Power: The Dynamics of Federal Organization* (London, England: Oxford University Press, 3rded., 1980) p. 15.

153 Ibid. See also, Harvey C. Mansfield, "Reorganizing the Federal Executive Branch: The Limits of Institutionalization," *Law and Contemporary Problems*, vol. 35, summer, 1970, p. 462.

154 This, for example, was one of the original basis for the Federal Government becoming involved in standards, Cochrane, op. cit., footnote 65.

Some standards organizations would welcome such a change. A number who have acted independently in the past have made it clear that they would be much more inclined to coordinate their policies at the national level if they could do so within an organization that is not competing with them for standards sales.[155] Some industry groups who are becoming impatient with the standards community squabbles and want to be more assertive in the use of standards might also support this option. They might be hesitant, however, to te extent that government funding is involved.

ANSI is not likely to favor this option; on the contrary, it has argued persistently in favor of the status quo. However, there may be some room for maneuvering and incentive to compromise. If enough of its members become dissatisfied by the present set of arrangements, ANSI will be pressed to reconfirm and/or broaden its role. Under the circumstances, it may be willing to trade off standards sales in exchange for a greater coordinating role and Federal support.

Option B: Clarify and Strengthen the Mandate of the Interagency Committee on Standards Policy

Many of the problems experienced by the Interagency Committee on Standards Policy are due not just to the Committee's organizational form; they stem also from overly ambitious expectations about what the committee might reasonably accomplish.[156]

Although called on to coordinate, such committees are often expected to develop a policy consensus--a task much more easily said than done.[157] For, if the chairman of an interagency committee actually had power to force a consensus, he or she would enjoy more authority than the President himself.[158] On the contrary, the chairmen of interagency committees often have very little authority. When these committees are established, it is generally understood and agreed upon in advance that the power relationships among the members will remain the same.[159] Given this tendency to delegate responsibility without equivalent authority, interagency committees are likely to be most successful when they are assigned realistic tasks.[160] In addition, these tasks should be related to some overall shared goal-one that is agreed on at the outset and which, over time, can sustain an organizational commitment.[161]

One option for the Federal Government, therefore, is to clarify the mandate of the Interagency Committee on Standards Policy, relating it to an overall national standards policy. This option presumes, of course, the existence of a commitment to develop such a policy. To sustain an organizational commitment, a national standards policy will need to be worked out in an organizational context that is broader than the focus now provided by the Office of Management and Budget. Acknowledging the relationships between standards and national economic peformance, it might be developed, for example, in the Economic Policy Council[162] or the Office of Science Technology Policy (OSTP).

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155 Mr. Brooks, ASTM, personal communication. At a subsequent meeting Mr. Brooks said that this was not ASTM's main Opposition. More important to ASTM, he said, was his opposition to the use of the canvass method of standards of adoption. Responding to thi comment, ANSI director Manny Paralta points out that ASTM takes advantage of the canvass method when the need arises.

156 Seidman, op. cit., footnote 160.

157 As Seidman has noted:

> The quest for coordination is in many respects the twentieth century equivalent of the medieval search for the philosopher's stone. If only we can find the right formula for coordination, we can reconcile, harmonize compelling and wholly divergent interests, overcome irrationalities in our government structure, and make hard policy choices to which no one will dissent.

Op. cit., footnote 160, p. 205.

158 Seidman, op. cit., footnote 160, p. 216.

159 Ibid., pp. 213-216.

160 It is interesting t- note, in this regard, that even though the problems of interagency committees are well known, such committees continue to be established. President Carter, for example, planned to reduce the number of these committees as part of his reorganization efforts. Instead, however, during one 12-monthperiod, he established seven such committees by executive order. Alan Schick, "The Coordinating Option," Peter Szanton, *Federal Reorganization: What Have We Learned?* (Chatham, NJ: Chatham House Publishers, Inc., 1981), pp. 95-96.

161 As Alan Schick has noted, "Interagency committees cannot succeed as organizational orphans. When nobody has a vested interest in the group's work and nobody is responsible for following through on its decisions, a committee will languish even if its formal status remains intact." Alan Schick, op. cit., footnote 168, p. 97.

162 President Reagan set up the Economic Policy Council in 1985 as a means of working out interagency economic policy issues. A Cabinet-level body, it is comprised of the Secretaries of the Treasury, Commerce, State, Energy, Agriculture, and Labor; the Director of the Office of Management and Budget; the U.S. Trade Representative; and the Chairman of the Council of Economic Advisers. The Vice President and the Chief of State are ex-officio members, and the heads of nonmember departments may be invited to attend when issues germane to their activities are under discussion.

From the point of view of agency stakeholders, any proposed new interagency coordination could generate strong opposition. As Harold Seidman has noted, efforts at coordination are not designed to make friends. For "coordination is rarely neutral," and always "advances some interests at the expense of others." [163] Thus, any proposal to ***enhance coordination*** is likely to be judged less on its merits than on how it might redistribute power among existing players. OTA interviews with members of the Interagency Standards Policy Committee suggest that lack of participation was not due to concerns about turf, but rather for lack of a clear and meaningful mandate. However, were the committee to have a significant mandate, it is likely that power disputes would arise.

Option C: Delegate to a Federal Agency the Responsibility for Coordinating and Implementing Federal Standards Policy

Existing Federal standards policy is limited to support for private-sector development of standards. The Federal role, according to this position, is to encourage all Federal agencies to voluntarily use consensus standards. Unlike in other countries, the Federal Government has given little consideration to the notion that standards serve as an industrial infrastructure, or as international marketing tools for American companies.

The findings in this report contradict this point of view. They emphasize that the U.S. Government—as representative of the Nation—has a growing stake in standards and the effectiveness of the standards setting process. They describe, moreover, a number of market and political failures in the system, and outline reasons why, in the future, private sector and national goals may no longer coincide.

If the Federal Government favored the development of national standards goals, it might delegate the responsibility for implementing them to an agency within the Federal Government. The most likely candidate is NIST, given its history and experience in this area. Based on the analysis in this report, some of the functions that NIST might perform would include:

. Build an organizational capacity at the Federal level to address standards questions. To this end, for example, NIST might sponsor research on standards and standards development processes especially as it relates to standards usage by industry and the impact on the national economy as well as to the question of how the outcomes of standards processes may vary in different economic and organizational contexts.
- Support standard development activities through the promotion or development of an information infrastructure. Sponsor efforts to identify and reduce obstacles (i.e., copyright issues) to the development and use of such an infrastructure.
- Educate producers, users, and other interested parties with respect to the role of standards and the importance of participation in standards processes both domestic and international.
- Foster and/or sponsor programs to encourage the use of international standards by potential trading partners.
- Monitor the private sector process to assure that its performance is consistent with public sector goals. Serve as an ombudsman, providing a mechanism for feedback about the effectiveness of the standards process.
- Identify, on behalf of the government, areas where future standards activity will likely be required (i.e., environmental concerns, critical technologies, etc.).
- Foster a debate about, and coordinate interagency interests in, national standards policy.
- Represent, along with private sector standards developers, the United States in international standards negotiations.

Were NIST to be assigned such tasks, it would need to have much greater resources in this area than it has today. Not since its heyday in the postwar years has NIST had such a mandate, so its financial and human resources to perform such functions are no match for the complex tasks involved. NIST would also need greater political support. One can only speculate whether Congress, given budget concerns, would be willing to fund such a program. And in recent years the Executive Branch, through OMB, has sought to curtail the role of NIST rather than enhance it. Nor would the private sector be likely to support such a role for NIST, judging from the recent NIST hearing on the Standards Council of the United States of America (SCUSA) proposal.

163 Seidman, Op. cit., footnote 160, p. 205.

Although perhaps not politically viable, this option has considerable merit from a public administration point of view.[164] According to many public administration experts, once an authentic national need meriting Federal attention has been clearly identified should be addressed within the public sector. Privatization of public sector tasks, it is argued, diminishes government resources to deal with complex policy issues, and undermines the principal of political accountability.[165]

Option D: Establish a Government Corporation or Instrumentality to Focus on Public/Private Standards Goals[166]

Perhaps a more politically viable option would be to create a joint venture between government and the private sector, where national standards policy might be worked out and the tasks identified above pursued. As in Option C, the actual development of standards would continue to be performed by the private sector. This kind of an arrangement might be especially appealing in today's political climate, given efforts to limit the role of government.[167] It might be especially appropriate in the case of standards, which serve both public and private functions.

While foreign to the free-market advocacy style of the American political economy, organizational arrangements that promote collaboration among government industry and user interests are not only common in other parts of the world but also extremely successful. In Japan, for example, such collaboration is an integral feature of industrial policy. Generally, the Minister of International Trade and Industry (MITI) issues "administrative guidance" to alert large corporations of its plans. Industry, which often employs ex-MITI officials to facilitate its liaison with MITI, usually complies with this guidance. MITI also coordinates with industry through advisory committees and public and private-sector forums.[168]

In the United States, such collaboration has been much more limited. Here, the most typical kind of cooperative arrangement between government and the private sector has been the government corporation or instrumentality .169 Precedents for such organizations date back to 1781 with the establishment of the First Bank of the United States. Their major supporters were those suspicious of politics and politicians. They wanted government to be "run in a more business-like manner. ''[170]

The public corporation's popularity ebbed and flowed throughout American history, becoming

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164 As identified by Ira Sharkansky, there are four intellectual roots that, in this country, provide a public administration rationale. They are: "l) the desire to maintain political accountability in public administration; 2) the desire to maintain the traditional equilibrium among the three constitutional branches of government by preserving the separation of powers and checks and balances; 3) the desire to insure that professional and technical skills are brought to bear on relevant matters of policy formulation and implementation; and 4) the desire to maximize the efficient use of resources by means of a hierarchical form of organimation.' See Ira Sharkansky, ''Adnmfiustrative Organization and Control Units: Structures and Their Intellectual Roots," *Public Administration: Policy-Making in Government Agencies* (Chicago, IL: Rand McNally College Publishing Co., 3rd cd).

165 See for discussions, Ron C. Moe, "Government Corporations and the Erosion of Accountability: The Case of the Proposed Energy Security Corp.," *Public Administration Review,* November/December 1979; Ronald C. Moe and Thomas H. Stanton, "Government-Sponsored Enterprises as Federal Instrumentalities: Reconciling Private Management with public Accountability,"*PublicAdministration Review,* vol. 49, July/August 1989, pp. 321-329; Harold Seidman, "The Quasi World of Federal Government,'' *The Brookings Review, summer* 1988, pp. 213-27; and Ronald C. Moe, "Liabilities of the Quasi Government" *Government Executive,* November 1988, pp. 47-50.

166 There is n. precis, or legal definition of a Government corporation. Most broadly stated, "Government corporations are organized to achieve a public purpose authorized by law." Harold Seidman, "The Theory of the Autonomous Government Corporation: A Critical Appraisal,"*Public Administration Review,* vol. 12, spring, 1952. p. 93. They are, however, operationally and financially independent of Government. A good portion of all public corporations are not-for-profit. These include, for example, the Corporation for Public Broadcasting, the National Park Foundation the Securities Investor Protection Corporation, and the United States Railway Association. Most of their funding comes from Government. Instrumentalities are government sponsored enterprises, such as the National Academy of Sciences. They perform no commercial functions and are designed to minimize Presidential involvement. Ron Moe, CRS, personal communications.

167 According to Moe, "While American society might want the Federal Government to "do something" about a particular problem area, there is also an aversion on the part of a substantial portion of the public towards creating a new department or agency since this is seen as just more 'bureaucracy.' The acceptable solution in several instances has been to create quasi-governmental units that emphasize their privateness and their profit seeing character.

Ronald C. Moe, Library of Congress, Congressional Research Service, ''Administering Public Functions at the Margin of Government: The Case of Federal Corporations, ' HD 2755, Dec. 1, 1983, p. 22.

168 Jill Hartley, "The Japanese Approach to the Development of New Residential Communication Services," Marjorie Ferguson (cd.) New *Communication Technologies and the Public Interest* (London, England: Sage, 1986), p, 168; See also, Ira Sharkansky, *Wither the State? Politics and Public Enterprise in Three Countries* (Chatham, NJ: Chatham House, 1979).

l@ For a discussion, see Ronald C. Moe, op. cit., footnote 167.

170 Ibid., p. 9.

more popular during periods of crisis and emergency.[171] Thus, a number of government corporations were established to deal with the problems arising from the Depression and during the First and Second World Wars. These included the Reconstruction Finance Corporation, the Commodity Credit Corporation, and the Tennessee Wiley Authority.[172] More recently, however, the rapid growth and increased autonomy of government corporations began to raise concerns among government administrators[173] and political scientists, who fear that they are no longer accountable to either Congress or the President.[174]

Because of their long and varied history, public corporations differ considerably in terms of their goals and organizational structures. 75 Like COMSAT, they may be profit-making corporations sponsored by government and calling for a major government role. Or, as in the case of the Corporation for Public Broadcasting, they may be nonprofit ventures in which government's role is limited to appointing the board of directors.

A public corporation created to develop and oversee national standards policy could take a variety of forms, given this organizational leeway.[176] Its board of directors, for example, could be comprised of individuals representing government, standards development organizations, industry, and the general public. Its role could be advisory, or supervisory. Its structure and functions could even be negotiated among the key interested parties. Such an arrangement would allow for flexibility, provide for the efficient use of resources, promote cooperation, and be capable of evaluation and foresight. Established on behalf of the public interest, but operating somewhat apart from government, it could help the United States to better promote its interests in the international arena, while still keeping with American tradition (see box l-A).

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171 Ibid., pp. 6-7.

172 Ibid.

173 The Brownlow Commission, while recognizing the value of this form of organizational arrangement, recommended that they be incorporated within existing Federal agencies. Concerned that government corporations were getting out of hand, Congress, in 1945, passed The Govemment Corp. Control Act, which established budgeting and auditing standards. The act provided, moreover, that no corporation be created or acquired by any agency or corp. of the Federal Government without the specific authorization of Congress.

174 See, for example, Harold Seidman, "Government-Sponsored Enterprises in the United States,' Bruce Smith (cd.) *The Public Use of the Private Sector* (London, England: Macmillan Co., 1975).

175 As Moe points out, ''By 1981, efforts t. neatly categorize the ne breed of corporations were doomed to frustration. Neither the President nor Congress had used a set of criteria when creating "corporations,'rather each new "corporation' tended to be viewed sui generis." Op. cit., footnote 167, p. 26.

176 For one example see H.R. 6496, introduced in May 19,1948. This bill was designed to incorporate the American Standards Association. Its purpose was to operate exclusively as a nonprofit educational and scientific organization, and, in connection therewith, to assemble and diffuse knowledge concerning the standardization of measurements, materials, products, methods, operations, and nomenclature; to study, approve, and promote the use of suitable and desirable standards; to provide systematic means by which organimations concerned with standardization work may cooperate in creating and developing such standards so that they may represent a consensus of those concerned with their scope and provisions; to furnish facilities for promoting the use of such standards; to serve as a clearinghouse for information on standardization work in the United States and foreign countries; and to cooperate with the Government of the United States, and with other organizations in standardization matters, including cooperation in international standardization matters. "

Box l-A—The United States and Saudi Arabia Standards Program

Created in 1989 by NIST and the American and Saudi Roundtable (an association of U.S. companies with business interests in Saudi Arabia), the Program has had a substantial impact on the development of Saudi national standards.

Many Saudi product standards, incompatible with U.S. products, promulgated prior to 1989 with assistance from Japan, the United Kingdom, Germany, and other countries, have diminished U.S. export opportunity by $100 to 500 million annually.[1]

Since the inception of the NIST Roundtable Program, no standard incompatible with U.S. products has been promulgated, and effort is underway to achieve revision of the earlier, damaging standards.

Under the program, a U.S. standards advisor, stationed in Riyadh, works directly with the Saudi standards agency (SASO), providing advice and counsel on standards development. The advisor obtains standards in the draft stage and sends them to NIST, which disseminates the drafts to U.S. companies, industry associations, and standards organizations for comments. NIST collects and harmonizes the comments and sends them to the U.S. standards advisor who presents and advocates them to the Saudi agency. Unlike any U.S. industry and thereby provides the Saudis the broadest possible expertise and establishes maximum credibility for U.S. comments.

The Program demonstrates that industry and government can work effectively together to bring U.S. standards capability to bear on foreign standards development.

Formed by a Memorandum of Understanding between NIST and the American/Saudi Roundtable, the Program costs about $5000,000 per year ($250,000 from the private sector maintains and supports the Standards Advisor in Saudi Arabia, $250,000 from the NIST budget maintains the standards dissemination and review system). Private sector funds have been contributed by fewer than 50 U.S. companies, however, out of the several hundreds which benefit from the program.

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1 Study by U.S. Embassy, Riyadh, Saudi Arabia, 1991.

SOURCE: American and Saudi Roundtable.

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Standards Setting in the United States

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Chapter 2
Standards Setting in the United States

Introduction

The current U.S. standards process was adopted at the turn of the century, as the Nation entered the industrial age. Its form reflects American political culture and the manner in which industrialization took place in the United States. In contrast to many other countries, where unified national standards bodies were established in conjunction with the State, standards development organizations in the United States first emerged in the private sector, in response to specific needs and concerns.

Today, the U.S. economy is in a state of flux due to a number of developments. These include the emergence of a highly competitive global economy in which the United States is no longer dominant; the rise of regional trading blocs, the growing importance of multinational corporations and other transnational nongovernmental institutions, and the rapid advance of technology.

Just as the industrial era gave rise to the present standards development system, so too these major structural changes will likely place new demands on it. To understand the implications of these changes for the U.S. standards process, one must first look historically at the evolution of standards within the U.S. economy and the institutional arrangements that promote their development.

The Evolution of Standards in the U.S. Economy

The Role of Standards in Economic Transactions

Standards are part of all social interactions. Interpersonal relations cannot occur without some mutual expectation. Language, itself, is based on a common understanding, as are simple gestures.[1] Shared expectations give coherence and meaning to social life. They are necessary for cooperation. When reenacted and reinforced over time, such normative expectations give rise to "standards of behavior.'

Standards also serve to govern economic interactions. In preindustrial societies, for example, economic interactions were often regulated by family relationships and codes of human behavior.[3] Bureaucracy provided a parallel function in more complex organizations. By standardizing roles, relationships, and responses, workloads were greatly reduced.[4] Standards are especially important in the marketplace, because market interactions require a high level of cooperation and coordination. Standards lower the cost of economic transactions and, thus, can greatly improve efficiency.

Economic standards have proliferated and become more highly valued, as economic relationships became more intricate. One major impetus for standardization was economic specialization. With

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[1] Irving Goffman, *Frame Analysis (New* York, NY: Harper and Row, 1974).

[2] **Norms". . .designate any standard as a rule that states what human beings should or should not think, say, or do under a given set of circumstances.' Judith Blake and Kingsley David, "Norms, Values, and Sanctions," Robert E.L. Fairs (cd.),** *Handbook of Modern Sociology (Chicago, IL:* **Rand McNally, 1964), p. 456. Norms guide the behavior of individuals belonging to a group. People conform to norms not only for fear of punishment, but also because norms are internalized, so people believe they correctly define the right thing to do. John and Erma Perry,** *The Social Web: An Introduction to Sociology (New* **York, NY: Harper and Row, Publisher, 1979), p. 95.**

3 As Karl Polanyi notes:

> **in preindustrial societies trading relations were governed by standards relating to magic, etiquette, and norms of reciprocity.**

See Karl Polanyi, *The Great Transformation: The Political and Economic Origins of our Time* **(Boston, MA: Beacon Press, 1957 cd.), p. 57. For a discussion of the relationships between social and economic interactions in preindustrial England, see Neil Smelser,** *Social Change in the Industrial Revolution: An Application of Theory to the Lancashire Cotton Industry, 1770-1840,* **(London: Routledge and Kegan Paul, 1959).**

4 As James Beniger notes:

> **One example from within bureaucracy is the development of standardized forms. This might at first seem a contradiction in that the proliferation of paperwork is usually associated with a growth in information to be processed not with its reduction. Imagine how much more processing would be required, however, if each new case were recorded in an unstructured way, including every nuance and in full detail rather than by checking boxes, filling blanks, or in some other way reducing the burdens of the bureaucratic system to only the limited usage of formal, objective, and impersonal information required by standardized forms.**

James Beniger, *The Control Revolution: Technology and the Economic Origins of the Information Society* **(Cambridge MA: Harvard University Press, 1986), pp. 15-16.**

the division of labor and specialization, tasks became more interdependent, requiring greater cooperation and information exchange.[5]

Mass production provided a tremendous impetus for standards development, since standardized processes required that there be standardized parts.[6] Mass production, and with it the demand for interoperable parts, was especially prominent in the United States where the economic conditions for large-scale production were ripe. In no other country was there a geographic market large enough to absorb the output of a single standardized commodity or stable enough to sustain continual large-scale production.[7] Nor was there anywhere else a labor or consumer market equivalent to that in the United States, which could take advantage of an ever expanding volume of mass produced capital and consumer goods.

Henry Ford was one of the first to recognize the relationship between mass production and mass consumption, and he paid generous wages accordingly. However, by 1920, most businessmen subscribed to the view that it would be the wage earners who would be "the spenders of the nation. ' Not surprisingly, therefore, by 1928 the average American's national income was estimated to be one-third greater that the average European's.[9]

The relationship between standards and mass production was self-reinforcing. Further advances in precision manufacturing required the development of machine tools and precision gauges, which in turn further drove the need for standards and standard measures. Of particular importance was the vernier caliper, which was first made in the United States in 1851.[10] Inexpensive and capable of reading to thousandths of an inch, the new caliper permitted ordinary machinists-whether they were gun smiths, watchmakers, or sewing machine manufacturers-to develop precision, interoperable parts.[11]

Standards were also spurred on by the extension of markets across great distances. Coinage, for example, was used to standardize value, increasing both the potential and geographic scope of trade.[12] Coinage allowed people to compare things in the abstract, and hence carry out exchanges irrespective of time and distance. As trade became more dispersed, standards were needed to assure that products manufactured in different locals could work together and be easily replicated, assembled, and repaired[13] (see box 2-A). Moreover, standards were required to facilitate trading, itself. For example, the railroad extended trade over vast regions, so proce-

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5 See, for a discussion, Emile Durkheim, *The Division of Labor in Society (New* York, NY: Free Press, 1933).

6 As noted by Harold Williamson:

> Chief among the other elements in the pattern of mass production is the principle of standardization. Stemming from the rudimentary division of labor, standardization involved the continuous pursuit, and progressive realization, of uniformity of the materials, operations and products of industry, which made possible the future subdivision and mechanization of labor.

Harold Williamson, (cd.) *The Growth of the American Economy (New* York, NY: Prentice Hall, 1951), p. 722.

7 Michael J. Piore and Charles F. Sabel, *The Second Industrial Divide: Possibilities for Prosperity* (New York, NY: Basic Books, 1984).

8 As Williamson notes:

> **Mass consumption was the main support as it was the prerequisite of mass production. . . The American home market, in the words of Andrew Carnegie, is a "vast homogeneous market, " and this factor too was a major influence affecting the evolution of mass production. Across the horizontal plane and its great geographical extent, as well as up and down the vertical social scale, the American market place underwent a standardization of taste and consumption that bore profound psychological and economic significance. In part, the demand for great quantities of identical and similar commodities was built up by the subtle suggestions of salesmanship and advertising that were a parallel and logical accomplishment of mass production itself.**
>
> **In part also, such ready standardization of consumption was due to the scarcity of craft skills in the new country. This basic compatibility between mass production and standardized mass consumption was, furthermore, a practical manifestation of that democratic egalitarianism. Williamson, op. cit., footnote 6, p. 721-722.**

9 **Ibid.**

10 Constance McLaughlin Green, "Light Manufacturing and the Beginning of Precision Manufacture,' Harold Williamson, op. cit., footnote 6, p. 201.

11 **Ibid.**

12 See, for a discussion, Donald B. Woodwind and Marc A. Rose, *A Primer of Money (New* York, NY: McGraw Hill Book Co., Inc., 1935).

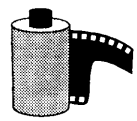
13 **Ibid., p. 6.**

Box 2-A—The Need for Standards

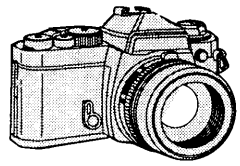
Everyday, millions of pictures are taken by thousands of people who profess not to understand standards. There are few better illustrations of the types and nature of standards than this example. It gives some indication of the number of types of standards involved.

To begin, the film and the camera matched. They were not made by the same manufacturer, but they interoperated. This interoperation was made possible by voluntary consensus standards. The film maker and the camera maker agreed to conform to market pressure and used a standard 35mm format. No law requires this; the market expects the standard to be honored The camera understood that the film speed was one specified by an ISO number-ISO standing for the International Organization for Standardization. Again, the market expects conformance to a standard

The film was sent to a processing plant-and the internal standards of the processing plant require that the film be tagged with appropriate header information to ensure that it is returned to the owner. The film is developed according to a certain process, usually specified on the outside of the film canister. The chemicals used to develop it must be disposed of in a manner approved by environmental authorities, and the final pictures are printed in a reasonably standard format, usually three inches by five inches. These were then returned to the sender, the check cashed, money deposited and the transaction completed. It is a simple occurrence, but one that is completely driven and controlled by standards, on which our industrialized society is built.



The film:
standard size and sprocket and sensitivity



The camera:
standardized speeds, lens size, f-stop, batteries, flash, and film advance.



The developer:
regulations, internal standards on processing speed, rules for film return, disposal of dangerous chemicals.

SOURCE: Reproduced with the permission of ANSI.

SOURCE: Carl Cargill, "Justifying the Need for a Standards Program," *Standards Management: A Handbook for Profits (New York, NY:* ANSI, 1990), pp. 1-2.

dures for billing and exchange were also standardized through bills of lading.[14]

Stakeholders in the Standards Process

As the role of standards increased, so did the number of people who had a stake in the selection of standards. Many early standards were simply set unilaterally, by 'the powers that be. European monarchs, for example, established standard weights and measures as a matter of royal prerogative.[15] In similar fashion, Article 1, Section 8 of the United States Constitution authorizes the Federal Government to set standard weights and measures.[16]

14 As noted by Kirkland:

> A national railroad system required business innovations facilitating joint and through operations. Passengers must make connections with tolerable certainty and ease: the freight cars of a corporation must not come back to stop at some corporate terminus where an agency would have to unpack their cars and transfer it to the cars of another carrier, like as not just across the street. Almost unchronicalled and undated, the railroads introduced through bills of lading, and though shippers still carped at their limitations, these bills became the accepted method of freighting in the seventies. . .

Edward Kirkland, *Industry Comes of Age: Business, Labor, and Public Policy* (New York, NY: Holt, Rheinhard, and Winston, 1961), p. 49.

15 As Soloman notes:

> . . .according to *The Oxford English Dictionary,* the *word standard is derived* from an early concept of the flag or standard bearer; one might say, "the King's Standard."

Richard Soloman, "New Paradigms for Future Standards" (Cambridge MA: Research Lab of Electronics, MIT, 1989), pp. 1-2.

16 It is noteworthy that Congress did not act directly on this authority. On Apr. 2, 1722, Congress adopted the decimal system of money; weights Of coins, however, were not standardized until 1828, when Congress adopted the British troy pound as the standard for American coinage. Rexmond C. Cochrane, *Measures for Progress: A History of the National Bureau of Standards* (Washington DC: National Bureau of Standards, 1966) p. 24.

Producers got involved in standardization when trade was extended across greater distances. Standards served as a trademark, allowing them to differentiate their products from their competitors, and to price products for different markets. It was to this end, for example, that American farmers played such an important role in setting agricultural standards during the frost half of the 18th century. They realized that by grading and classifying their products, they could set up separate distribution channels and increase their profits. Thus, when farmers moved west, they labeled their products by the region of their origin, while wholesalers used these names—Goschen butter, Genessee flour, and Herkimer cheese—as designations of grade.[17]

Suppliers were brought into the standards process with industrialization and the development of precision manufacturing. Recognizing that production costs could be greatly reduced with interchangeable parts, they began to produce to specifications.[18] Gun manufacturing was one of the first industries in the United States to take advantage of production based on interoperable parts, followed by clock making and the manufacturing of bicycles and sewing machines.[19] In 1813, Simon North signed a contract with the Federal Government to produce 20,000 pistols. His contract specifically stipulated that, "the component parts of pistols, are to correspond so exactly that any limb or part of one pistol. . maybe fitted to any other of the twenty thousand."[20]

No one understood the value of interoperability better than Henry Ford, who, in 1913, limited production at his Highland Park plant to the standard, black Model T. ''Any customer can have a car painted any color he wants," he said, "so long as its black."[21] Ford, however, was not the only one to standardize the production of cars. Henry Lebland, who created the Cadillac and the Lincoln, illustrated the benefits of interchangeable parts when, in 1908, he took apart three Cadillacs; mixed up the parts; put the cars back together, and then drove them away.[22]

Consumers also gained from standardization. Mass produced goods were cheaper. Thus many consumer goods—such as cars, refrigerators, and vacuum cleaners, which were once regarded as luxuries-became more accessible to all. Between 1914 and 1924, Ford produced more than 15,000,000 standardized Model Ts, the cost of which dropped during the same period from $950 to $240.[23]

Standards also conveyed product information and provided greater quality control. One of the frost product areas to benefit from standards was that of food. Responding to scandals in the meat packing industry, Congress passed the Pure Food and Drug Act of 1906. This legislation not only protected against misbranding and food adulteration; it also standardized containers for marketing fruits and vegetables, thereby eliminating false measurements and deceptive shapes.[24] Later the Department of Agriculture, continuing the standards program initiated during the First World War, developed standards for fruits, vegetables, peanuts, honey, butter, cheese, eggs, and meat, and established inspection stations at a number of key distribution centers.[25]

17 James Beniger, op. cit., footnote 4.

18 As Cargill points OUt:

> It was the secondary suppliers who most spurred the growth of voluntary standards; screw sizes, pipes and valve fittings, and rail ties were just a few of the scores of newly standardized objects. Various interest groups coalesced within industries to insure that their industry has its standards—standards were intended to make the industry grow or to make it more profitable and/or less complex.

See Carl Cargill, *Information Technology Standardization: Theory, Process, and Organization* (Digital Press, Boston 1989), pp. 20-21.

19 Siegfried Giedion, *Mechanization Takes Command: A Contribution to Ananomous His- tory (New York,* NY: Oxford University Press, 1948), pp. 47-50.

20 Ascited in G.S. Radford, *The Control of Quality in Manufacturing (New* York: NY: The Ronald Press CO., 1922), P. 270.

21 Allan Nevins and Frank Ernest Hill, *Ford: The Times, The Men, The Company (New* York, NY: Scribner, 1954).

22 For a discussion of the impact of standards on the automobile industry, see George V. Thompson, *Journal of Economic History*, vol. 14, *Winter*, 1954, pp. 1-20.

23 In this seine it @@t be said that Ford's real genius was in recognizing the explosive market for a less expensive ''everyman''car—easily built, sold, and maintained. Personal communication, Carl Cargill, DEC. Williamson also notes that:

> the philosophical and practical relation between mass production and mass purchasing power was perceived early by Henry Ford. By 1920, it had become a commonly held business option that "wage earners . . . are the spenders of the nation."

Williamson, op. cit., footnote 6, p. 721; See also Gidieon, op. cit. footnote 19.

24 One of the problems for consumers was the lack of standard weights and measures.

25 Alice Edwards, ''Standardization in the Household, " in *Annals of the American Academy of Political Science*, 1928, p. 213, hereafter referred to as *Annals.*

The general public became even more attuned to the need for standards because of the many problems accompanying industrialization. With more and more mishaps due to the rapid expansion of technology, safety standards were introduced.[26] Explosions averaging 1,400 per year led the American Society of Mechanical Engineers, for example, to write a comprehensive boiler code in 1910. Once most States and cities had moved to adopt the code, such explosions were virtually eliminated.[27]

The leaf fire in 1904 on the grounds of the National Bureau of Standards also had a significant impact. Dealing with the fire was made much more difficult because the fire hoses could not be coupled because of differences in threads. The incompatibility between hoses and hydrants also accounted for the problem controlling the Baltimore fire, which occurred the same year. Buildings numbering 1,526 and all electric lights, telegraph, telephone, and power facilities in an area of more than 70 city blocks were destroyed before the fire burned out. And fire companies from outside the area could not link their hoses to the Baltimore hydrants, making it impossible for them to help[28] (see box 2-B).

With the advance of technology and its further deployment in industry, scientists and engineers began to play a special role, as a group, in standards development.[29] Faced more and more with the need to quantify their results, they could not proceed in their work without more accurate standards of measurements, precision instruments, and better tools.[30] Thus, even though standards were a boon to industry, it was the scientist and not the industrialist who called for national standards to be developed through a Federal Bureau of Standards.[31] The demand for electrical standards was especially acute, and it was in fact the scientist and engineers working in this field that supplied the frost cadre of workers for the National Bureau of Standards after it was established in 1901.[32]

Although the Federal Government became involved in standards as early as the mid-eighties through the work of the Office of Weights and Measures, and later with the establishment of the Bureau of Standards, it was not until World War I that the government's stake in standards was really brought home to the Nation. In 1917, product diversity was so great it threatened to hinder the war effort. To deal with the problem, the government set

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26 As David Van Schaack, writing in 1928, described the impetus behind safety standards:

> One of the most interesting developments of the last decade or two has been the rapid increase of interest in industrial safety. It was only natural that the astonishing progress in machine production which had placed the United States in the forefront of industrial nations should direct its attention to the human waste accompanying it. . . . This waste made its first appeal to the moral sense, but this was soon supplemented by a steadily increasing belief that accidents in industry have more than a humanitarian aspect—that they have such an impact on production that they must be taken into consideration from an economic point of view.

David Van Schaack, "Development of Safety Codes," op. cit., footnote 25, *Annals*, p. 70.

27 Achsah Nesmith, "A long, arduous march toward standardization" *Smith- sonian Magazine*, February 1985, p. 185.

28 Remend C. Cochrane, op. cit., footnote 16, pp. 84-86. To overcome such problems it is not enough to merely set standards; standards need to be implemented. As Nesmith notes:

> Sixty years after the Baltimore fire, the city learned that firemen in an adjoining county were requesting fireplugs which did not fit hoses made to national standards be marked with fluorescent paint so firefighters could tell where special adapters were needed.

Nesmith, op. cit., footnote 26, p, 188.

29 As described by Cargill:

> Standardization was pushed by the growing group of technocrats, headed by the engineers—civil, metallurgical, mining, electrical. For the first time an emerging discipline had a body of literature that dealt with demonstrable reality, capable of being duplicated. . . . This reliance on a factual, demonstrable base is the hallmark of the standards industry-It is no accident that in the late 1800s, the American Society for Testing Materials (ASTM) was one of the first organizations to gain prominence as a standards group.

Cargill, op. cit., footnote 18, p. 21.

30 The first real effort to develop accurate weights and measures did not occur until 1832 under the direction of Ferdinand Rudolf Hassler, who collected the various standards used in government departments. It was a slow process, however, and Hassler's work was only half completed when he died in 1843. Cochrane, op. cit., footnote 16, pp. 24-25.

31 As Cochrane notes:

> The builders of America's industrial complex had little interest in standards as such, but the scientists, engineers, and experimenters working for them found themselves increasingly hampered without them.

Cochrane, op. cit., footnote 16, p. 9.

32 According to Cochrane:

> Electric light and power companies developed at aphe- nomenal rate throughout this period. So numerous were the demands of the electrical industry and of electrical research labs for basic measurements, instrumentation tests and calibrations that almost half of the new people coming into the Bureau went into this division,

Ibid., p. 109.

up a Commercial Economy Board of the Council of National Defense, whose task was to simplify the use of labor, capital, and equipment for all industries.[33] In 1918, the Board was incorporated within the War Industries Board, which eventually supervised the manufacture of over 30,000 articles of commerce. The intensity of this campaign made every American conscious of standards-its impact "reached into every home, every office, factory, institution, and government agency in the United States." 34

Concern about the post war economy led government to take a continued-if not more intense—interest in standards, in the period following the war. The hope that wartime simplification efforts would endure was dashed when manufacturers' sought to revive consumer demand by increasing product diversity during the "buyers' strike" of 1919-1920.[35] The government's response to the post war slump was quite the opposite.[36] Inspired by the report, *Waste in Industry,* written by the American Academy of the Federated American Engineering Societies, the government hoped to revive the economy by increasing economic efficiency through greater standardization.

The driving force behind this "crusade for standardization,' was Herbert Hoover, Secretary of Commerce under President Harding. Hoover called for a three-pronged approach to the reduction of waste in industry: 37

- standardization of business practices and of materials, machinery and products;
- specifications to insure good quality of products; and
- simplification in variety of products.

In contrast to the wartime simplification program that had focused on military products, Hoover's program was directed at the economy as a whole. To carry out the program, he organized agencies within the Department of Commerce to provide standards assistance to business at their request.

The standards crusade was considered a success. It reached a peak in the late twenties when, according to the American Standards Association:[38]

> Standardization had become "the outstanding note of this century," its influence pervading "the remotest details of our industrial regime' topping "all sources of scientific knowledge and [affecting] every phase of design, production, and utilization. "

Balancing the Public and Private Interests in Standards

As more and more stakeholders became involved in standards, it became necessary to differentiate the responsibilities among them. Of prime importance was the relationship between the public and the private sectors. Although the government actively promoted standardization at the turn of the century, it gradually relinquished this responsibility to the private standards development organizations. However, because standards serve both public and private functions, this arrangement was not without tensions. And, every so often these tensions erupted from under the surface, as they have today.

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33 The government worked in cooperation with industry. In 1917, the American Chamber of Commerce met in Atlantic City, where it endorsed the committee system. According to this system, each industry would organize its own committee and cooperate with government in its own fashion. Reflecting the attitudes of business, W.E. McCullough, a participant noted:

> The experience of the members of these committees, which were largely made up of executives of several industries opened their eyes to the danger which they had been drifting into prior to the war in permitting the increasing of their varieties, which also meant the insidious reduction of volume, thereby decreasing their plant efficiency, and greatly increasing their costs.

E.W. McCullough, "The Relation of the Chamber of Commerce of the United States to the Growth of the Simplification Program in American Industry," pp. 9-10, *Annals,* op. cit., footnote 23.

34 According to Cochrane:

> Labor savings in the manufacture of products from clothing to coffins reportedly reached as high as 35 percent. Savings over prewar consumption of materials in some instances rose to 50 percent as simplicity ruled and plentiful wood, paper, zink, and cotton replaced the steel, tinplate, copper, brass, bronze, pig@ nickel, and raw wool consumed by the war, The country had experienced nothing like it before.

Cochrane, op. cit., footnote 16, p. 167.

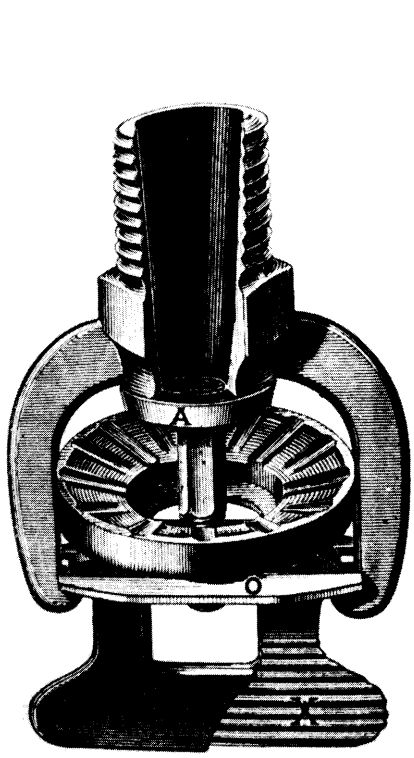
35 Ray M. Hudson, "Organized Effort in Simplification, " op. cit., *Annals,* footnote 23, p. 1.

36 Cochrane, op. cit., footnote 16, p. 255.

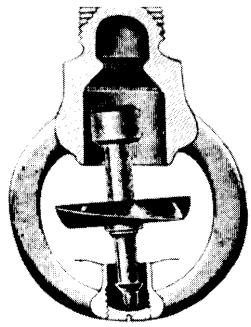
37 Congressional Research Service, Science Policy Division, *Voluntary Industry Standards in the United States: An Overview of their Evolution and Significance for Contress,* Report to the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, U.S. House of Representatives, 93rd Cong. 2nd Sess., July 1974, hereafter referred to as CRS 1974.

38 Ibid.

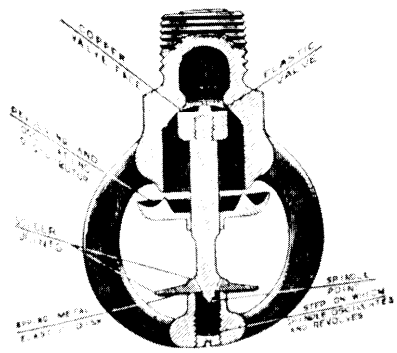
Box 2-B—Facsimile Edition of NFPA's First Standard—the Fire Sprinkler Standard



BUELL.



HILL—OPEN



HILL—CUT OPEN

Photo credit: James Smalley/NFPA

This is a facsimile edition of NFPA's First Standard-the Fire Sprinkler Standard. It is the very standard which led to the creation of the National Fire Protection Association in 1896. At that time, the Association's first Secretary, Everett U. Crosby, reported that within a small radius of New York City alone, "nine radically different standards for size of piping and sprinkler spacing" existed.

In 1897, he described the principles applied in creating the Sprinkler Standard-a process that continues to direct NFPA technical committees today:

> To bring together the **experience of different sections** and bodies of underwriters, to come to a mutual understanding, and, if possible, an agreement on general principles governing fire protection, to harmonize and adjust our differences so that we may go before the public with uniform rules and conditions which may appeal to their **judgement** is the object of this Association.

SOURCE: National **Fire Protection Association.**

The American Preference for Pluralist Solutions

The American preference for private, pluralist solutions is as old as the Constitution itself. Presag-***ing the*** loosely organized and fragmented standards system to be found in the United States, Publius (a.k.a. James Madison), in the *Federalist Papers* (no. 10) contends that the only way to guard a-gainst domination by a majority faction is to promote a large number of diverse competing

ones.[39] Writing to Thomas Jefferson, James Madison summed up this view:

> *Divide et impera,* the reprobated axiom of tyranny is, under certain qualifications, the only policy by which a republic can be administered on just principles.[40]

The Founding Fathers were successful in framing the Constitution to have just such an effect. From the outset of the new republic, Americans proved to have a penchant for joining factions and establishing associations, a trait that did not escape the observation of Alexis de Tocqueville when he visited America in the mid-1800s. As he described in *Democracy in America:*

> Nothing . . . is more deserving of our attention than the intellectual and moral associations of America. Americans of all ages, all conditions, and all dispositions constantly form associations. They have not only commercial and manufacturing companies, in which all take part, but associations of a thousand other kinds, religious, moral, serious, futile, general or restricted, enormous or diminutive.
>
> . . . Wherever at the head of some new undertaking you see the Government of France, or a man of rank in England, in the United States you will be sure to find an association.[41]

This support for voluntary, private sector associations 42 was reinforced by a general suspicion of the state and preferences for market solutions.[43] Although these values were often supported more by rhetoric than practice, they were greatly popularized by the progressive movement, which had its heyday in the late 1800s just at the moment when industrialization was primed to take off.[44] Thus, whereas in many other countries government actively sponsored the growth and development of business, in the United States industrial development was managed, directed, and financed primarily by the private sector.[45]

The Emergence of Standards Organizations

The first American standards organization were in keeping with this tradition. They generally emerged to deal with specific needs as they arose, and thus took a variety of forms (see table 2-l). Often established on an industry by industry basis, there was little interaction between them.[46] The frost American standards organization was the United States Pharmacopial Convention, which was setup in 1829 to establish uniform standards for drugs. The American Iron and Steel Institute, established in 1855, was the frost trade association to develop standards. The American Society of Civil Engineers, which was formed in 1852, was the first scientific

---

39 As described by Plattner:

> How can a republic be protected from such a faction? The first and most important part of Publius's answer is that "the existence of the same passion or interest in a majority at the same time must be prevented." In other words, far from seeking the greatest possible unity among the citizens, as the legislators of the small virtuous republics did, the framers of the American Constitution made the choice of encouraging multiplicity and disunity.

See Marc F. Plattner, "American Democracy and the Acquisitive Spirit," Robert A. Goldwin and William Sebambu (eds.) *How Capitalist is the Constitution?* (Washington DC: The American Enterprise Institute, Constitutional Studies Series, 1982), ch. 1.

40 James Madison to Thomas Jefferson, Oct. 24, 1787, Galliard Hunt, (ed.) *The Writings of James Madison, 9* vols. (New York, NY: G.P. Putnam's Sons 1906, as cited in ibid.

41 Alexis de Tocqueville, *Democrac, in America (1963* cd.), pp. 106 and 110.

42 For cross cultural comparisons, see Robert Wuthnow (cd.), *The Voluntary* Sector in *Comparative perspective* (Princeton, NJ: Princeton University Press, 1991).

43 See for discussions, Willi Paul Adams, "Republicanism," Jack P. Green, ed., *Encyclopedia of Political History* (New York, NY: Scribners, 1984); see also Dorothy Ross, "Liberalism," ibid.

44 Member of the progressive movement helped t. expose a number of scandals that linked politicians and business, reinforcing Americans suspicions of the government. Ironically, the reputation of big business was actually improved. As Walsh notes:

> Laissez-faire economic theory seemed newly justified by the record of great corporate successes between 1889 and 1929. The role of government in that development was discounted and its reputation tarnished.

Annemarie Hauch Walsh, *The Public' sBusiness; The Politics and Practices of Government Corporations* (Cambridge, MA: The Mit Press, 1978), pp. 25-26.

45 See, for a discussion, David Vogel, "Gov ernment-Industry Relations in the United States: An Overview," Stephen Wilks and Maurice Wright (eds.), *Comparative Government- Industry Relations* (Oxford: Clarendon Press, 1987), ch. 5.

46 As described by Cargill:

> The tone for the entire voluntary standards effort was set by 1890. There was a strong concentration on creating standards within specific disciplines (metallurgy, mechanical engineering, electrical engineering, etc.), and emphasis on demonstrable and reproducible facts, and an internal focus on the part of the participants-a modified siege mentality.

Cargill, op. cit., footnote 18, p. 21.

Table 2-l—Selected Features of Nine Private Standards Setters

	Founding date
American Society of Mechanical Engineers (ASME). .	1880
Underwriters Laboratories (UL).	1894
National Fire Protection Association (NFPA).	1896
American Society for Testing and Materials (ASTM)..	1898
Building Officials and Code Administrators international (BOCA).	1915
American Gas Association Labs (AGA Labs).	1918
American National Standards institute (Anal)	1918
The American Conference of Government Industrial Hygienists (ACGIH).	1938
Southern Building Code Congress (SBCCI). ....., .	1940

SOURCE: U.S. Department of Commerce, National Bureau of Standards, *Standards Activities of Organizations in the United States,* NBS Special Publication 681 (Washington, DC: U.S. Government Printing Office, August 1984).

and technical society involved in standards development.[47]

While these private standards organizations could boast a number of accomplishments, perhaps the most impressive standardization effort of the period was the interconnection of the Nation's railways. By 1897, 1,158 independent railroad companies laid and interconnected over 240,000 miles of track with little assistance from government. This feat required not only the standardization of gauges but also of cars and their equipment. Also needed were uniform procedures and freight classifications as well as standardized time.[48] That such an achievement was accomplished within the private sector prompted a New York editorial writer to remark that:

> The laws of trade and the instinct of self preservation effect reforms and improvements that all legislative bodies combined could not accomplish.[49]

The private sector approach survived the war time simplification effort, and was reconfirmed by Secretary of Commerce Hoover, when he undertook the standardization crusade in 1921. Hoover was a staunch believer in the private sector. Vetoing a public power bill that called for an active government role, he proclaimed, for example:

> I hesitate to contemplate the future of our institutions, of our government, and of our country if the preoccupation of its officials is no longer to be the promotion of justice and equal opportunity but is to be devoted to barter in the markets. This is not liberalism, it is degeneration.[50]

In accordance with this perspective, the Division of Simplified Practice set up in the Department of Commerce was designed to supply guidance, information, and assistance. But compliance with the program was purely on a voluntary basis.[51]

The depression capped the voluntary approach to standard setting. In 1933, Congress cut the Bureau's standards appropriations and impounded its funds. As a result, the staff of the Simplified Practice Division was cut from 40 to 4, and much of its work in the area of commercial standards was transferred to the American Standards Association (ASA).[52]

Tensions Within the System

Notwithstanding the American preference for voluntary standards, there were a number of tensions in the standards setting community. Consumers were among the first groups to question the system. In the wake of Hoover's standardization crusade, they began to question whether they had derived any benefits from it. It was clear that standardization had saved industry money, but consumers saw little evidence that these benefits were being passed down to them.[53] They also looked to the Bureau for consumer product information, an area that business was loath to have government become involved in.

The business community also began to register complaints about the expansion of the Bureau's role, charging it with meddling in their affairs. Alarmed at the establishment of a trade standardization

47 U.S. Department of Commerce (Robert Toth, cd.) *Standards Organizations in the United States,* NBS Special Publication 681, P. 4.

48 Kirkland, op. cit., footnote 14, pp. 49-51.

49 As cited in ibid., p. 50.

50 As cited by Annemarie Hauch Walsh, op. cit., footnote 44, p. 15.

51 Cochraine, op. cit., footnote 16. As Ray Hudson, the Assistant Secretary of Commercial Standards within the Department described:

> The committees operate on the principle tbat if producers, distribution% and consumers of a commodity can meet and develop a program of simplification which can be of benefit to all concerned, the Department of Commerce is glad to assist in securing its general adoption and in seeing that it is subject to periodic review so as to keep it in accor with the best current practice.

Hays, *Annals,* op. cit., footnote *24,* p. 9.

52 CRS, 1974, op. cit., footnote 37, P. 16.

53 Cochrane, op. cit., footnote 16, p. 202.

division at the Bureau, the American Engineering Standards Committee (AESC) formally petitioned the Bureau to withdraw from all commercial standards activities. Members of the Bureau refused to attend private sector meetings in protest.[54]

For the next two decades, relations between the public and private sectors were severely strained. The Bureau charged that the ASA was deliberately duplicating and blocking its standards. Meanwhile, ASA accused the Bureau of usurping its functions by promoting Federal specifications as commodity standards.[55]

The Need for Cooperation and Coordination

With the government's retreat from the standards arena together with the proliferation of standards organizations, the need for national coordination of standards activities soon became apparent. Standards organizations were not only competing with one another to write standards, they were also writing conflicting standards, thus defeating the purpose.

The first steps towards coordination took place in 1918, during the war, when five national engineering societies, together with the U.S. Departments of War, Navy, and Commerce, formed the nucleus of an organization that was to become the AESC. In 1927, the representatives of 365 national organizations—technical, industrial, and governmental—were officially accredited to the AESC. The following year, this group was reconstituted to form the American Standards Association (ASA). However, despite ASA, coordination continued to prove difficult, because of competition among standards organization.[56]

The second world war placed even greater demands for coordination on the U.S. standards community, again raising the question of the government's role in standards .57 To meet the needs of war, the government became involved in setting standards for consumer goods. At the behest of the Department of Commerce, a special consultant, Carroll L. Wilson, was asked to report on the standards problem, with particular attention to the role the National Bureau of Standards should play in the postwar period. Wilson concluded that both the government and the private sector standards programs fell short. Acting on Wilson's recommendations, the ASA broadened the scope of its concerns to include consumer goods. The ASA constitution was also revised so that all groups with an interest in a particular standard would have a voice in its development. Moreover, the revised constitution required that three members at large be included on the association's board of directors in order to provide a greater voice for consumer interests.[58]

The broadening of ASA's mandate had only a marginal effect on its ability to serve as coordinator of all private sector standards activities. In February 1965, Francis L. LaQue, vice president of the International Nickel Co., issued a report on the state of the United States standards system, which had been undertaken at the request of Herbert Holloman, Assistant Secretary of Commerce for Science and Technology. According to the report, the principle standardization problem in the United States continued to be that of achieving legitimacy and coordination. The study noted that only 2,300 of the 13,675 nationally produced and used standards were designated as American standards through ASA. To overcome this problem, the report called for a national coordinating institution for voluntary standardization with international recognition such as that granted other national standards bodies. To assure such recognition, LaQue proposed that this institution have a Federal charter and that its standards be officially designated as U.S. standards.[59]

Hoping to gain such a charter, the ASA adopted anew constitution and bylaws and took on the name of the United States of America Standards Institute.(USASI). Characterizing itself as a federation of trade and other organizations, it redefined its mission. Among its purposes were to:

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54 Cochrane, Op. cit., footnote 16, p. 302.

55 Ibid., p. 304.

56 CRS, 1974, op. cit., footnote 37, p 13.

57 To meet the needs of the war, industry advisory committees were set up to serve as liaisons with government on matters concerning simplification and standards.

58 CRS, 1974, op. cit., footnote 37, p. 18.

59 Report of the Panel on Engineering and Commodity Standards of the Commerce Technical Advisory Bored. Francis L. LaQue, Chairman, 1965. Parts A and B.

- act as the national coordinating institution for voluntary standardization;
- assure that the interests of all concerned are included in the process;
- eliminate duplication and conflict;
- promote knowledge and use of voluntary standards;
- simplify the development of standards;
- encourage the development of standards in accordance with the Institute procedures;
- serve as a national clearing house; and
- provide the channel for U.S representation in the development of international standards recommendations.

Acting purely as a coordinating body, the Institute no longer intended to develop standards; rather it would orchestrate their development through the combined technical talent and expertise of its member bodies and certify that these standards development bodies adhered to the consensus process.[60]

The government and other members of the standards community resisted the effort of ASA to strengthen its role. A national charter was not forthcoming, and the FTC protested the use of the name USASI on the grounds that it suggested that ASA was an official organization of the Federal Government. A compromise was reached, and ASA became the American National Standards Institute (ANSI). Reporting on the state of the U.S. standards process several years later, the Stanford Research Institute (SRI) saw little hope for the future. The situation, according to SRI, was in fact deteriorating.

> There is little hope that the situation will improve in the next several years. In fact fragmentation is becoming worse. Up through the mid-1960s, a favorable solution appeared possible under the guise of the quasi-official American National Standards Institute (ANSI). . . . Reportedly, however, ANSI now has less support and less probability of succeeding as the nominal national voluntary standards coordinating agency than it did a decade ago.
>
> At the same time, other standards organizations are attempting to strengthen their individual positions, portending less opportunity for a coordinated effort. A leadership conflict exists and will probably persist for some time.[61]

The U.S. Standards Development Process as it Exists Today

Were Publius to observe the United States standards process today, he might well be pleased. American standards organizations continue to operate in a pluralistic framework. Almost half of all standards are set as part of a voluntary consensus process, in which all, or most of the key players—including government agencies—participate (see figure 2-l).

On the other hand, times have changed. The United States is no longer an isolated, homogeneous agricultural society where the greatest danger is rule by an oppressive majority. Quite the contrary. Among the dangers that the United States faces today is a loss of competitiveness, due partially to a failure at leadership in the international standards development process. Thus, like many reports on the U.S. standards process, Publius might be alarmed by the lack of leadership and failure to develop a national standards policy. However, leadership would require either that the private sector work cooperatively, or that the Federal Government assume a greater role. Ironically, neither remedy is likely, precisely because of the intensity of conflict that Publius prescribed.

Private Sector Standards Organizations

Within the U.S. standards community, there are approximately 400 organizations involved in standards development (see table 2-2). These groups are organized and function independently of one another, although they all arrive at decisions through a process of consensus, and provide some level of due process. All have mechanisms for participation, comment, and appeal.

There are five different types of private sector standards organizations. These include: trade associations, professional societies, general membership organizations, third-party certifiers, and consortia.[62]

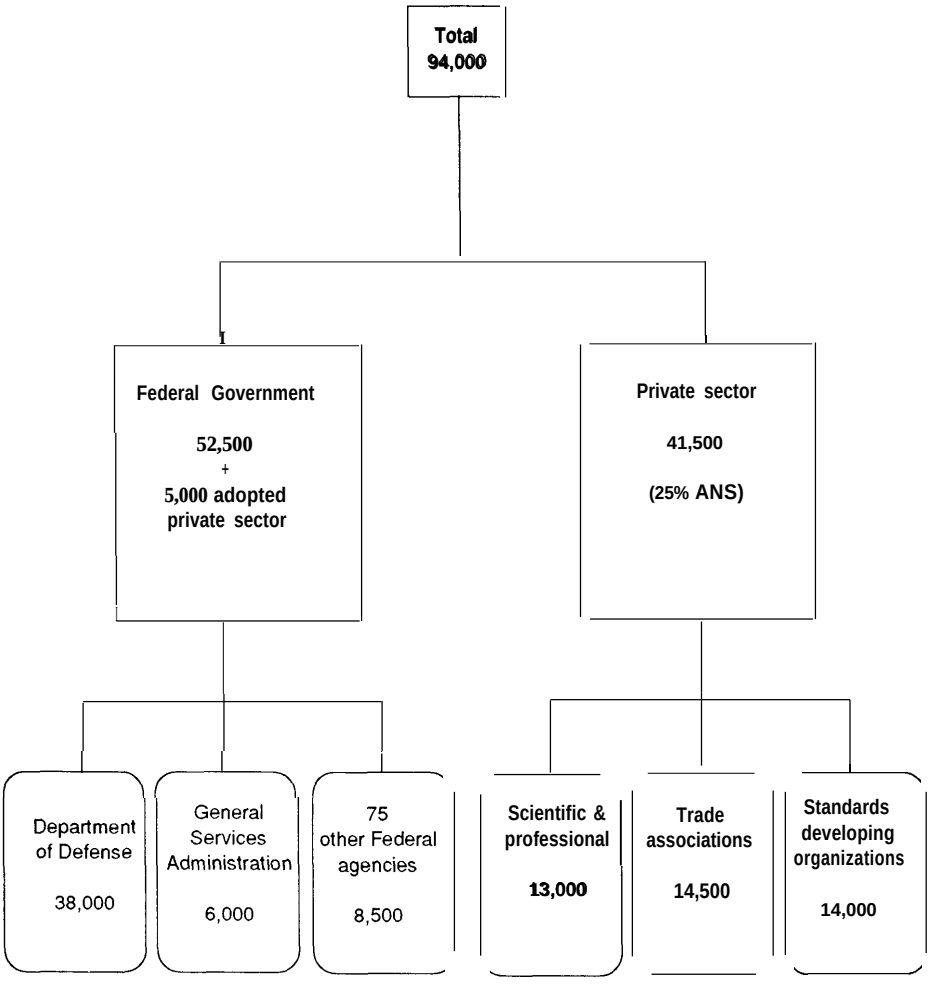
Trade associations are the most homogeneous, since they were most often created specifically to promote their industries' needs. Trade associations are also considered to be among the most exclusive standards bodies. Precisely for this reason, they are

60 CRS, 1974, op. cit., footnote 37, pp. *6-*7.

61 SRI, *Industrial Standards* (Menlo Park, CA: SRI, The Long Range Plannin g Service, 1971), p. 3.

62 Ross E. Cheit, *Setting Safety Standards: Regulation in the Public and Private Sectors* (Berkeley, CA: University of California Press, 1990), p. 150.

Figure 2-1—U.S. Standards



SOURCE: Robert Toth, Toth Associates.

also the most likely to replicate market forces. Although some trade associations sell standards, they are generally supported overall through membership dues. Thus, with funds already committed, participation tends to be high. Among the trade associations participating in standards development are, for example, the National Electrical Manufactures Association (NEMA), the American Petroleum Institute (API), and the Computer Business Equipment Manufacturers Association (CBEMA). Trade associations are also among the largest supporters of ANSI. This may be because ANSI buffers their activities from potential charges of anti-trust infringement.

Professional societies include organizations such as the American Society of Agricultural Engineers (ASAE), the American Society of Automotive Engineers (ASAE), and the Institute of Electrical and Electronics Engineers (IEEE). These societies are intended to advance theory and practice in a technical field, and thus have a strong engineering bent. Members participate as individuals, not as industry representatives. Not surprisingly, therefore, industry groups sometimes complain that professional society standards do not adequately represent market forces. To support their organizations, these societies often rely on the sale of standards, and thus they jealously guard their turf as they would a

Table 2-2—Twent y Major Nongovernment Standards Developers

	Number of standards
Aerospace Information Association	3,000
American Association of Cereal Chemists	370
American Association of State Highway& Transportation Officials	1,100
American Conference of Governmental Industrial Hygienists	700
American National Standards Institute	1,400
American Oil Chemists Society	365
American Petroleum Institute	880
American Railway Engineers Association	300
American Society of Mechanical Engineers	745
American Society for Testing and Materials	8,500
Association of American Railroads	1,350
Association of Official Analytical Chemists	1,900
Cosmetic, Toiletry & Fragrance Association	800
Electronic Industries Association	600
Institute of Electrical & Electronics Engineers	575
National Fire Protection Association	275
Society of Automotive Engineers	5,100
Technical Association of the Pulp and Paper Industry	270
Underwriters Laboratories	630
U.S. Pharmacopoeia	4,450

SOURCE: NIST Special Publication 806.

market. Some of the tensions within the standards communities relate to these standard sales.[63]

General membership organizations are the most broad based of all the standards development organizations. Included among them, for example, are the American Society of Testing Materials (ASTM) and the National Fire Protection Association (NFPA). These organizations pride themselves on their fair and open standards processes (see figure 2-2, and table 2-3). Efforts are made to assure that participants represent a variety of backgrounds and interests. Moreover, their procedures most closely approximate formal due process. The National Fire Protection Association, for example, has 32,000 members including among them architects, engineers, fireman, manufacturers, and representatives from the insurance industry, government, and labor. And final standards decisions are made in plenary session, with everyone voting. These organizations are heavily dependent on sales for their survival. Standards sales, for example, constitute 80 percent of ASTM's income and 66 percent of NFPA's.[64]

Third-party certifiers are independent organizations that test products to assure that they meet certain standards. Often these groups also write the standards to be certified. Manufacturers pay such labs to test their products for standards conformance. Third-party certifiers tend to have a strong engineering orientation, and they are among those who generally support the canvass method of standards development. These groups have a major stake in the outcome of European decisions about certification and testing. Underwriters Laboratories and the American Gas Association are examples of these kinds of standards organizations.

Consortia are not generally included among the traditional list of standards developers. These groups have emerged to deal with the rapidly developing information and communication technologies, and they are becoming increasingly popular. In the past year, consortia have been established, for example, to set standards for switched multimegabit data service (SMDS), Fiber Distributed Data Interface (FDDI) over twisted pair, asynchronous transfer mode (ATM), and frame relay technologies. They are generally exclusive groups who operate in a relatively closed environment, and thus questions may emerge in the future with respect to due process and the relationship of these groups to the rest of the standards community.

The Role of ANSI

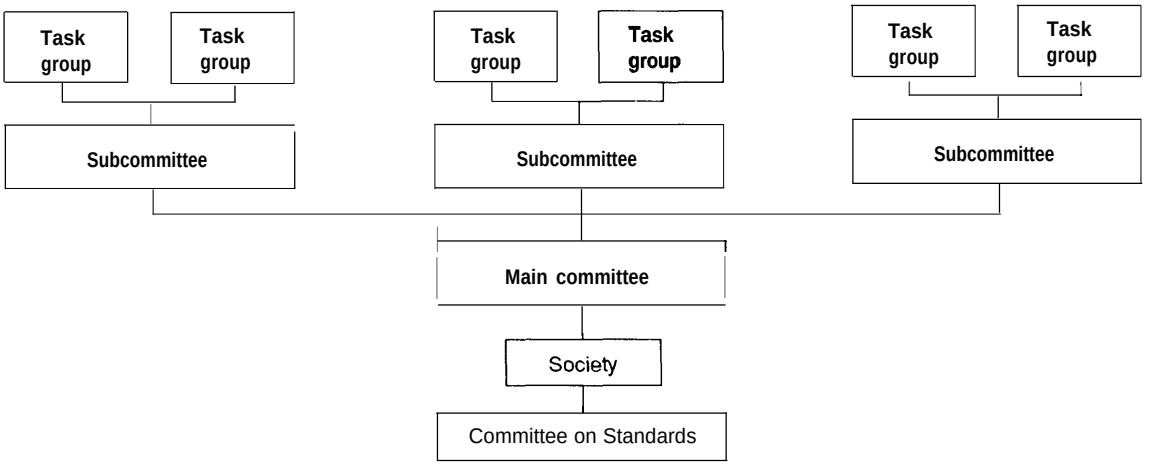
While functioning independently, many of these standards bodies coordinate their activities through the American National Standards Institute (ANSI). ANSI is a private, non-profit federation of standards organizations. Having no official charter, ANSI is in effect the ''self-designated" national coordinating body for U.S. standards development organizations as well as the internationally accepted member body in the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

Receiving the bulk of its financial support from private sector contributions (28 percent come from standards sales), ANSI's existence depends on its ability to continually meet the needs of its diverse membership. This has not always been easy, and

[63] Some claim, for ~.pie, that the present troubles between ASTM and ANSI can be traced back to an incident involving ASTM and IEEE. Allegedly, IEEE rushed to register a standard with ANSI that had actually been developed within ASTM. ANSI, it is said, was willing to oblige IEEE because it had a dispute of its own with ASTM. OTA interviews.

[64] Cheit, op. cit., footnote 64.

Figure 2-2—ASTM Consensus Process



SOURCE: American Society for Testing and Materials.

Table 2-3—Balloting Sequence and Requirements

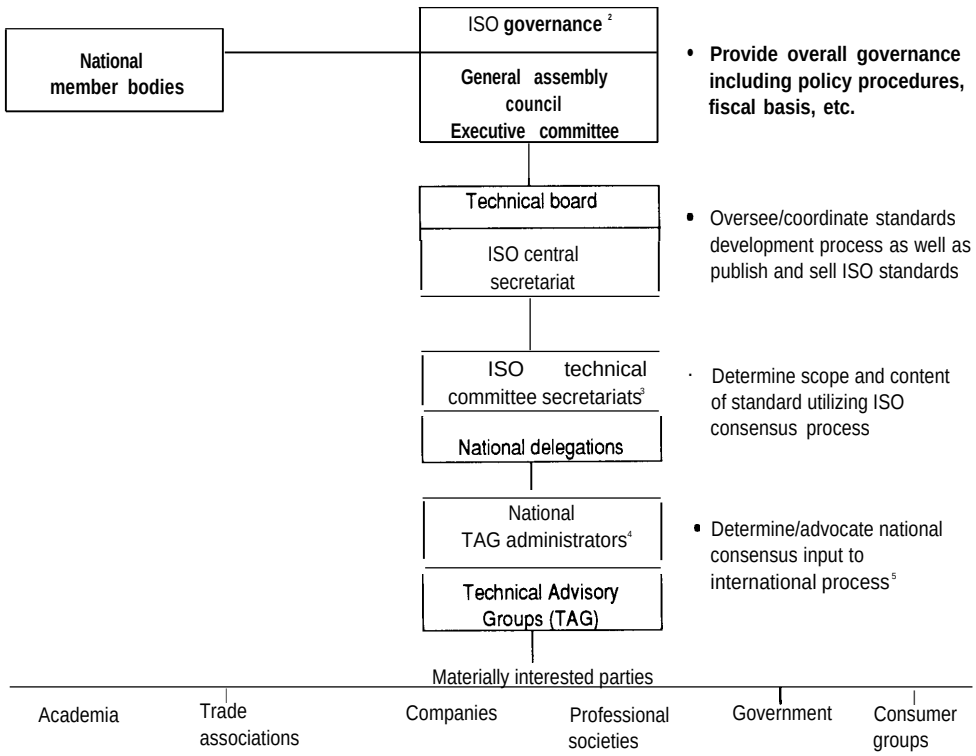
Level	To initiate	To complete successfully and proceed to next level
Task group study	No formal requirements	No formal requirements
Subcommittee ballot.	Subcommittee chairman approval or motion passed at subcommittee meeting At least 30 days between issue & closing date Cover letter explaining reasons for ballot	60% of ballots returned 2/3 affirmative votes (of total affirmative & negative votes cast on each item) All negative votes considered No negative votes are persuasive
Main committee.	Completed submittal form sent to headquarters with item All main committee ballots issued by headquarters	60% Of ballots returned 9/10 affirmative vote (of total affirmative & negative votes cast one each item) All negative votes considered All pink forms completed & returned to staff No negative votes are persuasive
Society ballot.	Staff submits items to society ballot after successful main committee ballot	All negative votes considered All green forms completed & returned to staff No negative votes are persuasive
Committee on..	Staff submits item to Committee on standards after successful society ballot	Committee on standards agrees that correct procedures were followed
Approval & publication. . . .		

SOURCE: American Society for Testing and Materials.

some of the major U.S. standards bodies—such as ASTM, ASME, and IEEE-have refused to defer to ANSI, and continue to act independent both domestically and internationally.

ANSI does not develop standards. Rather, it functions as a central clearing house and coordinating body for its member organizations, which develop standards on a decentralized, committee

Figure 2-3-Overview of ISO-ANSI Process



NOTES: 1 ANSI, AFNOR, BSI, DIN, JISC, SCC, ETC
2 **Includes ISO Secretary-General and Treasurer**
3 **Generally ISO national member body except in U.S. Typically delegated to TAG administrator**
4 **ANSI-** *Accredited* U.S. **administrators include: AAMI, ASME, ASTM, CBEMA, NEMA, etc.**
5 **In U.S. involves advancing either consensus standard or position as determined by TAG**

SOURCE: American National Standards Institute.

basis. Nor does ANSI make judgments about the substance of a standard. Instead, it certifies that these voluntary standards bodies have arrived at standards through one of three ANSI accredited procedures. Having met ANSI's approval, a standard is entitled to become an American National Standard. In 1988, the National Bureau of Standards (NBS)--now the National Institute of Standards (NIST)-estimated that approximately 8,500 standards, or 25 percent of all nongovernmental standards, have been processed through ANSI.[65]

As the member body of ISO and the manager of U.S. IEC activities, ANSI also coordinates the U.S. standards position in the international arena (see figure 2-3). ANSI is the only member body within these organizations that is not officially so designated, and one of the few that receives no financial support from its national government.

The Role of the Federal Government in Standards

The Federal Government does little to promote voluntary standards. Instead of orchestrating the U.S national standards setting process, the government has focused much of its efforts on the fairness and effectiveness of the standards development process.[66]

[65] Patrick Cooke, *A Review of U.S. participation i, International Standards Activities* (Washington, DC: U.S. Department of Commerce, National Bureau of Standards, 1988), p. 17.

66 The U.S. Government has, however, traditionally set procurement specification for all its purchases. Thus, the Department of Defense and the General Security Administration account for a major portion of all government standards. However, both agencies are moving towards greater reliance on voluntary standards.

This preference for voluntary consensus standards was reaffirmed in the 1979 Trade Act, which formally recognizes the private sector's role in standard development, and in the Office of Management and Budget (OMB) Circular A-119, which directs Federal agencies to use voluntary standards wherever possible in both regulatory and procurement activities. In both instances, however, the Federal Government retains the right to assume a greater role when necessary.[67]

The Consumer Movement and the Rise of Regulatory Standards

The Federal Government's interest in standards was rekindled in the late '60s and early '70s in response to consumer concerns about safety and anti-trust matters. Ralph Nader frost raised the issue in 1965, when he published *Unsafe at Any Speed,* which severely criticized automobile standards as they had been developed by the Society for Automotive Engineers. Other horror stories about the standards system abounded. Testifying some years later on the Voluntary Standards Accreditation Act, Nader summarized consumers' concerns about the standards process.

> . . .Trade product standards often harm consumers. The history of standards is strewn with abuses: standards essentially written by large corporations to exclude competitors from the marketplace, standards that misrepresent hazardous products as safe, standards that boost sales while benefiting only the producer, and standards designed to head off tough government safety requirements rather than protect the public.[68]

Congress was quick to react. In 1967 it set up a National Commission on Product Safety to analyze the effectiveness of consumer product standards. After reviewing more than 1,000 standards, the Commission concluded that the system was 'chronically inadequate both in scope and permissible levels of risk."[69] Moreover, it suggested that the voluntary sector process was unable to produce adequate standards, given the dominant role of industry .70 This attitude was reflected in much of the health and safety legislation that followed, which often made special provision for standards.[71] It was also the basis on which Senator James Abourezk, in March 1975, and again in 1977, introduced the Voluntary Standards and Accreditation Act (S.825) designed to give the Federal Government considerable control over the voluntary standards system.[72]

Responding to consumer concerns and allegations of antitrust infringements and unfairness, the Federal Trade Commission also undertook a major investigation of the U.S. standards system. After extensive hearings, at which over 200 people testified, it too concluded that the entire standards process should be regulated. It proposed a rule that would require standard setters to meet a substantive "fairness," criterion.[73]

Another outcome of this period was a major increase in the number of Federal Agencies issuing standards. From the late '60s until the early '70s a

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67 OMB Circular A-119 and the 1979 Trade Act.

68 Ralph Nadar, Testimony on the *Voluntary Standards Accreditation Act, Hearings on S825, Before the Subcommittee on Antitrust and Monopoly of the Senate Committee on the Judiciary,* 1st Sess. *1977.*

69 National Commission of Product Safety, Final Report of the National Commission of Product Safety, June 1970, as cited in Robert Hamilton, "The Role of Nongovernmental Standards in the Development of Mandatory Standards Affecting Safety and Health," *Texas* Law *Review,* vol. 56, No. 8, November 1978, p. 1372.

70 Ibid. It should be noted that ANSI created the Consumer Council in 1967 in response to these criticisms, This Council reviews all consumer related standards prior to their acceptance by ANSI.

71 For example, as Hamilton notes:

> . . .the Federal Energy Authorization of 1977 required that the Administrator consult with the Attorney General and Chairman of the FTC "concerning the impact of such standards on competition," before adopting a voluntary standard, and state in the public notice that the organizations that promulgated the standard meet a number of requirements.

Ibid.

72 This legislation, which was strongly opposed by ANSI, would have established a National Standards Management Bead that would essentially take over ANSI's role. The Board would have had the responsibility for manag-ing and coordinating the voluntary standards pro- gram, including the accreditation of standards devel-opment organizations and the listing and approving of "national standards." The FTC would be author- ized to consider appeals and order revision in standards when necessary. Some members of the voluntary sector, such as NFPA, supported the bill, with modifications. Ibid, p. 1438.

73 See U.S. Federal Trade Commission, Standards and Certification: Proposed Rule and Staff Report (December 1978). These conclusions Were very controversial, however. Under a new administration, the FTC reversed its course. Viewing due process less comprehensive, it decided to enforce standards infringements of antitrust law on a case-by-case basis. See 'Memorandum to the Federal Trade Commission from Amanda B. Pedersen, Aug. 29, 1985.

Table 2-4-Legislation: Creating the Need for Government Standards

Safe Drinking Water Act of 1974 (Public Law 93-523)
Child Protection and Toy Safety Act of 1969 (P.L. 91-1 13)
Lead-Base Paint Poisoning Prevention Act of 1970 (P.L. 91-695)
Consumer Product Safety Act of 1972 (P.L. 92-573)
Mobile Home Construction and Safety Standards, Title VI of the Housing and Community Development Act of 1974 (P.L. 93-383)
Traffic and Motor Vehicle Safety Amendments of 1970 (P.L. 91-265)
Highway Safety Act of 1970, Title II, Sec. 202 of Federal-Aid Highway Act of 1970 (P.L. 91 -605)
National Environmental Policy Act of 1969 (P.L. 91-190)
Resource Recovery Act of 1970(P.L.91-512)
Clean Air Amendments of 1970 (P.L. 91-604)
Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500)
Federal Environmental Pesticide Control Act of 1972 (P.L. 92-51 6)
Federal Energy Administration Act of 1974 (P.L. 93-275)
Solar Heating and Cooling Demonstration Act of 1974 (P.L. 93-409)
Medical Devices Amendments Act of 1975 (P.L. 94-295)
Occupational Safety and Health Act of 1970 (P.L. 91-596)
Toxic Substances Control Act of 1976 (P.L. 94-469)

SOURCE: William T. Cavanaugh, "Needed: A National Standards Policy," *ASTM Standardization News, vol. 5, No. 6,* June 1977, p. 13.

rash of environmental, health, and safety legislation was passed, and agencies were created to administer these laws (see table 2-4). Included among these, for example, were the Consumer Product Safety Commission (CPSC), the Environmental Protection Agency (EPA), and the Occupational, Safety and Health Administration (OSHA). Whereas private sector standards bodies adhere to a consensus process in developing standards, government regulatory agencies must comply with the Administrative Procedure Act, which provides for both formal and informal rulemaking.[74] These agencies vary considerably in their size and resources (see table 2-5). The number of standards that they set is small in comparison to the number of overall national standards, and many of them now use standards developed by private sector organizations .75

A National Standards Policy - OMB Circular A-119

Responding to repeated appeals for a national standards policy, OMB in 1976 proposed a draft circular that called for the incorporation of voluntary standards by reference. Noting that the voluntary standards process had been greatly improved, it required agencies to use commercial standards whenever possible, and to identify commercial standards when they were used. Comments on the circular were mixed, with some agencies being more responsive than others. A revised circular was issued in 1977 to incorporate many of the concerns that had been expressed. This circular distinguished between procurement and regulatory standards, and estab-

Table 2-5—Selected Features of Six Public Agencies Involved in Safety Regulation, 1988

Agency	Founding date	Budget [a]	Staff [b]
Consumer Product Safety Commission (PSC).. . .	1972	$32,696	459
Environmental Protection Agency (EPA)	1970	4,968,429	11,127
Federal Aviation Administration (FAA).	1958	2,367,778	46,811
Federal Drug Administration (FDA).	1906	483,066	7,032
National Highway Traffic Safety Administration (NHTSA).	1970	62,534	503
Occupational Safety and Health Administration (OSHA).	1970	235,474	2,532

[a]Appopriated funds only; does not include highway or airport trustfunds.
[b]Full-time staff only.

SOURCE: *Federal Budget, 1988* (Washington, DC: Government Printing Office, 1988).

74 See, for a discussion, Richard B. Steward, "The Reformation of American Administrative Law," *HarvardLaw Review,* vol. 88, No. 8, June 1975, pp. 1667-1813.

75 Ross Cheit, op. cit., footnote 62, p. 30.

lished a number of procedural due process requirements, many of which were drawn from S.825.[76] The revised circular was controversial, and opposed by many voluntary standards organization, including ANSI. A final version of Circular, OMB A-119 was adopted in 1982. Now, with the due process requirements eliminated, OMB Circular A-119 is strongly supported by the private sector.[77]

Coordinating the Federal Role

OMB Circular A-119 also provides a mechanism for coordinating the Federal role in standards policy. In accordance with the circular, the Department of Commerce (DOC) set up an interagency consultative mechanism to advise the Secretary and agency heads in implementing Federal standards policy (as defined in the Circular). Its mission is to coordinate agency views and to develop, where possible, a single, unified position. DOC assigned this task to the Interagency Committee on Standards,[78] which operates under the direction of NIST Policy .79 Overall oversight rests with OMB, and the committee is required to report back to it on a triennial basis.[80]

While active during its first year, this interagency committee has reportedly not met for the last year and a half.[81] Meetings focused on implementing the Federal policy to encourage agency use of voluntary standards, as directed in its mandate. The committee also set standards for agency participation in voluntary standards bodies and laid out guidelines for public sector use of private certification bodies. Participants claim, however, that scant attention was devoted to evaluating existing policy or finding ways to improve it.[82] Nor was there much effort to identify future standards issues or to view them strategically as part of the industrial infrastructure.[83] Some members claim that the group is not a useful mechanism for sharing information or coordinating interagency issues. One person noted with some irony that his chance of interacting with agency counterparts was better at private sector meetings of ANSI's Government Member Council.[84]

Some of the problems faced by the Interagency Committee on Standards Policy stem from its organizational form. Interagency committees have a poor record of policy coordination.[85] Among the problems associated with them are that they tend to:

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76 As described by Hamilton:

> The due process and other basic criteria include not only the traditional procedural requirements of fairness, openness and balance, but also require standards organizations to give preference to the use of performance criteria rather than design, materials or constructive criteria, to accept a mediation or conciliation service provided by the Department of Commerce. . . and to include a statement, in all literature they publish that participation by government officials in that organization does not constitute government endorsement.

The Department of Commerce was to police these requirements, and publish a list of the standards bodies tbat complied with them. Hamilton, op. cit., footnote 69, p. 1442.

77 See, Memorandum to Heads of Executive Departments and Agencies, from David Stockman, regarding OMB Circular No. A-119, "Federal Participation in the Development and Use of Voluntary Standards," Oct. 26, 1982. For an evaluation of its effectiveness in promoting the use of private sector standards, see Steve Spivack, *Implementation of OMB Circular A-119: An Inde- pendent Appraisal of Federal Participation in the Development and Use of Voluntary Standards*, (Washington, DC: U.S. Department of Commerce, March 1985).

78 The ICSP was established in 1985 to coordinate Federal Agency Standards Policy.

79 The Committee's Charter goes further than OMB Circular A-119 in calling for interagency consideration of standards policy.

80 OMB Circular A-119.

81 It should be noted that some subcommittees met more frequently. The Commerce mandate establishing the committee requires that a meeting be held at least once a year.

82 Personal communications with members of the Committee. All requested anonymity. Annual report to Secretary of Commerce cited and tracked progress of agencies in using voluntary standards. But the analysis provided with the data is minimal.

83 The Charter of the Interagency Committee on Standards Policy, developed by commerce, is much broader than the OMB Circular. However, overall support for the Committee was not sufficient to support this broader mandate. John Donaldson of NIST suggests that the problem was circular. Because the OMB mandate was narrow, people at higher, policy levels didn't get involved. Without their involvement, however, it was impossible to expand the Committee's mandate. John Donaldson, NIST, personal communication.

84 Personal communications with member of the Committee, who requested anonymity.

85 Characterizing this form of arrangement, Harold Seidman notes, for example:

> "Interagency committees are the crabgrass in the garden of government institutions. Nobody wants them, but everybody has them, Committees seem to thrive on scorn and ridicule, and multiply so rapidly that attempts to weed them out appear futile." But, as Seidman is quick to add: "The harshest critics have yet been unable to devise satisfactory substitutes.'

Harold Seidman, *Politics, Position, and Power: The Dynamics of Federal Organization (New* York, NY: Oxford University Press, 3rd. cd., 1980), p. 207.

- bury problems rather than resolve them;
- make it difficult to get tasks accomplished because too many people with only a peripheral interest become involved;
- dilute interest in, and commitment to, addressing a problem; and
- lead to outcomes based more on the distribution of power within a committee than on policy considerations .86

Such problems are clearly reflected in the Interagency Committee on Standards Policy.

The Office of Management and Budget (OMB) reviews the work of the Interagency Committee on Standards Policy on a triennial basis. Although OMB is the ultimate coordinating mechanism in the Federal Government, it can do little more than establish a policy directive. There is little staff support in the area of standards.[87] The Deputy Director of the Office of Federal Procurement Policy is in charge of overseeing Circular A-119. However, there is no one person at OMB who focuses explicitly on standards.[88]

The Trade Act of 1979

The Trade Act of 1979 requires the Secretaries of Commerce and Agriculture to monitor the standards process to assure that United States interests are adequately represented. It provides no guidelines, however, to determine what is required for adequate representation. The Associate Director for Industry and Standards within NIST is assigned responsibility for carrying out the functions specified in the Act.

An interagency task force has also been set up under the auspices of the Office of the U.S. Trade Representative (USTR) in conjunction with the Act. Although somewhat more active than the NIST Interagency Committee on Standards Policy, its focus is more limited. Agency members meet when necessary to try to reconcile trade and other agency policies.[89] The committee is not meant to be a forward looking group, or to consider standards in strategic terms. Like the Office of the USTR, it tends to be reactive on standards issues, responding only when the need arises.

Federal Support for the Voluntary Standards Process

Currently, the Federal Government does very little to promote the development of voluntary standards. Whereas in its early years the National Bureau of Standards organized business groups to convene for discussions of standards issues,[90] NIST has only limited outreach and/or educational programs except for the publications of standards directories and reports. Business concerns about standards are generally channeled to the Federal Government through the Interagency Federal Advisory Committee (IFAC),[91] but there is no information flowing in the opposite direction. Although government agencies, such as the Office of the International Trade Administration (ITA), or the United States Trade Representative (USTR) [92], respond to business queries and concerns about standards, they make little effort to educate businesses as to the value and use of standards in trade.[93] Even within the Small Business Administration there is no standards education or awareness program. The most elaborate promotional event in

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86 Ibid.

87 Ron C. Moe, "The Hud Scandal and the Case for an Office of Federal Management," *Public Administration Re- view,* vol. 511, July/Aug. 1991, pp. 298-307.

88 David Gold, OMB, personal communications.

89 Susan Troje, USTR, personal communication.

90 Cochrane, op. cit., footnote 16.

91 The Industry Functional Advisory Committee o, Standards fo, Trade and Policy Matters was established on Mm. 21, 1979, and extended on Mar. 11, 1982, Mar. 6, 1984, Mar. 7, 1986, and Mar. 8, 1988, by the Secretary of Commerce and the United States Trade Representative pursuant to the authority delegated under Executive Order 11846 of Mar. 27, 1975. The Committee consists of approximately 40 members, with approximately 20 members from the Industry Sector Advisory CommitteeS and approximately 20 from such private-sector areas as to provide expertise on the subject of standards.

92 The USTR coordinates trade policy between the President, Congress, and the private sector. It manages the private sector advisory system, consults regularly with Congress, and chairs the interagency committees which develop trade policy with the Executive Branch. 199T*rade Policy Agenda and 1990 Annual Report of the President of the United States on the Trade Agreements Program,* (Washington, DC: USTR, 1991), p. 103.

93 Don Mackay, National Association of Engineers, and Bob Toth, Toth Associates, personal communications.

which the government is involved is National Standards Week.[94]

Apart from the membership dues paid by Federal agencies to standards bodies, the U.S. Government provides almost no funds for private-sector standards development. Even the recently established NIST program, aimed at promoting trade through standardization in developing countries, depends heavily on business contributions.

~ Although S.J. Res. 291 would have designated the week Oct. 14, 1990 as "National Standards Week, " it failed to pass. Personal communication, Don Mackay, National Association of Engineers.

Chapter 3

Standards Setting in Comparative Perspective: The European Experience

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Chapter 3

Standards Setting in Comparative Perspective: The European Experience

Introduction

Dissatisfaction with the U.S. standards setting process has led to several reports and recommendations, but little action. Failure to respond is partially due to the way the standards debate is posed. The issues are polarized, and the solutions cast in all or nothing terms. One side argues that the U.S. standards system works fine and should remain in private sector hands. The other contends that it's failing and should be taken over by government. No hybrid solutions, which call for sharing responsibility between government and the private sector, are proposed.[1]

Looking comparatively at the systems in other countries, however, it is clear that there are a variety of ways to organize standards processes, with government playing a greater role in some and a lesser role in others. The case of Europe is particularly illustrative. Although European countries share much in common, each approaches standards development somewhat differently, reflecting their differences in history and culture. Their collective experiences provides diverse options that have not been considered by U. S. policymakers. The European experience is also revealing, because standards organizations in all these counties are, themselves, reevaluating their own strengths and weaknesses in the light of European economic integration.

Nation by Nation Comparisons; Germany, France, and The United Kingdom

As in the United States, the move towards simplification and standardization accelerated after the First World War. While there was only one standards organization in Europe before the war—the British Engineering Standards Association—by 1928 there were 16.[2] Advancing technology and the demand for interoperable parts drove the need for standardization, paralleling experience in the United States. Europeans also adopted the consensus approach, with standards evolving through negotiations among interested parties in an open process of give and take.[3]

However, in contrast to the United States, where the market was large enough to sustain mass production, Europeans were dependent on intercountry trade for large-scale production. From the beginning, therefore, European standards organizations were viewed as part of the industrial infrastructure, and European standards organizations geared their operations towards trade promotion. Moreover, European governments generally pursued active industrial policies, and thus they played a greater role in standards development than was typical in the United States. But the relationship between government and the private sector, and the extent of government involvement in standards, differed from

[1] This phenomenon is not limited to the area of standards. As Peter Katzenstein notes:

> **But America's national debate on industrial policy betrays the strength of a liberal ideology. We conceive of the political alternatives that confront us as polar opposites: market or plan. The biases of our ideology are reinforced by a veritable national obsession with Japan, a country that American businessmen in particular view as a statist antidote to America's ideological celebration of market competition.**
>
> **Our political debate typically pits the proponents of government against the advocates of market competition. Fundamentally, the debate concerns the character of state involvement in the economy.**

Peter Katzenstein, Small *States in World Markets: Industrial Policy in Europe* (Ithaca, *NY:* Cornell University Press, 1985.), p. 19.

[2] Victor S. Karabasz, "Simp~lcationand Standardization in Europe," *Notes from* the Annuls: *Standards in Industry* (New York, NY: The American Academy of Political and Social Science, 1928), p. 25.

[3] Florence Nicolas, with the cooperation of Jacques Repussard, *Common Standards for Enterprises.* (Luxembourg: *office* of Official Publications for the European Community, 1988).

country to country. European national standards organizations can be differentiated according to the following characteristics (see table 3-l).

- types of financial support-e. g., voluntary contributions from industry, sale of standards and standards related services, and public subsidies;
- degree of centralization;
- dependency on the public sector; and
- size of standards organization and scope of activities.

Germany

German standardization is based on a corporatist approach to government-industry relations.[5] In contrast to the United States, where there is no agreed on national standards policy, in Germany, standards are intended to serve the public good.[6] Moreover, German national standards policy is neither formulated through competition among standards development organizations, nor imposed by government.[7] Rather, German standards policies evolve through negotiations among economic interests and other key interest groups in society. However, in contrast to the United States where such groups participate in an ad hoc fashion, in Germany they are organized nationally through peak associations.[8] German standardization efforts are similarly centralized, operating through a nationally recognized standards organization, the Deutsche Institute für Normung e.V. (DIN).

This pattern of German standardization was set in May 1917 with the establishment of the Normalienausschus für den Maschinenbau. Although originally focused on machine parts, this standards body rapidly expanded its activities to other industries. Six months after its inception, its name was changed to the Normenausschuss der Deutschen Industries to reflect its broader mission. Like other national standards organizations that emerged at the same time, the Normenausschuss operated on a committee basis, with all parties represented and each free to comment on draft standards. It received some funding from the Reichs Kuratorium für Wirtschaftlichkeit, an industry association that was itself supported by government grants. Additional financing came from technical societies, trade associations, government departments, and contributing indus-

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[4] **Ibid., p. 26.**

[5] According to Katzenstein:

> **Democratic corporatism is distinguished by three traits: an ideology of social partnership expressed at the national level; a relatively centralized and concentrated system of interest groups; and voluntary and informal coordination of conflicting objectives through continuous political bargaining between interest groups, state bureaucracies and political parties. These traits make for low-voltage politics.**

Peter Katzenstein, op. cit, footnote 1, p. 32.

For general discussions of German politics and industrial policy, see, W. Streeck, *Industrial Relations in West Germany* (London: Heinemann, 1984); See also K. Dyson, "West Germany: The Search for a Rationalist Consensus," J. Richardson (cd.), *Policy Styles in Western Europe* (London: Allen & Unwin, 1982).

[6] This is typical of German **government-industry relations in general. As described by Paterson and Whitston:**

> **. . .there appears to be in the German case a sense of organic unity, a commitment to action in the national interest which extends the interests of individuals or particular groups. The importance of this orientation is that it allows the state to facilitate action by other actors which promotes the achievement of long term national goals.**

William Paterson and Colin Whitston, "Government-Industry Relations in the chemical Industry: An Anglo-German Comparison," Stephen Wilks and Maurice Wright (eds.), *Comparative Government-Industry Relations* (Oxford: Clarendon Press, 1987), p. 38.

[7] As described by Paterson and Whitston:

> **. . .the State in the Federal Republic acts in a variety of ways as a supporting, facilitating, encouraging force in the formation and preservation of broad, encompassing, internally heterogeneous interest organizations. Ironically, but hardly unintended, the interventionist policy of the German state on the organizational forms of social interests enables it in many cases to abstain from direct economic intervention since it provides interest groups with a capacity to find viable solutions between and for themselves.**

Ibid.

[8] As noted by Anheir:

> ***The* organization of trade and industry is one of the major aspects of Germany's centralized society. All firms are represented by three types of associations; industrial business associations, employers' associations, and chambers of commerce and industry. A key characteristic of the West German landscape of economic organimations is the grouping of decentralized constituencies into more central units to form "peak associations. "**
>
> **. . .Together economic associations (Wirtschaftsverbande) provide the prototypical example of liberal corporatism.**

Helmut K. Anheir, "West Germany: The Ambiguities of Peak Associations," Robert Wuthnow (cd.), *Between States and Markets: The Voluntary Sector in Comparative Perspective* (Princeton NJ: Princeton University Press, 1991), pp. 68-71; See also, Peter J. Katzenstein, *Policy and Politics in West Germany: The Growth of the Semisovereign State* (Philadelphia, PA: Temple University Press, 1987); and Peter J. Katzenstein (cd.), *Industry and Politics in West Germany: Toward the Third Republic* (Ithaca, NY: Cornell University Press, 1989).

Table 3-l—Comparative Table of Some European Standards Institutions
(the figures are taken from ISO and Cen documents and refer mainly to 1986)

Country	Standards institution	Status[a]	Staff	Number of pages of standards	Annual output of standards	CEN secretariat (out of 82 technical committees) (1987 figures)
Germany (FR)....	DIN	2	596	120,000 (25,700)	1,400	34
Denmark.	DS	1	65	15,000 (2,355)	250	6
Spain.	Aenor	1	70	78,200 (6,589)	850	0
France.	Afnor	1	446	138,344 (13,366)	1,100	17
Italy.	UNI	1	48	30,000 (6,41 1)	270	3
Netherlands.	NNI	2	100	55,000 (5,500)	110	2
United Kingdom..	BSI	1	1 ,200[b]	125,000 (9,360)	660	10

[a]Status: 1. Organization under private law but given a public service function by the State.
2. Private organizations.
[b]About half the staff is engaged on testing laboratory and certification work.
[c]The approximate number of standards is given in brackets.
[d]Order of magnitude.

SOURCE: Florence Nicolas, with the cooperation of Jacques Repussard, *Common Standards for Enterprises* (Luxembourg: Official Publications for the European Communities, 1988), p. 26.

trial firms.[9] German standards were well respected in Europe, and the Deutscher Normenasschuss was very productive. With both large and medium firms actively participating, it produced more than 2,100 standards in its first 10 years.[10]

DIN plays a similar role in Germany today. DIN is a consensus organization with a central administration that manages the administrative and financial activities of DIN as well as the various committees that actually develop standards. These committees are comprised of representatives from producer groups, the academic community, user groups and organizations (including consumer advocate groups), government, and trade unions.[11] The general membership, made up of all these groups, elects a president who appoints the director of DIN. As in most consensus processes, the standards go through a period of review and comment before they are formally adopted. In Germany, an additional step is followed: once agreed on, but before they are officially released, standards are reviewed by the Standards Examination Office to assure that there are no overlaps. There are 8 basic principles that govern DIN's operations:[12]

1. voluntarism: standards are recommended, not imposed;
2. publicness: standards processes are open;
3. participation of all interested parties;
4. unity and consistency: standards form a unified whole;
5. keeping to the point: standards transcribe the state of the art;
6. geared to economic factors: market factors are taken into account;
7. geared to benefit the community as a whole; and
8. internationalism: focus on trade.

In contrast to the United States where standards organizations are often taken for granted, DIN is an important presence in Germany. DIN employs over

[9] Associations of trade and businesses have a long history in Germany, going back to the guildlike craft societies of the Middle Ages. Such associations continue to provide the basis for interest group representation in the public sector. Anheir, op. cit., footnote 7.

[10] Karabasz, op. cit., footnote 2, p. 28.

[11] Carl Cargill, *Information Technology Standardization: Theory, Process, and Organizations* (Boston, MA: Digital Press, 1989), pp. 190-191.

[12] Dr. Helmut Reihlen, Director of DIN, speech to the General Meeting of the 1991 German Foundry Convention Berlin, June 21, 1991: See also DIN, *One World, Free Trade, Free Standards* (Berlin: Deutsche Institute für Normung, rid.).

900 people, and has offices in 40 locations nationwide. Many Germans are aware of the importance of standards, and knowledgeable about DIN's role in their development. Moreover, the Germans have an excellent reputation for standards development, so many other European countries look to Germany for standards. [13]

One reason for DIN's prominence is its formal status. In 1975, the government of Germany signed a contract with DIN, designating it as the national standards organization of Germany and the official representative of Germany in international standards organizations. Because DIN has a monopoly on standards development and standard sales, the national resources available for standardization can be utilized to the fullest. In exchange for the government's political and financial support, DIN "undertakes to consider the public interest in all of its work in the preparation of standards, " and "to give preferential treatment to requests from the Federal Government to carry out work on standards projects which the Federal Government considers of public interest. " Although DIN standards are voluntary, they too have a special status, serving as the basis for regulatory law.

DIN also has strong support from the business community. Because German business is well organized, participation in standards development also tends to be high.[14] Moreover, businesses have a strong incentive to adopt DIN standards, since the use of DIN standards shifts liability to the user, and insurance companies often refuse to grant policies to those whose products fail to carry the DIN testing and inspection marks .15 German businesses also benefit from DIN's export oriented policies.

Because trade is essential to the German economy, DIN is very active in international standards development. DIN members hold the secretariat of 15 percent of all International Organization for Standardization (ISO) and IEC technical committees and subcommittees, and 40 percent of those in Comité Européen de Normalisation and Comité Européen de Normalisation Electrotéchnique (CENLEC). Moreover, the resources devoted to international and regional standardization have been steadily on the rise (see figure 3-l). DIN is able to make this commitment to international standards in part because of the support it receives from the German government. In addition to the income that DIN receives from members dues, standards sales, and related activities, DIN also receives a subsidy from the public sector, which constitutes approximately 15 percent of its total budget (see figure 3-2). These funds are generally targeted to activities that promote industry, increase competitiveness, or that protect against the risks of technology.[16]

France

Standardization in France also reflects French political culture and the way in which authority has traditionally been divided between the state and the private sector. Whereas in the United States, standardization bodies took advantage of the penchant for voluntary associations, in France the opposite was the case. From the time of the French Revolution, voluntary associations in France were looked on, not as the basis for a democratic order, but rather as narrow interests impeding public welfare and the good of the nation, which it was believed could only be embodied in the state.[17] This perspective can be clearly seen, for example, in a speech made to the

13 As described to OTA staff in Sweden, 'We are a small country dependent upon trade, so why not let the Germans— who do an outstanding job-set the standards for us." Or, as one member of the French standards community noted, "The French are individualists; they can't make good standards. We are happy to use German standards. Setting standards comes naturally to them."

14 As noted by Anheim:

> For most fins, joining business and interest groups is both necessary and useful. The size distribution of West German Industries shows that the great majority have between 2 and 20 employees. Only 891 of 360,463 manufacturing firms have more than 1,000 employees, and about 1,200 employ between 500 and 999 people. They are in a weak bargaining position vis à vis political authorities unless they join together.

Anheim, op. cit., footnote 7.

15 Cargill, op. cit., footnote 10, p. 191.

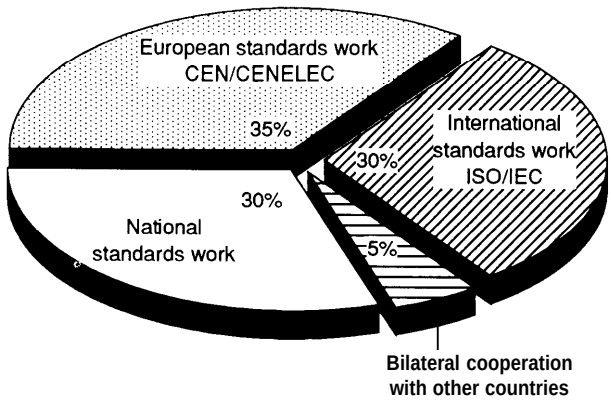
16 Reihlen, op. cit., footnote 11.

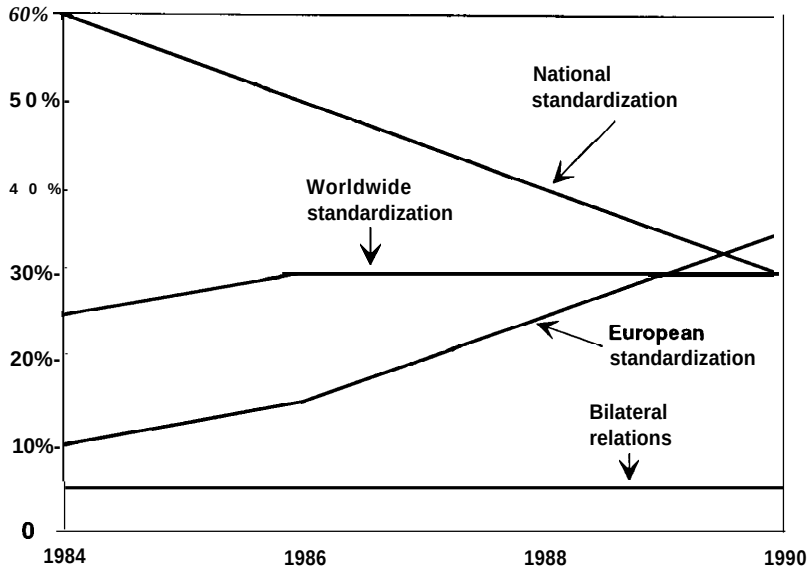
17 As described by Veugelers and Lament:

> During the Revolution the state pursued a persistent struggle against bodies such as guilds, the nobility, and political clubs, which stood between the citizen and the republic. Since then both the Left and the Right have at various times viewed with suspicion the church, voluntary associations, decentralization, and ethnic pluralism.

Jack Veugelers and Michele Lament, "France: Alternative Locations for Public Debate." Robert Wuthnow (cd.), *Between States and Markets.' The Voluntary Sector in Comparative Perspective* (Princeton, NJ: Princeton University Press, 1991), p. 140.

Figure 3-l—Resources Devoted by Deutsche Institute fur Normung (DIN)





Resources devoted by DIN to the various levels of standardization in percent of total budget.

KEY: DIN=European Committee for Standardization; CENELEG=European Committee for Electrotechnical Standardization; IEC=International Electrotechnical Commission; ISO=International Organization for Standardization

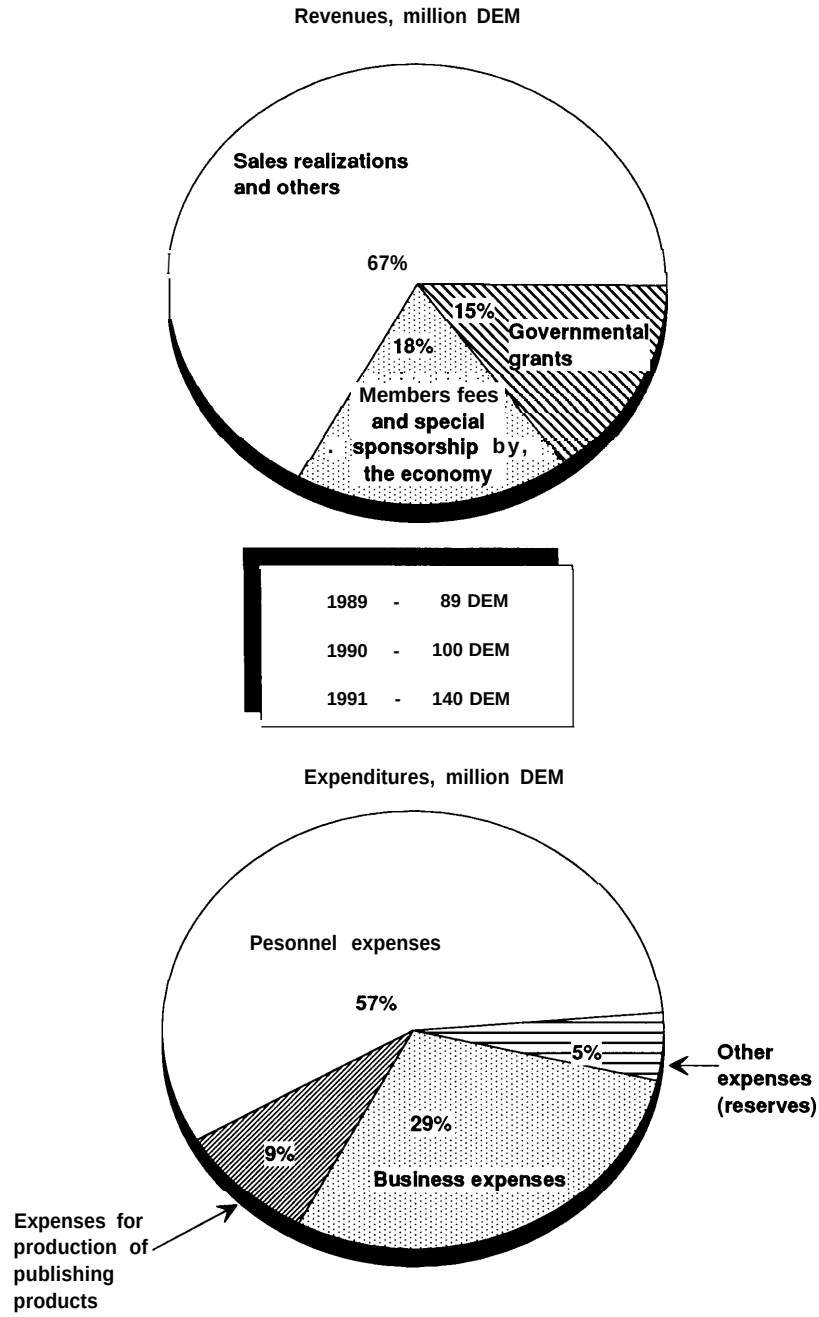
SOURCE: Deutsche Institute fur Normung, 1991.

French Constituent Assembly in 1791 that called for an end to all voluntary associations:

> It should not be permissible for citizens of certain occupations to meet together in defense of their pretended common interests. There must be no more guilds in the state but only the individual interest of each citizen and the general interest. No one shall be allowed to arouse in any citizen any kind of intermediate interests and to separate him from the public weal through the medium of corporate interests.[18]

[18] Reinhard Bendix, *Kings or People: Power and the Mandate to Rule* (Berkeley and Los Angeles: University of California Press, 1978), p. 372.

Figure 3-2-Budget of Deutsche Institute fur Normung (DIN)



SOURCE: Deutsche Institute fur Normung, 1991.

Mirroring the dominant role ascribed to the state in French politics,[19] standardization in France emerged at the national level, with one stroke, from a Presidential decree. The first standards organization, the Association Francaise de Normalisation (AFNOR), was founded on June 10, 1918. Unlike the national

[19] For discussions, see J. Hayward, "Mobilization of private interests in the service of public ambitions: the salient element in the dual French policy style," J. Richardson (cd.), *Policy Styles in Western Europe* (London: Allen& Unwin, 1982); See also J. Hayward, *Governing France: The One and Indivisible Republic* (London: Weidenfeld & Nicolson, 1983); and D. Green, "Strategic management and the state:France," K. Dyson and S. Wilks (eds.), *Industrial Crisis: A Comparative Study of the State and Industry* (Oxford: Martin Robertson, 1983).

standards bodies in Germany and the United Kingdom, which were private sector organizations, the Association Française de Normalisation was attached directly to the Ministries of Commerce, War, Naval Affairs, Public Works, and Labor. Included among its members were the Academy of Science, the Society for the Encouragement of National Industry, the Society of Civil Engineers, the Society of Electrical Engineers, and the Society of mining Engineers as well as other technical societies.[20]

AFNOR continues to be linked with government today. Although reconsititued as a private organization in 1926, AFNOR's status was again changed in 1984, when the French Government declared standardization a public service and entrusted AFNOR with responsibility for sourcing, coordinating, approving, and promoting standards; training in the use of standardization; and controlling the use of the NF label—a trademark that shows compliance with a French national standard. AFNOR was also named to represent France at international meetings.

A High Council for Standardization was created in 1984 to oversee the French standardization process. It is convened under the authority of the Minister for Industry and Research and presided over by the chair of AFNOR. Included among the Council's 51 members are representatives from government, local communities, the various sectors of the economy (industrial, agricultural, services, and commercial), and unions, as well as standards participants, academicians and scientists. The Council advises the Minister of Industry and Research on the future direction of standards and comments on AFNOR's general program.[21]

AFNOR's board of directors also includes senior civil servants appointed from the government ministries that have a strong interest in standards. Other board members are elected by the board from the AFNOR membership for 3-year terms, other generally elected members who serve as representatives with 3-year terms, and experts appointed by the various ministries.[22] The Bored manages AFNOR's day-to-day operations and approves AFNOR standards. It is supported by committees that deal with finances, consumer interests, international affairs, and certification.[23]

Responsible for managing and coordinating the entire French standards process, AFNOR pursues 6 basic missions:[24]

1. evaluating standardization needs;
2. setting up standardization strategies;
3. allocating standards resources;
4. leading and coordinating the standards system;
5. participating in European and international standardization; and
6. motivating AFNOR's partners.

AFNOR's work is carried out by two different kinds of groups. Organization/follow-up working groups are concerned with administrative matters—defining standardization tasks, assigning them to appropriate groups, and setting up and guiding the standardization efforts. Technical development/standards creation working groups, made up of experts, are charged with creating the standards.[25]

The United Kingdom

Standards setting in the United Kingdom most closely resembles the U.S. standards setting process. This similarity stems from sharing a pluralist political culture. However, the British standards system differs from the U.S. system in two major ways—the emphasis placed on trade and international standards, and the formal relationship existing between the British Standards Institution (BSI) and the national government. These differences suggest that some changes in the U.S. system could be made without undermininggg the traditional approach to standards development.

The British Engineering Standards Association, established in 1901, was the first national standards organization to be established in Europe. Engineering groups were the major source of standards development, as they were in the United States. The procedures for developing standards were almost identical to those used in the United States, although

20 Karabasz, op. cit., p. 28.

21 Cargill, op. cit., footnote 10, p. 192.

22 Ibid.

23 Ibid.

24 *AFNOR: Standards and Strategies* (Paris: AFNOR, rid.).

25 Ibid.

there was no government organization corresponding to the Division of Simplified Practice of the U.S. Department of Commerce to facilitate the work of simplification.[26]

The British Engineering Standards Association was granted official status in April 1929, when His Majesty King George IV conferred on it a royal charter.[27] Supplementary charters were granted in 1931 (when its name was changed to the British Standards Institution (BSI)), 1968, 1974, 1981, and again in 1989. The Charter identifies four major purposes for BSI

- to coordinate the efforts of producers and users for the improvement, standardization, and simplification of engineering and industrial materials;
- to set up standards of quality and dimensions, and prepare and promote the general adoption of British Standard Specifications and schedules;
- to register, in the name of the Institute, marks of all descriptions, and to prove and affix or license the affixing of such marks; and
- to take such action as appears desirable or necessary to protect the objects or interests of the Institution.[28]

In accordance with its bylaws, BSI is a voluntary organization, with membership open to all interested parties ranging from nationalized industries all the way to professionals and consulting engineers. Standards Policy Committees established by the Board of the Institute appoint technical committees, as needed, to develop standards. In developing standards, these technical committees follow the consensus procedures practiced by other national standards organizations.[29] BSI is supported by membership dues, the government, and revenues from the sale of standards and standards activities.

British standardization has been global in perspective from the start. This emphasis was required for trading with the Empire. To meet the needs of its colonies, for example, the British developed four telegraph pole standards, one for every climate. Moreover, funds were appropriated from the outset to have British standards translated into foreign languages, with the hope that such standards would increase British trade.[30]

Today, the British continue to link standards policy and trade policy. Noting the relationship between standards and competitiveness, for example, a 1982 White Paper, developed by the Department of Trade, called on the British Government to lend greater support to British standards efforts by establishing a formal memorandum of understanding with BSI.[31]

With funding from the government, BSI now provides export support to its members through the Technical Help to Exporter Section (THE). This group identifies the appropriate standards and regulations for almost any product in almost any country

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26 Karabasz, op. cit., footnote 2, pp. 28-29.

27 It is not unusual in British politics for government to look to the private sector to carry out public sector tasks. This tradition was already in evidence, for example, in the sixteenth century when local parishes were empowered to levy "poor rates," for the maintenance of workhouses, houses of correction and almhouses. As described by James:

> The subsidies [from government] facilitate private and private-sector growth, but they also enable the government to extract concessions in return, in the form of regulations over inputs, outputs, and other characteristics that satisfy diverse constituencies. The subsidies, and the regulations and market forces that accompany them, have the effect of raising costs. . . .Thus, the very factors that originally created the demand for a private sector also set in motion forces making the private sector more like the public; as the private sector grows, with government funding and regulating, it becomes quasi-governmental.

E. James, 'The Nonprofit Sector in Comparative Perspective," W.W. Powell, *The Nonprofit Sector: A Research Handbook (New* Haven, CT: Yale University Press, 1987), p. 413.

28 British Standards Institution (BSI), *Royal Charter and Bye-laws* 1981, *Amended 1989*.

29 Ibid.

30 Karabasz, op. cit., footnote 2.

31 As described in the White Paper:

> If standards-making and related activities are to contribute more effectively to industrial and trade policy objectives, there must be close co-ordination between the Government and the British Standards Institution (BSI) as the national Standards authority, Government representation on BSI's Board already includes the Department of Trade, the Minister of Defense, the Department of the Environment and the Department of Industry. However, both the Government and BSI consider that, if the status of standards in this country is to be enhanced significantly, there is a further need for a more formal and detailed understanding between them on their roles and obligations under the standards system. Consequently, the Government and BSI have agreed to draw up a memorandum of understanding.

Department of Trade, *Standards, Quality and International Competitiveness,* presentedto Parliament by the Secretary of State for Trade, by Command of Her Majesty, July 1982 (London: Her Majesty's Stationary Office, 1982).

in the world to assist its members. Drawing on a pool of 100 external translators, THE produces approximately 1,000 new standards translations each year.[32] BSI also conducts seminars and conferences to help its members understand and prepare for the single European market[33] (see figure 3-3).

BSI is also involved in a number of programs in developing areas. Working with AFNOR through the program RESOURCE, BSI serves as consultant to the European Economic Community (EEC and Association of South East Asian Nations (ASEAN) program on Industry Standards and Quality Assurance. In addition, it has provided advisory and consultancy services in Saudi Arabia, Bahrain, Yemen, Tunisia, Turkey, Hong Kong, Taiwan, Singapore, Malaysia, Thailand, Brunei, Brazil, Mexico, and Mauritius.[34]

With an eye to future trading opportunities, BSI is focusing more on regional and international standards setting. The amount of effort devoted to European standardization has greatly increased over the past few years. Between 1989 and 1990, for example, the number of man days spent on European work rose from 15,000 to 21,000, while the input to European Committees increased from 2,179 man days to 9,034. BSI is also active in ISO and the IEC. In 1990, it held 114 secretariats in ISO, and 24 in the IEC.[35]

Figure 3-3—British Standards Institution (BSI) Conferences and Seminars



NOTE: British Standards Institution conferences and seminars in 1992 covered the country.

SOURCE: *British Standards Institution Annual Report and Accounts, 1989-90, p. 4.*

Towards European Standardization

The United States is not alone in rethinking its standards setting processes in the light of a changing global environment. Discouraged, somewhat, by the slow pace of European integration, the EC Commission proposed major reforms in 1985, which were intended to speed up the process.[36] These proposals comprised 287 specific actions that together would create a "Europe without boundaries. " When carried out, all barriers to the free flow of people, goods, services, and capital among EC countries will be eliminated.[37] A key mechanism for speeding the pace of integration is the harmonization of European standardization and certification processes.

European Standards Bodies: The Role of CEN, CENELEC and ETSI

European standardization began in 1965 with the establishment of the Comité Européen de Normalisation (CEN) and the Comité Européen de Normalisation Electrotéchnique (CENELEC), which together are referred to as the Joint European Standards Institute. As nonprofit international associations, these two organizations resemble national standards bodies, with a few major exceptions. The members of CEN and CENELEC are the 16 nation

32 "wOr&g with Foreign Words," *BSI News*, June 1990, p. 18.

33 Between 1989-1990, for example, BSI held four conferences on the design and inspection to ASME pressure vessel codes, one on motor vehicles, and one on electrical equipment exports to Europe. In addition, the Technical Help To Exporters Section took part in the Manufacturers Agents National Association of the U.S.A road show, which looked at the United States as a potential market. *BSI Annual Report and Accounts 1989-1990* (London: BSI, 1990), p. 9.

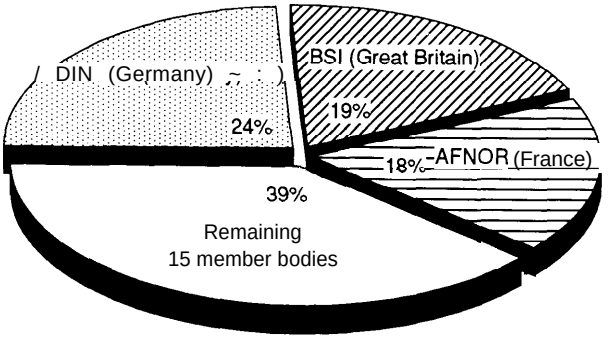
34 Ibid.

35 "BSI meets European challenge, " *BSI News*, June 1990, p. 5.

36 CEC, *Completing* the *Internal* M„&*White Paper from* the Commission to *the European Council* COM (85) 310 final.

37 Most of the internal market measures outlined by the Commission in 1985 have been drafted and tabled, and two-thirds of these have been adopted by the EC Council. Lesssuccessful, however, has been the record of implementation. As of June, 1991, only 1/4 call directives had been implemented. See Professor Helmut Reihlen, "Standardization & Certification in Europe-1992 and Beyond," *AST, Standardization News*, June 1991, p. 38.

Figure 3-4-Deutsche Institute fur Normung (DIN) Working Towards Europe



KEY: AFNOR=Association francaise de normalisation; BSI=British Standards Institution; DIN= Deutsches Institut für Normung eV.
SOURCE: Deutsche Institute fur Normung, 1991.

states of Europe, who have committed themselves to adopt European standards in place of national standards (see figure 3-4). Moreover, standard decisions are made, not on the basis of consensus, but rather on the basis of a qualified majority .38

The organization of CEN is similar to CENELEC. It is governed by a general assembly that is comprised of all 16 member nations (see figure 3-5). This group meets annually to establish policy. Day-to-day operations are in the charge of the Secretary General, who is aided by a technical coordinating committee and a management committee. Planning committees assure that CEN's schedule mirrors the Community's priorities. Standards are developed in technical committees, where efforts are made to reach unanimous decisions. A subordinate body, known as CENSER, deals with certificates of conformance to CEN standards.[39]

CEN and CENELEC produce three kinds of documents: European standards (EN), harmonization documents (HD), and European prestandards (ENV). When an EN is issued, governments must make it a national standard, withdrawing any competing national standards. However, national governments can continue to maintain or issue national standards on a subject pertaining to an HD, so long as it is technically equivalent. ENVs are applied provisionally, for a period of no longer than 5 years, so member governments can maintain conflicting standards until the ENV is converted to an EN or HD.[40]

Since 1986, approximately 30 standardization mandates related to EEC legislation (calling for about 800 European standards) have been assigned to CEN and CENELEC.[41] To meet these needs, they have greatly intensified their operations. Thus, the number of Technical Committees and working groups has doubled between December 1987 and December 1989, and the number of draft European Standards rose from 220 in 1986 to 950 in 1989.[42] Despite these efforts, the European standards processe is viewed as proceeding too slow.

Speed in standards development is especially important in telecommunications and information technologies, since these technologies will play a major role in linking the nations of Europe.[43] To meet this need, the EC established a special standards body, the European Telecommunications Standards Institute (ETSI) in March 1988. ETSI'S organizational structure is designed to accelerate standards development. For example, standards are adopted not on the basis of a consensus procedure, but

38 Voting is weighted. For EEC members the weighting coefficients provided in Article 148 of the Treaty of Rome for EEC Members are used. Coefficients for the EFTA countries were decided by common agreement taking into account political and economic considerations. As described by Florence Nicolas:

> In the context of European standardization the qualified majority rule does not mean a simple two-thirds majority; there are other additional conditions for the adoption of a European document in order to ensure that the standard is the outcome of an agreement involving the largest possible number of countries. Consequently, the number of countries voting against, the number of abstentions and the number of votes against are taken into account. Finally, there is an appeal procedure designed to ensure that the decisions taken are fair.

Florence Nicolas, op. cit., footnote 3, p. 30.

39 Ibid.

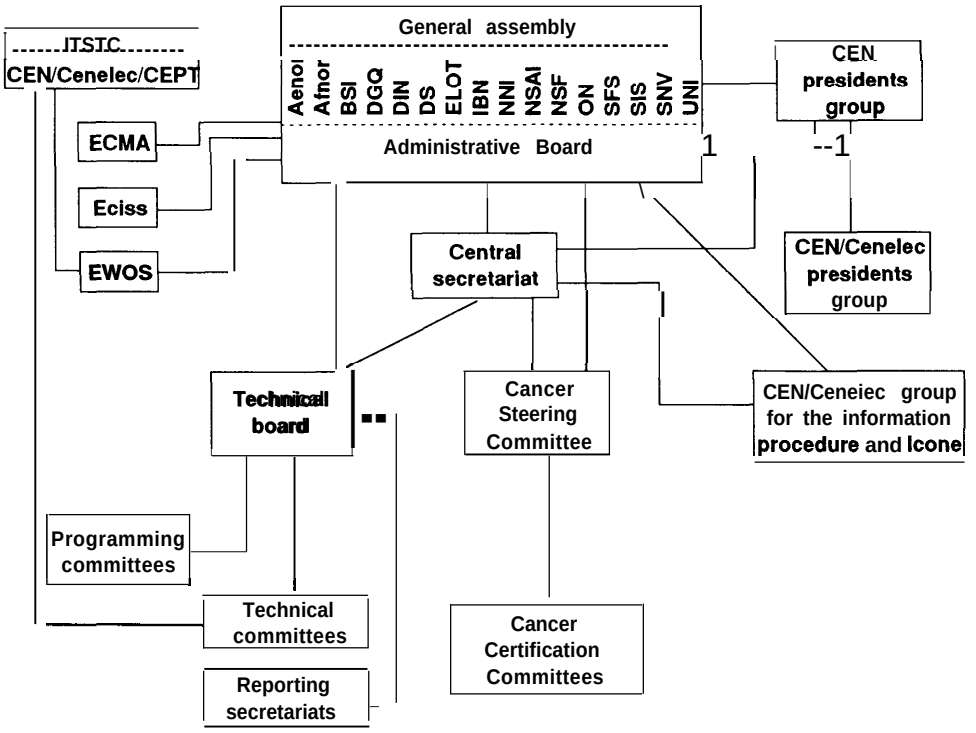
40 Ibid., pp. 30-31.

41 Lucy Kalloway, "Tkchnical Standards Machinery Grinds Exceedingly Slow," *Financial Times,* May 14, 1990, p. 4.

42 Commission Green Paper on the Development of European Standardization: Action for Faster Technological Integration in Europe, Brussels, Oct. 8, 1990, COM (90) 456 final, hereafter refereed to as *Green Paper.*

43 For the rationale behind the creation of ETSI, see Commission on the European Communities, *Green Paper on the Development Of the Common Market for Telecommunications Services and Equipment,* COM (87) final, Brussels, June 30, 1987, pp. 2&22.

Figure 3-5—The Organizational Structure of Comité Européen de Normalisation



KEY: Afnor=Association francaise de normalisation; BSI=British Standards Institute; CEN=European Committee for Standardization; CENELEC= European Committee for Electrotechnical Standardization; DIN= Deutsches Institut für Normung eV; DS=Dansk Standardisetingsrad; ECMA=European Computer Manufacturers Association; ELOT=Hellenic Organization for Standardization; IBN=Institut beige de normalisation; NNI=Nederlands Normalisatie Instituut; UNI=Ente nazionale italiano di unificazione.

SOURCE: Florence Nicolas, with the cooperation of Jacques Repussard, Common Standards for *Enterprises* (Luxembourg, office for Official Publications for the European Community, 1988), p. 29.

through a system of individual weighted voting.[44] Moreover, in contrast to the technical committees in other standards organizations-which are comprised of interested parties-ETSI's technical committees are staffed by experts chosen on the basis of their technical competence. When a high priority is given to a standard, these technical committees set up expert Project Teams, whose members work on standards development full time.

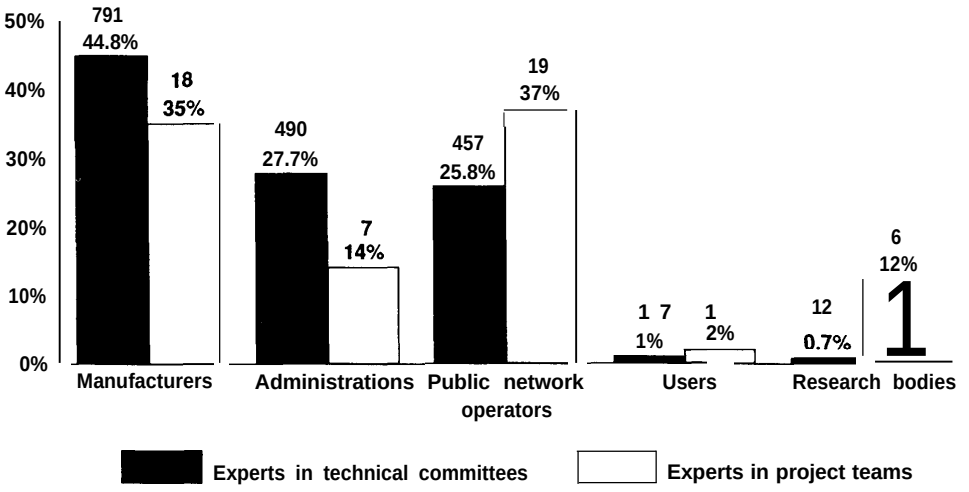
ETSI's membership is heterogeneous, including representatives from manufacturers, administrations, public network operators, users, and research bodies (see figure 3-6 and 3-7). Moreover, a new membership category has recently been created. In addition to full members, there are now associate members who can participate in meetings but cannot vote. Together these members, which are grouped into national delegations, constitute ETSI's general assembly. Day-to-day operations are carried out by the secretariat, led by a director chosen by the general assembly. The technical assembly, however, is the "highest authority within the Institute for the production and approval of technical standards."[45] It is in the technical assembly that ETSI's priorities are set, through the Costed Work Program. Whereas standard decisions are made by weighted voting, the Costed Work Program requires a unanimous vote.

ETSI's resources have been steadily increasing (see figure 3-8). Before 1991, its budget was divided between Common Operating Costs and the Costed

44 Votes used t. be weighted on a national basis. This voting system was revised in 1991. Now individual members votes are weighted according to their sales or, in the case of administrations, on the basis of their gross domestic products. Exceptions are made when, in voting on a standard, ETSI must be consistent with the rules of Article 148 of the Treaty of Rome and those of CEN and CENELEC. *ETSI, No.* 5, spring 1991, p. 3.

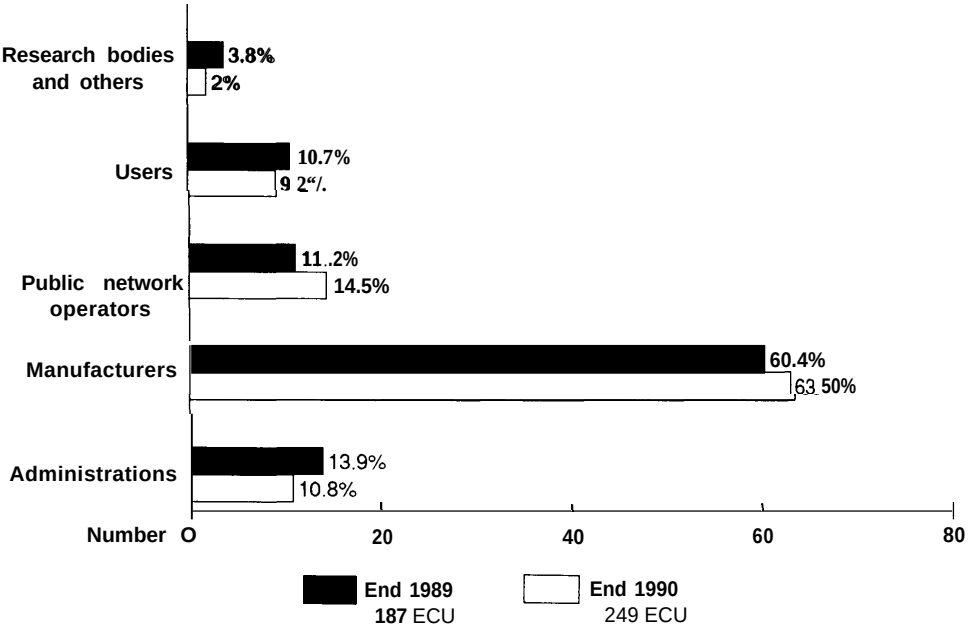
45 Rules of Procedure of the European Telecommunications Standards Institute, Copenhagen 1988, Article 6.3.

Figure 3-6-Participation in European Telecommunications Standards Institute (ETSI)



SOURCE: European Telecommunications Standards Institute, May 1991.

Figure 3-7—European Telecommunications Standards Institute (ETSI) Membership

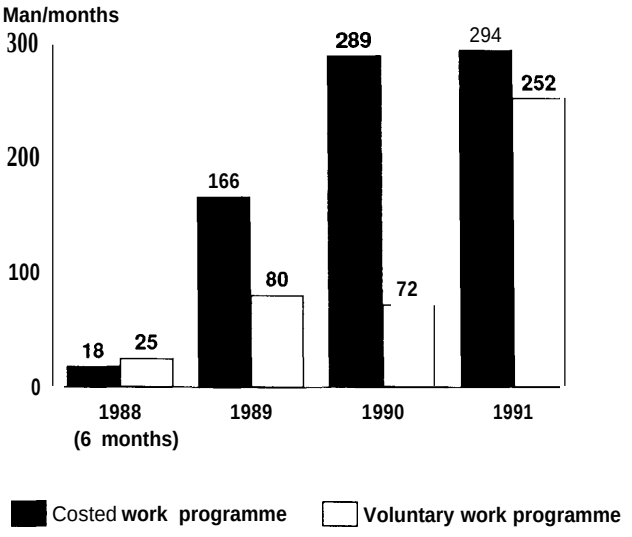


SOURCE: European Telecommunications Standards Institute, May 1991.

Work Program. Administrations (mainly the PTTs) paid the operating costs, while all members shared the costs of the work program. In 1991, a single budget was adopted. Now manufacturers, network operators, service providers, and research institutes pay according to their turnover, and administrations pay according to their Gross Domestic Product (GDP).[46]

[46] ETSI, op. cit., footnote 43, p. 3.

Figure 3-8--Resource for European Telecommunications Standards Institute (ETSI) Project Teams



SOURCE: European Telecommunications Standards Institute, May 1991.

The New Approach

Viewing standardization as a priority task, the European Commission (EC) adopted a new approach for developing European standards in May 1985.[47] This program is based on the mutual recognition of test data and product certification within the EC. It calls for two separate procedures-one for regulated and one for nonregulated products.

Products that have potential health, safety, or environmental implications are regulated by the commission. The commission writes directives for these products, which have the force of EC law. These directives outline broad essential requirements that products must meet.[48] CEN, CENELEC, and ETSI write detailed standards that meet these requirements, which manufactures may choose to follow. Or, manufacturers may meet the directive using another approach. Manufactures must prove conformance to the commission's directive in one of two ways. They can submit their products to testing by an independent laboratory, which is itself licensed as a *notified body* by a member government. Or they can test and certify their products themselves (a procedure known as self-certification.) If challenged, the burden of proving conformance rests with the manufacturer.

Manufacturers can continue to use national standards for nonregulated standards. However, to allow for harmonization, nations are required to treat all EEC products alike. Any product that can be legally sold, manufactured, and marketed in one member nation must be able to be sold on an equal basis in any other country .49

The Green Paper on Standards

Even though the number of European standards has greatly increased, the demand for European standards continues to outpace Supply.[50] The EC estimates, for example, that by 1993, the EEC will need at least 1,000 European standards.[51] With the exception of telecommunication and information technologies (which are to be set through ETSI) the task of developing these standards falls to CEN and CENELEC. To support this development, the EC contributed more than 60 percent of CEN/CENELEC's secretariats budgets in 1990. Moreover, in an effort to speed up the process, the EC proposed a number of reforms in its 1990 *Green Paper on the Development of European Standardardization.*[52]

These proposals, however, have been highly controversial. National standard development bodies have been opposed, as have CEN and CENELEC, since the Green Paper calls for the eventual

47 Progress in European standardization has been greatly facilitated by the passage of the Single European Act, adopted in February 1986. As one of its major objectives, it calls for the completion of the European internal market by the end of 1992 to create a continental trading area. To facilitate this end, the Act substitutes qualified majority voting for the previous system requiring unanimity. See, Patrick W. Cooke, *A Summary of the New European Community Approach to Standards Development* (Washington DC: U.S. Department of Commerce, National Bureau of Standards, August 1988), p. 2-3.

48 Diane Good, "The Implications of 1992 for U.S. Manufacturers: Products (Product Standards and Product Liability) and Environmental Law," *International Quarterly,* vol. 2, July 1990.

49 This principle comes from the historic *Cassis* de *Dijon case* decided by the European Court of Justice in 1979; the decision stated that French cassis could not be barred from sale in West Germany merely because it was manufactured to non-German specifications. CEC, *Europe Without Frontiers-Completing the Internal Market,* Periodical 3/1988 (Luxembourg: Office for Official Publications of the European Communities, 1988).

50 Green *Paper*, op. cit., footnote 43. See also Lucy Kalloway, Op. Cit., footnote 41.

51 Green *Paper*, Op. Cit., footnote 43.

52 Ibid.

restructuring of European standards organizations along industry, rather than national, lines.[53] Moreover, it would replicate the ETSI model, rather than build on the traditional voluntary approach to standards setting. Some contend that the EC's proposal would create a system that is too bureaucratic; others argue that it would unnecessarily limit due process. Having been barraged with negative responses, the EEC is currently revising its proposal to take these kinds of comments into account.

53 See, for example, "Comments of DIN on the Commission Green Paper on the Development of European Standardization as published in the Official Journal of the European Communities on January 6, 1991," CENELEC, "Commentary on the Commission Communication on the Development of European Standards,' (OJ 91/c 20/01); and 'The Future of European Standardization: The BSI Response to the European Commission Green Paper," (British Standards Institute, London: 1991),

Chapter 4

Structural Changes in the Standards Setting Environment

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Chapter 4

Structural Changes in the Standards Setting Environment

Throughout history, social institutions evolved in response to changing environments. Those that failed to adapt fell by the wayside; those that took advantage of a changing situation took the lead.[1] This rise and fall of institutions occurs because the conditions for success--or comparative advantage—vary according to circumstances. What works well in one case, will not necessarily succeed in another.[2] Thus, for example, the U.S. economy gained advantage over many European economies during the industrial era because mass production required a large market, which existed in the United States.[3] Today, however, the United States may lose this advantage because market conditions now require small batch, flexible, industrial processes that differ from traditional U.S. processes.[4] Similarly, although the British economy was successful in the nineteenth century, it declined in the twentieth because, unlike the Germans and others,[5] the British failed to anticipate the emergence of new markets and the growing importance of knowledge resources.[6]

Today, a number of structural changes are taking place in the standards setting environment. U.S. standards setting bodies must address these if they are to serve the needs of American industries and the Nation as a whole. To fully appreciate the implications of these changes, one needs to examine these trends and how they might affect the international standards setting arena.

The Emergence of a Global Economy in Which the United States No Longer Plays the Predominate Role

Key among the developments affecting standards setting is the emergence of a global economy in which the United States no longer plays the predominant role.[7] In a global economy, all nations are interdependent. They depend on one another not only for exports and imports, but also to support the international institutional mechanisms that enable such exchange. Standards are critical both to national economic performance as well as the function-

[1] As Andrew Schotter has pointed out:

> Economic and social systems evolve the way species do. To ensure their survival and growth, they must solve a whole set of problems that arise as the systems evolves. Each problem creates the need for some adaptive feature, that is, a social institution. Every evolutionary economic problem requires a social institution to solve it. . . . Those societies that create the proper set of social institutions survive and flourish; those that do not, falter and die. The distressing fact is that what is functional to meet today 'sproblems may be totally inadequate in meeting the tests our society faces tomorrow.

Andrew Schotter, *The Theory of Social Institutions* (Cambridge, London: Cambridge University Press, 1981), pp. 1-2.

[2] As described by Polanyi:

> A nation may be handicapped in its struggle for survival by the fact that its institutions, or some of them, belong to a type that happens to be on the down grade-the gold standards in World War II was an instance of such an antiquated outfit. Countries, on the other hand, which, for reasons of their own are opposed to the *status quo,* would be quick to discover the weaknesses of the existing institutional order and to anticipate the creation of institutions better adapted to their interests.

Karl Polanyi, *The Great Transformation: The Political and Economic Origins of our Time* (Boston, MA: Beacon Press, 1957), p. 28.

[3] See ch. 2.

[4] Piore and Sable estimate, for example, that in the 1970s, roughly 70 percent of all products in the metalworking sector consisted of small batches. See Michael J. Piore and Charles F. Sabel, *The Second Industrial Divide: Possibilities for Prosperity (New* York, NY: Basic Books, 1984), p. 26.

[5] It was during the late 1980s, for example, that the Germans established a number of major research universities, which had an industrial as well as research orientation. Many American universities, such as John Hopkins, began to follow suit. For a discussion, see Edward Shils, "The Order of Learning in the United States from 1865-1920: The Ascendancy of the Universities," *Minerva,* vol. 16, No. 2, summer, 1978.

[6] According to James Beckford, for example:

> Current thinking about the performance of the British economy in the twentieth century is that the process of secular decline relative to some other Western European countries, Japan, and the United States had its origins in the failure to plan adequately for the efficient exploitation of new markets and new resources in the late nineteenth century. The results of a rather rigid adherence to laissez-faire doctrines were evident even before World War I in a relative slowness to appreciate the importance of technical and scientific education, training, business studies and labor relations. . . . At present, the United Kingdom's weakness in industrial productivity is largely responsible for a serious decline in the country's living standards in comparison with those of other advanced industrial societies.

James Beckford, "Great Britain: Voluntarism and Sectional Interests," Robert Wuthrow (cd.),*Between States and Markets: The Voluntary Sector in Comparative Perspective* (Princeton, NJ: Princeton University Press, 1991), p. 33.

[7] For a discussion of U.S. hegemony and the implications for the world economy, see Charles Kindelberger, "Dominance and Leadership in the International Economy: Exploitation, Public Goods, and Free Rides,' *International Studies Quarterly, vol.* 27, pp. 242-254.

ing of the international marketplace. This means standards making bodies—at all jurisdictional levels—have a major role to play. However, greater resources will be needed in the international arena, since, in a global economy, domestic economic performance is increasingly dependent on the international marketplace.

From the U.S. perspective, the beginning of a global economy can be traced back to the end of the 19th century when large, multifunctional corporations emerged, many with branches or subsidiaries abroad. These firms became highly successful. Being the first of their kind, they used their size and complex corporate structures as barriers to late-coming rivals.[8] U.S. multinational firms had an advantage over their European counterparts, who were constrained in their operations by their much smaller domestic markets and, unlike American companies, were unaccustomed to competing on the basis of improved efficiency and cost reductions.[9]

As European and Japanese economies recovered from World War II and managed to overcome the U.S. technological lead, however, this pattern of U.S. economic hegemony shifted significantly, and American multinationals increasingly found themselves competing intensely with their European and Japanese counterparts.[10] Japanese corporations, benefiting from their export-oriented industrial policy, have been particularly successful in their efforts to establish international connections by investing and producing abroad.[11]

The integration of the international economy has been facilitated and fostered by a number of developments. These include:[12]

- the growing similarity of countries, both with respect to taste as well as to infrastructure, distribution channels, and marketing approaches;
- the emergence of a global capital market as witnessed by large flows of funds between countries;
- declining tariff barriers and the establishment of regional trading agreements;
- shifting opportunities for competitive advantage due to technology restructuring;
- the integrating role of advanced information and communication technologies;
- slow and uneven world economic growth that has fanned the flames of international competitiveness; and
- the emergence of new global competitors, principally from East Asia.

Together, these developments have given rise to a global economy in which patterns of international trade now primarily reflect patterns of international production. Specialization takes place on the basis of parts and specialized components, rather than on the exchange of finished products as in the past. Thus, interfirm and intrafirm trade is steadily replacing interindustry trade.[13] Today, for example, Japan provides approximately 40 percent of U.S. component parts in electronics and automobiles.[14]

Patterns of direct investment abroad also highlight this trend towards global economic integration

[8] Alfred D. Chandler, Jr., 'The Evolution of Modem Global Competition,'' Michael E. Porter (cd.), *Competition in Global Industries* (Boston, MA: Harvard Business School Press, 1986), pp. 408-409.

9 As Chandler has pointed out:

> In Europe, the lack of antitrust legislation meant that market power was achieved and maintained in the domestic market far more by contractual cooperation than through functional and strategic differences. In those British industries where a single firm did not dominate, federations of relatively small, usually family enterprises, normally in the form of holding companies, maintained agreement as to price, output and marketing territories.

Ibid.

> Because of the dominant position of American firms, the term "multinational corporation" originally was, according to Robert Gilpin, "a euphemism for the foreign expansion of American giant oligopolistic corp." The strength of the U.S. economic position was reflected by the fact that, in 1981, more than two-fifths of the world's direct foreign investment was accounted for by the United States, with the bulk of it being invested in advanced manufacturing. Moreover, foreign investment and the activities of American multinationals were increasingly critical to the U.S. economy in that, in the early 1970s, a sizable number of American corporations held more than $500 billion of their assets and gained more than one-half of their earnings abroad. Robert Gilpin, *The Political Economy of International Relations* (Princeton, NJ: Princeton University Press, 1987), p. 238.

10 Chandler, op. cit., footnote 8, p. 240.

11 Chandler, op. cit., footnote 8, p. 5.

12 Michael Porter (cd,), *Competition i„ Global Industries* (Boston, MA: Harvard Business School Press, 1986), pp. 2-3.

13 Gilpin, op.cit., footnote 9 p. 238. See also Jack N. Behrman, *Industrial Policies: International Restructuring and Transnationals* (Lexington, MA: Lexington Books, 1984).

14 Porter, op. cit., footnote 12, p. 225.

and interdependence. Between 1960 and 1988, for example, direct investment abroad by all firms in all nations increased by over 10 percent, to over $1.1 trillion.[15]

This trend is especially pronounced in the United States, where foreign direct investment increased during the same period faster than the world average—from $9.9 to $328.9 billion, or 18 percent per year. Moreover, foreign direct investment accounted for 3.4 percent of Gross National Product (GNP) in 1987, as compared to 1.8 percent a decade earlier.[16]

To date, the United States has not done well in this changing economic environment. The impact of foreign competition can be seen, for example, by examining the combined data on U.S. share of world imports and exports, with figures on the proportion of U.S.-made goods in domestic consumption. From these data, it is clear that the United States has lost world market share, for example, in merchandise. The situation is the same, moreover, in the case of microelectronics [17] (see table 4-l). As a recent OTA study concludes: "At least in the most important sectors, U.S. companies are not holding their own against foreign competition. ' '[18]

How the United States fares in this global economy depends not only on trade but also on standards, many of which will be established by other countries or in the international standards setting arena.[19] The role of standards in this equation for success is on the rise. In 1977, for examples, it was estimated that, for the year 1977, $69 billion of U.S. exports were subject to standards activity. No comparable figure is available today. However, it is estimated that of $83 billion in exports of manufactured goods to the European Economic Community (EEC) in 1990, some $48 billion is, or will, be subject to EEC product safety standards alone.[20]

Table 4-1—U.S. Share of World Imports and Exports

Year	Percent of imports	Percent of exports
1970	12.9	13.8
1973	12.4	12.4
1975	11.7	12.7
1977	13.6	10.8
1978	13.8	11.1
1979	13.1	11.1
1980	12.5	11.1
1981	13.4	11.9
1982	13.4	11.6
1983	14.4	11.1
1984	17.2	11.5
1985	17.9	11.1
1986	17.5	10.3

SOURCE: United Nations, Department of International and Social Affairs, 1985/86 *Statistic/ Yearbook,* 35th issue (New York, NY: United Nations, 1988).

The growth of imports also enhances the value of international standards. In 1990, 7.3 percent of Gross Domestic Product (GDP) and 38 percent of manufacturing were dependent on imports.[21] Imported products, many of which are component parts, must conform to standards that meet the needs of both foreign producers as well as manufacturers in the United States. Moreover, standards will need

15 U.S. Congress, Office of Technology Assessment *Competing Economies: America, Europe, and the Pacific Rim,* OTA-ITE-498 (Washington, DC: U.S. Government Printing Office, October1991), p. 26.

16 Ibid.

17 As OTA points Out:

> In microelectronics, Japanese manufacturers dominate world markets and technology developments in many products, starting with DRAM chips in early 1980s. Japanese manufacturers have challenged the American leaders in computers throughout the market, from laptop PCs to supercomputers, and few believe that they have reached their limit. After having pioneerescientific work in superconductivity. . ., Americans and Europeans have watched Japanese companies take solid steps to incorporating superconducting materials in commercial products. Andin high-resolution television, American companies have been mostly spectators in a game that involves European companies and governments struggling to catchup to the Japanese.

U.S. Congress, Office of Technology Assessment,*Competing Economies: America, Europe, and the Pacific Rim, OTA-ITE-498* (Washington DC: Government Printing Office, October 1991), pp. 123-124. The President's Council on Competitiveness drew a similar conclusion in its report, *Gaining New Ground: Technology Priorities for America's Future,* (Washington, DC: U.S. Government PrintingOffice, March 1991).

18 According to OTA "at least in the most important sectors U.S. Companies are not holding their own against foreign competition. In particular, American companies are beleaguered by Japanese competition." OTA op. cit., footnote 17, p. 5.

19 The number of participants involved in standards development within ISO is estimated to have increased from 50,000 in 1972 to 1(X),000 today. And the number of standards approved has increased from 2,000 in 1972 to 7,500 by 1985. Stanley H. Besen and Garth Saloner, "The Economics of Telecommunication Standards," R. Crandell and K. Flamm, *Technology and Government Policy in Computers and Telecommunications* (Washington, DC: Brookings Institute, 1989), p. 26.

20 This figure was provided by the Department of Commerce.

21 OTA op. cit., footnote17, p. 94.

to be made available to producers in a timely and efficient manner.

Failure to understand the implications of international standards can have serious consequences for U.S. industry. The U.S. machine tool industry is a case in point. For years, the industry was able to thrive without regard to international standards. Industry practices became de facto standards because the U.S. market for machine tools was so large. In a global market, where there is intense foreign competition, this is no longer possible. Not being involved in the development of international standards or experienced in producing products to foreign specifications, the U.S. industry has lost its competitive edge.[22] The Japanese, on the other hand, have gained considerable ground in the international market, in part by more effectively using standards to improve productivity and add value to their products.[23] Concerned about the fate of the machine tool industry, President Bush recently agreed to approve a 2-year voluntary restraint agreement on machine tools, which limits imports from Taiwan and Japan, to allow time for the industry to become revitalized.[24]

Although considerably more future standards work will take place in the international arena, it is not clear that the United States will have an effective presence there. The United States has been slow to appreciate the growing importance of international standards. Some say, for example, that U.S. standards bodies lost a tremendous opportunity in the early post-World War II years, when European standards institutions were still in a state of disarray.[25] Europeans, themselves, complain about the failure of the United States to make a real commitment to international standards. Some even suggest that U.S. involvement in the past was counterproductive. Americans, they say, were playing for much lower stakes than the Europeans, since standards implementation in the United States is voluntary, but compulsory in Europe. To the Europeans, therefore, U.S. participation sometimes appears perfunctory, if not at times obstructionist.[26]

The United States may also have considerably less influence than in the past to determine the character of international standards institutions.[27] The United States was able to play the dominate role in defining the post-World War H international economic order because of factors, many of which no longer exist, such as American economic and military preeminence, the threat of a common

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22 As the Chief Executive Officer of Cincinnati Milacrom described the situation to members of his industry, "Your competitors are global, your suppliers, your standards, your designs, your issues, your policies, your strategies—they all must become global. Technology is not a provincial field any more. [Industry must implement] radical measures.' "Cincinnati Milacrom hairman Issues Stern Warning to U.S. Manufacturers," New *Technology Week, Nov. 18, 1991,* p. 4.

23 Michael L. Dertourzos et al., *Made in America: Regaining the Productive Edge* (Cambridge, MA: MIT Press, 1989), pp. 241-242.

24 "Bush Approves Limited Extension of Machine Tool VRAs With Japan, Taiwan," *International Trade Reporter,* Jan. 1, 1992, p. 10.

25 Three was little incentive t. consider international standards, so long as national economies were independent of one another. Writing in 1928, K. H. Conduct explains the attitude of the time. He notes:

> Very little has been accomplished in international standardization. . . for obvious reasons. The manufacturing arts are different at different stages indifferent countries, and what is acceptable in the advanced countries is not in the backward ones. Until international trade is conducted on a basis less strongly flavored with nationalism, and industrial education has made more progress than it has yet, there will apparently be little economic justification for extensive standardization.

K.H. Condit, "The Economic Aspects of Standardization," *Standards in Industry (The American* Academy of Political and Social Science, Notes from the Annals, 1928), p. 40.

26 European interviews. Reacting t. these comments during the OTA review process, some members in the American standards community say that these comments are self-serving, and thus not to be taken too seriously.

27 Explaining U.S. hegemony in the past, Gilpin notes:

> For the first time ever, all the capitalist economies were political allies. American initiatives in the area of trade led to successive rounds of tariff liberalization. The dollar served as the basis of the international monetary system, while American foreign aid, direct investment, and technology facilitated the rapid development of advanced and certain less developed economies. American hegemony provided the favorable environment within which supply and demand forces created an era of unprecedent growth and an increasingly open economy.

Gilpin, op. cit. footnote 9, p. 5.

enemy, as well as relatively steady economic growth.[28] To affect standards processes in an international environment in which economic and political resources are now both better balanced and dispersed, the United States must exert greater effort and resources, as well as negotiate and compromise, more than ever before.

Rallying sufficient resources for this task will be difficult. The potential for market failures at the international level is high, since many American companies, especially in the small business community, do not recognize the implications of international standards in a global economy. By the time they realize the potential consequences, damage to the national economy may already be done. A key factor in determining outcomes in standards development bodies is the amount of resources and skills that participants contribute.[29] American participants must pay their own way, but participants from other countries are generally supported, at least in part, by their national governments.

The costs of international standards development and the expense of participating in the process is also a limiting factor. It has been estimated, for example, that the development of a major international telecommunications standard may require perhaps 1,000 person-years of experience, 20 person-years of actual effort, and $3 million.[30] Distributing standards information across national boundaries, when it requires cultural, political and language translation, is also costly.

If sufficient resources are brought to bear in the international arena, the payoff would likely be great. U.S. companies, which are no longer dominant in the market, and hence unable to set de facto standards, will benefit from a standards setting process where influence is not based solely on market power.[31] Equally important, signatories of the General Agreement on Tarriff and Trade (GATT) Standards Code[32] have pledged to adopt international standards, where they exist. Thus, if the United States supports the timely development of standards in international standards bodies, it may preclude the Europeans and others from using regional standards to restrict trade.

Increased Competitiveness and Greater State Involvement in Promoting National Economies

Even as the international marketplace becomes more integrated, the political and ideological framework that governed the post-war international order is coming apart. A revival of 19th century mercantalist philosophy and practice has been filling the gap. Acutely aware of the growing linkages between national economic well being and performance in the international marketplace, many governments are adopting policies to assure that their industries compete successfully. Standards and standards processes provide useful mechanisms to advance national industrial policies. Thus, they must be viewed in the context of an increasingly competitive, global environment.

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28 As described by Gilpin:

> The United States emerged from the Second World War as the dominant or hegemonic economic and military power in the international system. This unchallenged American preeminence was partially due to the wartime destruction of other industrial economies. From this perspective, the coremanding nature of American leadership in the early postwar period was 'abnormal" and would one day decline with the recovery of other economies. This artificial situation, however, caused false and extraordinarily high economic expectations among the American people that continued into the 1990s and made adjustment to economic and political decline extremely difficult.

Gilpin, op. cit., footnote 9, p.344.

29 See Martin B.H. Weiss and Marvin Sirbu, "Technological Choice in Voluntary Standards Committees: An Emperial Analysis," *Economics of Innovation and New Technology,* vol. 1, No. 1/2, 1988), pp. 111-132.

30 Odo J. Struger, "Impact of International and Foreign Standards on a Company's Operations," presentation Aug. 20, 1991, p. 6.

31 See for discussion, Joseph Farrell and Garth Saloner, "Competition% Compatibility, and Standards: The Economics of Horses, Penguins and Lemmings," H. Landis Gabel (cd.), *Product Standardization and Competitive Strategy (North* Holland: Elsevier Science Publishers, 1987), pp. 1-21; See also, William Lehr, "The Case of Two Data Transport Standards: IEEE's 908.6 Metropolitan Area Network (MAN) versus the ANSi X3's Fiber Distributed Data Interface (FDDI), paper presented to the nineteenth annual Telecommunications Policy Research Conference, Session on the Economics of Networks and Standardization, Solomon Island, MD, Sept. 30, 1991.

32 Article 2.2, Agreement on Technical Barriers to Trade. The Standards Code attempts to ensure that "techni~ regulations and standards are nOt prepared, adopted, or applied withaview to creating obstacles to international trade.' To accomplish this it lays out principles that guide the development and application of standards and the use of conformity assessments procedures. These principles include using international standards unless inappropriate for certain specific reasons and to not develop or apply standards in a way that poses an unnecessary obstacle to international trade. In the draft text, which is ahnost complete, countries pledge to use the least restrictive measure to accomplish a legitimate objective. In general these principles also apply to conformity assessment procedures (that is, the methods by which a body assures that a product conforms to a particular standard).

Standards for Industrial Policy

Mercantilism--the policy of state intervention in the economy—has a long history, which can be traced in Europe back to the development of national markets. Using their sovereign authority to establish national markets, European monarchs sought to control their impacts through regulation.[33] Although the policy of mercantilism was disavowed in England during the industrial revolution,[34] it remained entrenched on the continent, providing the successful blueprint for German industrialization at the end of the 19th century .35 Even in the United States, mercantilism continued to find a receptive audience throughout the first half of the nineteenth century.[36]

The decline of mercantilism after the Second World War was due, in part, to widespread disillusionment with the statist approach, which was carried to extreme in Fascist Italy and Nazi Germany. Equally important was the influential role played by the United States in reconstructing the post-war international economy based on the principles of trade liberalization and a stabilized monetary order supported by fixed exchange rates.[37]

The two pillars on which this system was based were the Bretton Woods monetary system, established at the Bretton Woods Conference in 1944, and the General Agreement on Tariffs and Trade (GATT) adopted in 1948.[38] The post-win international economic system was successful, so long as it was considered mutually beneficial.[39] Strains in the system became apparent, however, in the early 1970s, when the dollar started to diverge significantly from other currencies.[40] In August 1971, President Richard M. Nixon unilaterally suspended convertibility of the dollar and established a surcharge on U.S. imports, which was designed to force the reevaluation of European and Japanese currencies.[41] In 1973, the United States abandoned the Bretton Woods monetary system when it shifted to flexible exchange rates.

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33 & described by Polayni:

> Deliberate action of the state in the fifteenth and sixteenth centuries foisted the mercantile system on the fiercely protectionist towns and principalities. Mercantilism destroyed the outworn particularism of local and intermunicipal trading by breaking down the barriers separating these two types of noncompetitive commerce and thus clearing the way for a national market. . . . The "freeing" of trade performed by mercantilism merely liberated trade from particularism, but at the same time extended the scope of regulation. The economic system was submerged in general social relations: markets were merely an accessory feature of an institutional setting controlled and regulated more than ever by social authority.

Polanyi, op. cit., footnote 2, pp. 65-67.

34 The end of mercantilism in England is usually associated with the passage of the Reform Act of 1832, and the Poor Law Amendment of 1834.

35 Fo, the classic account of use of state power t. establish capitalism in Imperial Germany, see Thorstein Veblen, *Imperial Germany and the Industrial Revolution (New* York, NY: Viking Press, 1939).

36 See, for example, Forrest McDonald, who notes:

> That period [when the Constitution was adopted] was one of transition from ancient zero-sum conceptions of economic activity to modern growth-oriented conceptions. Precapitalism and anticapitalistic values, attitudes, and institutions, rooted in the feudal past, were far from dead in America, and those of mercantilism—a system in which economic activity was regulated by the state as a means of aggrandizing the international power and prestige of the state-were in full bloom. The new values, looking to free trade, entrepreneurship, and a market economy, were, with few exceptions, little more than a gleam in the eyes of a few advanced thinkers. The establishment of the Constitution thus was a benchmark in the evolution of systems of political economy, for it made possible-not inevitable—the transformation from the old order to the new.

Forrest McDonald, "The Constitution and Hamiltonian Capitalism," Robert A. GoldWin and William A. Schambra (eds.), *How Capitalistic Is the Constitution* (Washington, DC: American Enterprise Institute, 1984), p. 50.

37 See John Gerard Ruggie, "International Regimes, Transactions, and Change: Embedded Liberalism in the Postwar Economic order," *International Organizations,* vol. 36, pp. 379-415.

38 GATT was designed t. achieve "freer and fairer trade' by providingan agreed on set of universal rules for conductingcommercial policy. These incorporated three basic principles: 1) nondiscrimination, multilateralism, and the application of the Most Favored Nation Principle to all signatories; 2) expansion of trade through the reduction of trade barriers; and 3) unconditional reciprocity among all signatories. See, Marina v. N. Whitman, "Sustaining the International Economic System: Issues for U.S. Policy," *Essays in International Finance, No. 121.*, Department of Economics, Princeton University, p. 28.

39 It was hoped that the system would be flexible enough so that nations could pursue their domestic policies while still operating by the rules Of the game. Ruggie, op. cit., footnote 37.

40 Gilpin, op. cit., footnote 9, pp.140-142.

41 The unilateral act was greatly resented b, the other members of the Bretton Woods accord, They complained that the United States preferred to abandon the system, rather than have its freedom of action curtailed. From the American point of view, as defined by a former government official, "the growing economic and political strength of Europe and Japan made the Bretton Woods system obsolete." As cited in, Robert O. Keohane, "T'he International Politics of Inflation," Leon N. Lindberg and Charles S. Maier (eds.), *The Politics of Inflation and Economic Stagnation: Theoretical Approaches and International Case Studies* (Washington DC: Brookings Institute, 1985), p. 97.

At the same time, protectionism was also on the rise.Az **Exceptions and escape** clauses were built into the GATT, and nations began to resort to them at an increasing rate.43 Even when GATT's efforts to reduce tariff barriers were successful, they were often countered by the growing popularity and use of barter agreements and nontariff trade barriers.[44] Thus, the ratio of managed to total trade increased from 40 to 48 percent between 1974 and 1980. This percentage would be even greater had intrafirm trade between multinational corporations been considered.[45]

Retreating further from the post-war international economic system, many governments adopted industrial policies to improve their economy's comparative advantages. Japan's remarkable success, and that of several newly industrializing countries, rekindled an interest in mercantilism. Economic activity became increasingly politicized as the positive effect that government intervention on behalf of a nation's economy became apparent. When other nations, following Japan's lead, began competing aggressively for the same value-added, high-technology market, international trade became a zero-sum game.

The result is a highly competitive, global economy, in which multinational corporations are aided in their competitive endeavors by increasingly protectionist and interventionist policies of their home governments. Whereas in the past protectionist policies generally were intended to protect an infant or declining industry, today they are calculated to enhance or create a comparative advantage--especially in high technology, high value-added industries.[46] To the extent that governments can alter industry advantages, one can no longer view comparative advantage in the classic, economic sense, which calls for free trade.[47] Furthermore, these competitive policies are self-reinforcing. Because many countries are focusing their industrial policies to support the same sectors, there tends to be overproduction in these areas and, hence, increased pressure for protectionist policies.[48]

This atmosphere is not conducive to global solutions. When cooperation between nations is deemed appropriate, it increasingly takes the form of regionalism. Thus, in addition to the European Common Market, there now exists a Pacific trading area, a North American Trading Area, and-if all goes well with the Enterprise for the Americas Initiative-perhaps even an Hemisperhic Free Trade Zone.[49] However, unlike the European Community, which originated within the context of the post-war

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42 Ernest H. Preeg, 'f'& *American Challenge in World Trade: U.S. Interests in the GATT Multilateral Trading System* (Washington, DC: The Center For Strategic Studies, 1989).

43 As OTA points Out:

> There is an increasing tendency for nations to negotiate quotas bilaterally or among trading blocs or customs unions. GATT has recorded over 200 quota arrangements that restrict industrialized counties' imports in products such as textile and apparel, steel, motor vehicles, semiconductors, machine tools, footwear, and consumer electronics. These arrangements include the proliferation of voluntary restrain agreements (VRA)S that restrict trade between two nations. An example is the VRA between Japan and the United States in which Japan agreed to limit its exports of motor vehicles to the United States, from 1.76 million units in 1981 to 1.94 million units in 1985.

OTA op. cit., footnote 17, p. 121.

44 As the Council of Economic Advisers described the situation in its 1985 *Economic Report Of the President*, the world *is* moving *away* from *rather than* toward, comprehensive free trade. In major industrialized countries, for example, the proportion of total manufacturing subject to nontariff restrictions rose to about 30 percent in 1983, up from 20 percent just three years earlier.'Council on Economic Advisers, op. cit., footnote 17, p. 114. See also Gilpin, who notes:

> Thus by the late 1970s, several broad changes had begun to erode the GATT system of trade liberalization. As tariff barriers within the GATT have fallen, nontariffbarriers inmost countries have risen. Barter ocountertrade has grown rapidly, especially with respect to the less developed countries; the U.S. Commerce Department estimates that between 1976 and 1983, barter increased from approximately 2-3 to 25-30 percent of world trade.

Gilpin, op. cit., footnote 9, p. 195.

45 Gilpin, op. cit., footnote 9, p.207.

46 Gilpin, op. cit., footnote 9, p.261.

47 Gilpin, op. cit., footnote 9, p.277.

48 Behrman, op. cit., footnote 13, p.11.

49 ''Bush Hails Possibility of a Hemispheric Free Trade Zone During South Americas Trip' *International Reporter*, Dec. 5, 1990, p. 1824.

international system and was motivated by political as well as economic goals,[50] regional trading pacts today appear to be operating more defensively.

Standards developments must be viewed in this context. If the GATT cannot sustain an international economic order based on free trade principles, standards will be used, increasingly, as nontariff trade barriers and also as part of national, or regional, industrial policies. This is now happening both in Europe and Japan.[51]

Standards as Industrial Policy

The Japanese were the frost to use standards as a key component of industrial policy and the frost to be chastised for using them as nontariff trade barriers.[52] Because Japan had a small domestic market, and was late in the process of industrialization, the Japanese Standards System (JSS) originally focused on improving economic efficiency and gaining the benefits of technology transfer.[53] Later, standards were used to control product quality, and thereby promote trade. More recently, Japanese standards have been designed to address issues relating to "environmental safety, consumer protection, economy of natural resources, and energy. ''54 The Japanese have a rigorous procedure for testing and certifying these standards, which has been a source of dispute between the United States and Japan. Responding to U.S. complaints that these certification procedures were serving as nontariff trade barriers, the Japanese agreed, in May 1983, to accept the results of testing organizations located outside Japan.[55]

Standards also play a central role in the European plans for unification and industrial development. Although the creation of a single European market is still incomplete, there has been considerable progress made in this direction. Despite high tension, and a number of compromises, the recent European summit at Maastricht makes clear that Europe is on track towards creating a grand European Market.[56] If successful, the Europeans have much to gain. By most accounts, the removal of trade barriers will lead to increased productivity and growth due to heightened competition, the benefits of increased economies, and increased investment.[57] If European firms become more competitive, their exports will also increase.

Europeans may also gain in the area of standards development. With a market the size of the EEC, Europeans will likely have much greater economic and political leverage to promote their standards in the international arena. This may be the case in the future if the development of standards at the international level fails to keep pace with the European standardization process.

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50 For a discussion of the early history and logic behind the establishment of the European Community, see Emile Benoit, *Europe at Sixes and Sevens (WestPort,* CT: Greenwood Press, 1961). See also Ernst Haas *The Uniting of Europe: Political, Social, and Economic Forces* (Stanford, CA: Stanford University Press, 1968).

51 See, for example, Rhonda Crane, *The Politics of International Standards: France and the Color TV War* (Norwood, NJ: Ablex Publishing, 1979), for a discussion of how the French used standards to protect their color TV market. Some also claim that European enthusiasm for Open System Interconnection Standards (0S1) reflected their eagerness to prevent further consolidation of IBM's control of network standards through SNA, its proprietary network model. See for a discussion, Larry DeBoever, "Trek Toward Connection" *Computerworld, Nov. 16, 1987,* pp. S1-S13.

52 Donald J. Lecraw, ''Japanese Standards: A Barrier to Trade?'' H. Landis Gabel (cd.) op, cit., footnote 31, pp. 29-4.6. As the author points out, the most notorious case was that of the Japanese standard for baseball bats, which prevented the United States from exporting baseball bats to Japan. The problems was eventually resolved through the settlement court of the GATT

53 As Lecraw points OUt:

> At the start of Japan's industrialization process in the late 1800s, its industrial firms were small and inefficient, and lacked a modem technology base. To meet these problems, the Japanese government actively promoted industry rationalization, simplification of product variety, and interchangeability and compatibility between products. On the one hand, this strategy enabled Japanese firms to achieve the efficiency of high volumes even though they were relatively small, and on the other, it facilitated the transfer of technology from abroad since the same product or process could be used by all firms within an industry and by firms across industrial sectors.

Ibid., p 31.

54 Japanese Standards Association, ''Industrial Standardization System in Japan,'' JSA, Tokyo, 1978, p.1.

55 Ibid., p. 37. The Japanese first came under pressure to eliminate non-tariff trade barriers, including those relating to standards, during the Tokyo round of the GATT.

56 A major agreement was the decision to create a single European Bank and a single European currency by the end of 1999. See for a discussion of the issues, William Brozdiak, "National Destinies on the Line as EC Summit Convenes," *The Washington Post,* Dec. 8, 1991, A33; and "EC Nations Reach Accord on Landmark Unity Pacts,' *The Washington Post,* Dec. 11, 1991, pp. Al, A30.

57 While estimates of the magnitude of growth differ, few question that there will be growth. See for discussions Richard Baldwin, "The Growth Effects of 1992, " *Economic Policy,* October 1988, pp. 248-81; and Merton J. Peck, "Industrial Organization and the Gain from Europe 1992," in William C. Brainard and George L. Perry (eds.), *Brookings Papers on Economic Activity 2 (Washington DC:* Brookings Institution 1989).

How the European standardization process develops will have a major impact on the U.S. economy, because Europe as a whole constitutes the United States' largest trading partner.[58] If American industries have access to the European market, they stand to benefit from integration. In a growing, single market, there will not only be gains in trade; American firms will also have lower costs, since they will be able to deal with a single set of standards and a more unified administration.

On the other hand, if third-country access to the European market is hindered, American firms will suffer. This might happen, for example, if the European Community were (as the Japanese did previously) to adopt its own, independent testing/certification procedures. To compete in the European market, U.S. companies might then have to retool their products to meet European specifications, and/or undergo complex and costly certification and testing procedures. The new testing and certification system, which was adopted as part of the ''new approach,' could be especially problematic for American firms.[59] In accordance with this procedure, manufacturers can meet Community standards requirements either by having their products tested in an independent laboratory--or ' 'notified body' '-or by self certification, which involves testing their own products or having them tested by an outside laboratory. The problem for American companies is that, as of now, U.S. laboratories are not accredited in the European Community, and shipping products overseas for testing is costly and often impractical. Final decisions about testing will be made by the recently established European Organization for Testing and Certification. (EOTC) According to the Europeans, negotiations would be greatly simplified if they could deal with a single U.S. negotiating entity.

Europeans have sought to assure the United States they have no plans to create a ''Fortress Europe."[60] They point out that, under Community rules, the European standards bodies-CEN, CENELEC, and ETSI—are obliged to use international standards when they are, or will soon be, available. Moreover, under pressure from the United States, the European standards bodies now allow U.S. interested parties to review European standards before they are implemented.[61]

The Europeans, however, have a schedule to meet; they are unlikely to slow the process of European harmonization for lack of international standards. To reconcile their own interests with those of countries outside the European Community, they propose to reorganize international standards bodies to hasten the development of international standards. Moreover, they call on the United States to make a greater commitment to the development and *implementation* of international standards. They point out that, whereas 85 percent of all CEN and CENELEC standards are identical to international standards, only 22 percent of U.S. national standards are identical or technically equivalent.[62]

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58 The most important countries in terms of U.S. trade are Germany, the United Kingdom, France, and Italy, all of whom are among the top 10 in volume of total trade with the United States. The bulk of U.S. foreign direct investment is also located in Europe. OTA op. cit., footnote 17.

59 John Burgess, "Competing in a Diverse Market: U.S. Firms Seek Unity on Product Standards in Europe," *Washington Post,* pp. Al, A6; See also, Karen A. Frenkel, "The Politics of Standards," Communication *of the ACM*, July 1990, pp. 40-52; and Elizabeth Horwitt, "Finding Foreign Fingers in Standards Pie," *Computer World,* July 16, 1990, p. *56.*

60 See ISO Memo *to Executive* Board Members, "EC Commission Reaffirms Support for International Standards," June 3, 1991. As Prof. Helmut Reihlen, V. President 1S0, points out, "West Europe knows full well that it would only endanger its exports ifit hindered imports. . . it is not a question of one region making the other dance to its tune. The fact is that a great need for international standards has arisen in one region. An eager new market has been created so to speak.'

61 Karen Fitzgerald, "Global Standards, *ZEEE Spectrum,* June 1990, pp. 4446.

62 See EC Communique Study Group Issue Paper on International Standardization. Jan. 6, 1992, provided in response to the June 21, 1991 Joint Communique resulting from the U.S.-EC meeting between EC Commission Vice President Martin Bangemann and Secretary of Commerce Robert Mosbacher.

As Professor Helmut Reihlen points out:

> EC 1992, among other developments, including perhaps GATT's planned Code of Good Practice for standardizing bodies, has triggered a critical appraisal in the U.S. regarding its involvement in international standards work. The recognition is gaining ground that the U.S. can no longer sit back in the assurance that American Standards are *de facto international* standards, because of their extensive use. The response to this challenge can surely not be that the U.S. standard ". . needs legal protection. The track record of the United States in the implementation of international standards has been open to criticism; initial figures from the United States stated that fewer than 30 of the more than 38,700 privately developed standards in the United States today were ISO/IEC standards, though results of the American National Standards Institute sample study have since indicated that 22 percent of ISO/IEC standards are "identical or technically equivalent to U.S. standards. "

Concerned about assuring U.S. access to the European standardization process, Secretary of Commerce Robert Mosbacher initiated discussions in 1991 with EC Commission Vice President Martin Bangemann to work out some of the issues. On June 21st, the United States and EC governments and their respective standards developers agreed that the private sector should suggest ways to improve international standards to meet industry needs. A study group was formed to produce a joint report for Secretary Mosbacher and EC Commission Vice President Bangemann by the end of 1992.

Various private-sector standards groups have also been carrying on dialogues with European standards developers. The X3 committee, which is responsible for many information technology standards, has taken their concerns to the international standards committee, the JTCI.[63] ANSI has also been active, coordinating semiannual meetings with CEN and CENELEC, where their member organizations can share information with their European counterparts and discuss problems and issues.[64]

The Europeans and the United States differ in how to improve the situation. The Europeans stress the need for organizational reform to expedite the international standards process.[65] In contrast, the U.S. private-sector organizations call for more transparency in standards development and greater information exchange. And, whereas the Europeans look for a solution at the international level, the United States focuses more on a bilateral, U.S.-EEC exchange.

The U.S. response reflects the belief of many in the U.S. private sector that the United States is adequately represented in the international standards arena, and that its commitment to the international system is sufficiently strong.[66] To illustrate this point, they cite the number of leadership positions held, and the percentage of standards developed, by U.S. participants compared to France, the United Kingdom, Germany, Sweden, the Netherlands, and Japan (see figure 4-l). However, in the light of European unification, country-by-country comparisons are not the best measure; more telling is a comparison of the U.S. contribution to international standards with that of the European Community as a whole (see figures 4-2 and 4-3).

This private-sector view also ignores the point, which the Europeans are quick to make, that commitment to international standards is reflected not only by participation in the process, but also by a willingness to commit to the implementation of international standards. The United States has a problem in this regard insofar as the implementation of standards in the United States is—and will likely continue to be-voluntary.

Many in the private-sector also contend that the international system works well as it now exists, and does not require reorganization. They point to the increased productivity of the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), and note that both organizations have already undertaken a number of steps to shorten the standards development process.[67] However, these criteria of success maybe inappropriate. If the United States is concerned about the preemption of EEC standards, then the better measure for judging the effectiveness of international standards bodies is not whether they produce standards more rapidly, but whether these standards organizations will have developed the standards that the Europeans need by the time they are required. To address this problem, Europeans have raised the possibility of establishing a priority for developing international standards.

Standards as Marketing Devices

International standards developments will not only affect U.S. trade prospects in Europe, they will also affect U.S. competitiveness in the global market. Building on the relationships between standards and competitiveness, many industrialized nations use standards as marketing devices to sell their products in Eastern Europe and to the developing

63 The Joint Technical Committee (JTCI) is a information technology standards committee that resulted from a merger between an ISO and an IEC technical committee.

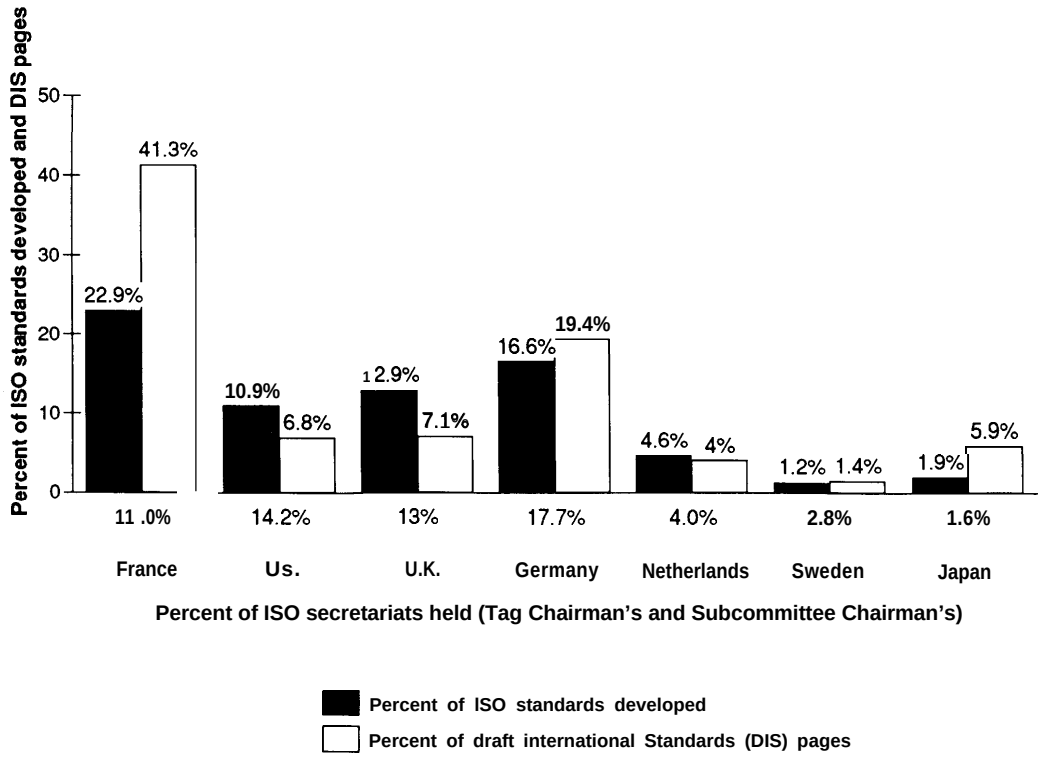
64 For a discussion of these activities, see American National Standards Institute (ANSI), *U.S. Voluntary Standardization* System: Meeting *the Global Challenge (New* York, NY: nd)

65 European draft response to Mosbacher/Bangemann communique.

66 This point represents that of several members of ANSI. OTA interviews suggest that the private sector is not, however, completely united on this point. Some would even argue the opposite,

67 See, for example, ANSI'S comments on OTA draft.

Figure 4-1—International Standards (ISO): Activity Level



SOURCE: American National Standards Institute (ANSI), 1990.

countries of the world.[68] Therefore, many of their foreign aid programs focus on standards.[69] They recognize that if they can influence the choice of standards in the developing world, trade will likely follow. This is because there are significant benefits to being the 'first' to get a standard accepted. When one standard starts to take hold, more and more companies "jump on the bandwagon' to adopt it.[70] And once a standard is in place, trading relationships can become locked in.

This kind of an arrangement is also advantageous for developing countries. They welcome help in setting up a national standards program, because they too see standards as a mechanism for building their economies. Standards will not only help them create a national market, they also provide an excellent and unobtrusive source of technology transfer, and reduce the importation of inferior products.

To stimulate trade, the EEC and Germany have provided financial support totaling $16 million to help establish an electronic component test laboratory in India. The laboratory also receives technical support from the German Agency for Technical Cooperation. In addition, specialist training in standardization is provided in Germany, the United Kingdom, the Netherlands, and Ireland. The European Commission has, moreover, conducted a study of the Association of South East Asian Nations (ASEAN) standardization base, and provided a grant of $6 million for an initial effort to implement its recommendations. Closer to home, the European

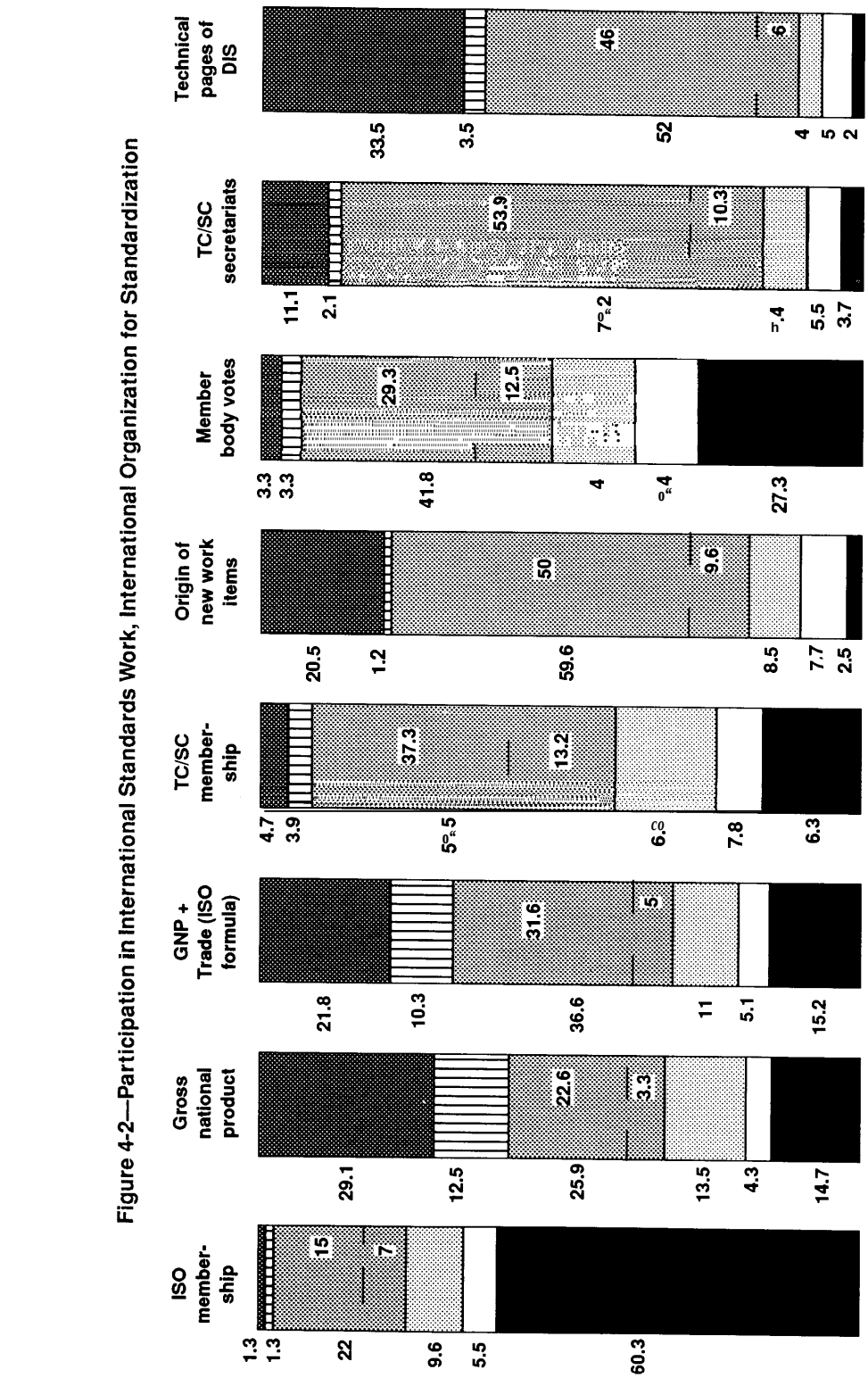
68 For a discussion of the benefits perceived to be derived from a unified market, see Paulo Cecchini, with Michael Catinat and Alexis Jacquemin, *The European Challenge: 1992: The Benefits of a Single Market* (Aldershot, UK: Wildwood House Press, 1988).

69 As described in the EEC Commission communication, *Cooperation in Science and Technology with Third Countries* (June 1990):

> Several developing countries have, by virtue of demographic and economic importance achieved a position which gives them substantial international weight either in terms of international leadership or of potential markets. It consequently behooves the Community, in the area of cooperation to reinforce their position and interests by contributing to integrating them more fully into the various European policies in such areas as commercial relations or the definition of norms and standards.

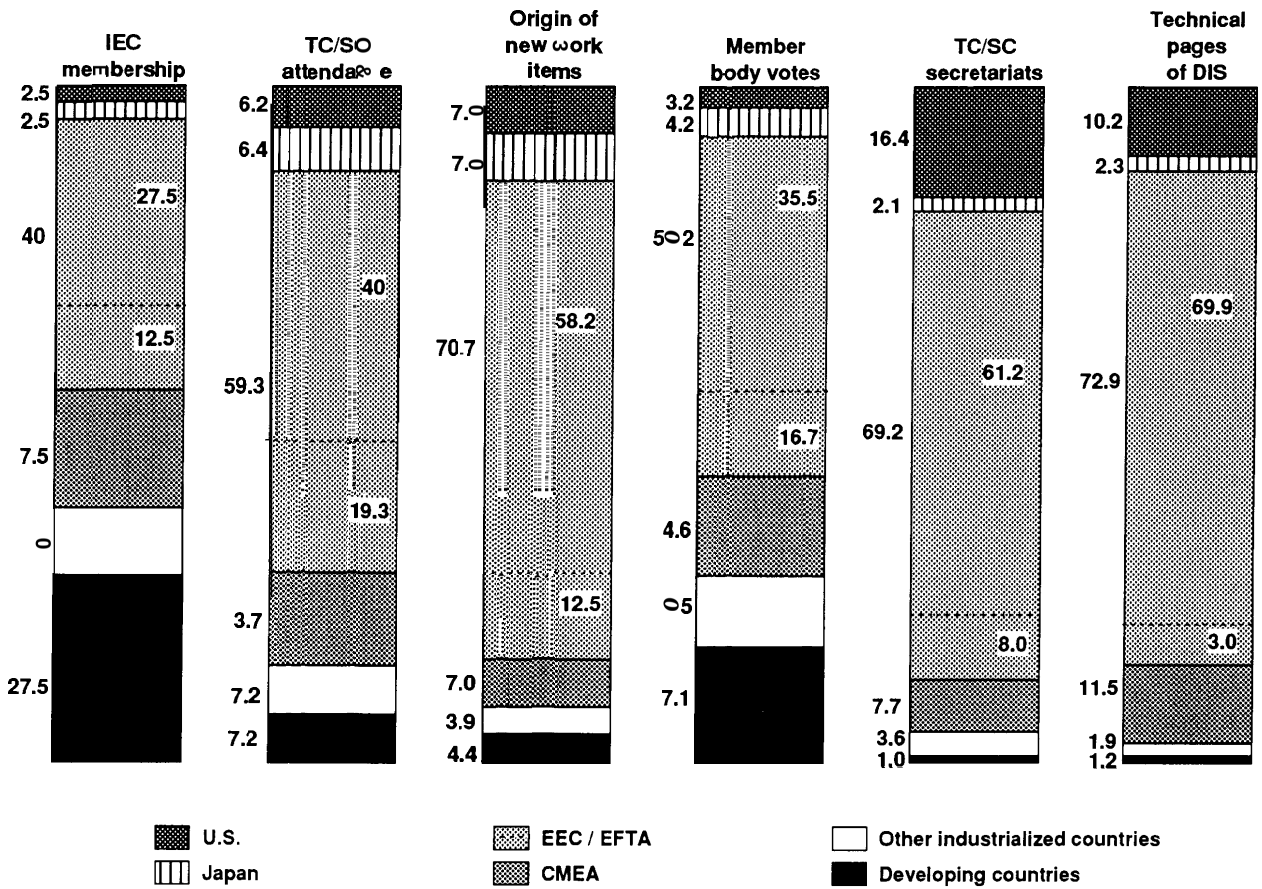
70 See, for a discussion of how the bandwagon effect impacts trade, Farrell and Saloner, Op. cit., footnote 31.

Figure 4-2—Participation in International Standards Work, International Organization for Standardization



KEY: DIS=Draft International Standards; EEC=European Economic Community; EFTA=European Free Trade Association ; SC=Subcommittee Chairman; TC=Tag Chairman.
SOURCE: International Organization for Standardization (ISO), 1988.

Figure 4-3—Participation in International Standards Work, International Electrotechnical Commission



nd Community; EFTA=European Free Trade IEC=International ec ec ss TC=Tag Chairman;

bc

R ec ec

Commission has provided Mexico $1.5 million in consultation and training in standardization, testing, and quality system certification. Also, the European Committee for Standardization (CEN), the German Institute for Standards (DIN) and the Spanish Standards Institute (AENOR) have each offered to provide a resident standards expert in Mexico. An AENOR senior staff person has completed a 4-week study of Mexico's standardization needs for the European Community .71

The Japanese are pursuing similar programs. The Japanese Five-Year Plan for Industrial Standards, for example, calls attention to the role that such technical cooperation can play.[72] In pursuit of this strategy, the Ministry of International Trade & Industry has sent technical experts to five countries to assist them in the development of their standards programs.[73] In the Philippines, for example, the Japan International Cooperation Agency sponsored a 13-person team, conducted a 500-person-day study of the Philippines national standardization system, and provided a $23.1 million grant to establish three regional labs.[74] Each year, the Japanese Government pays for 32 people from developing countries to come to Japan for technical training in standardization at courses and seminars ranging in duration from 4 weeks to 3 months.[75]

The United States has no equivalent programs. Most U.S. foreign aid programs are dissociated from trade issues. In the fall of 1989, a law was enacted directing the U.S. Department of Commerce to accept invitations from developing countries to provide technical assistance in developing standards programs except in the case of Saudi Arabia.[76] However, funding, which was to come from the private sector, has not been adequate. As of the spring of 1989, only $85,000 had been raised. According to one source, German industry raised $5 million for a similar effort in the course of 20 days.[77]

Failure to compete in this arena could make it difficult for the United States to fully benefit from the global economy and the future growth in world trade. The developing world will be a major world market, a fact that the United States cannot afford to ignore. Future trading opportunities are great. In the area of telecommunications alone, for example, estimates are that India will spend more than $40 billion over the next 10 years. Already the Association of South East Asian Nations is the United States' fourth largest trading partner.[78]

Rise of the Multinationals and Other Translational Groups

Nation states are not the only forces in motion that are recasting the world economic order. Multinational corporations play an increasingly important role, acting, at times, in ways that may be contrary to the interests of the nations of their origin.[79] Multinational corporations will be particularly influential in the area of international standards setting. Because their organizational structures span the world market, they can participate in a variety of national and regional standards activities. Given their size and independent status, the behavior and the goals they pursue will not only affect the choice of international standards; they will also influence the course of national standards processes themselves.

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71 Bob Toth, Toth Associates, personal communication.

72 According to the plan:

> Standardization and quality control, which are closely related to each other, area technical infrastructure of industries. It is necessary to propel technical cooperation in this field to correspond to requests from developing countries. From this viewpoint, efforts should be directed to securing human resources in this field. It should be noted that implementation phases of technical cooperation should be designed to incorporate appropriate measures reflecting the developing stage of country cooperation.

As cited in Robert Toth, "Promoting U.S. Competitiveness by Promoting U.S. Standards." Unpublished paper, n.d.

73 John R. Hayes, "Who Sets Standards?" *Forbes,* Apr. 17, 1989, pp. 111-112.

74 Robert Toth, Toth Associates, personal communication.

75 Japanese Industrial Standards Committee, *JIS Yearbook 1991.*

76 Dymally Amendment *to the* NIST appropriation Bill, 1989.

77 Hayes, op. cit., footnote [73]"

78 Bob TO@ Toth Associates, personal communication.

79 AS Robert Reich notes:

> Today corporate decisions about production and location are driven by the dictates of global competition, not by national allegiance. . . . Nor do trade flows between nations accurately keep score of which companies are gaining the lead. For the past two decades, U.S. businesses have maintained their shares of world markets even as America has lost its lead.

Robert B. Reich, "Who is Them?" *Harvard Business Review* (March-April 1991, p. 77.

The enhanced role of multinational corporations results from their changed character. In the past, most multinational corporations tried to exploit comparative advantage by producing or selling in a single country. In today's global environment, they seek a comparative advantage by integrating their activities on a worldwide basis.[80] To compete globally, firms must allocate all their activities among a number of countries to gain the optimum advantage.[81] Thus, depending on the particular case, it might be best for a firm to disperse its production facilities-such as design modification, fabrication, and assembly—to foreign countries, and to focus its own domestic production on the fabrication of key components .82 Or, alternatively, a firm might decide to manufacture a product domestically, but transfer abroad such downstream activities as distribution, sales, marketing, and service.[83] Vertically integrating all of these activities, multinational corporations generally take the form of large, international oligopolies. [84]

U.S. multinationals are already playing an independent role in European standards development. Not wanting to be excluded from Europe 1992, many U.S. multinationals have set up subsidiaries within the European Community. As European companies, they can be full members of European standards organizations. Thus, IBM, for example, now participates in European Telecommunications Standards Institute (ETSI) through each of its six European subsidiaries. Although IBM and other U.S. multinationals located in Europe gain through such participation, the United States economy as a whole may not.

If U.S. companies-large and small-are to have access to the European market, the United States must provide greater support for international standards organizations. However, in the current situation, this support comes from the private sector alone. If large multinational firms, who once provided the support for international standards development, now hedge their bets by participating in regional standards organizations, there will likely be fewer resources at the international level. Under such circumstances small companies who cannot afford to setup regional subsidiaries will be greatly disadvantaged.

In some cases, the conflict may be more direct. U.S. multinationals located abroad may pursue policies in Europe contrary to those in the United States. Such a situation is increasingly likely. Today, global managers must make decisions on the basis of profit margins, not nationality. Global companies can afford to be footloose. For example, warning the State of Nebraska when faced with the possibility of anew tax code, Charles Harper, head of ConAgra, a giant food-processing and commodity trading company, recently pointed out:

> The bonds of loyalty could slip over the weekend. Some Friday night, we turn out the lights-click, click, click—back up the trucks and be gone by Monday morning.[85]

Examples of such conflicts already exist in the case of standards. In spring 1991, for example, ETSI issued a draft policy involving patented standards. This policy would have required patent holders to license the standard only to EC producers or to producers in countries that adopt the EC standards. Such a policy would not only have prevented U.S. firms from using the patent on an equal basis; it would also be a strong inducement for other countries to adopt EC standards. American companies as well as ANSI opposed such policies. When asked about the EEC'S intentions, commission staff point out that the most ardent supporter of this policy within the commission is none other than the British subsidiary of Motorola.[86] Such incidents not only hurt U.S. industry; they also confuse Europeans,

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80 Porter, op. cit., footnote 12, p. 19.

81 Ibid., p. 23.

82 Ibid., p. 45.

83 As Michael Porter has said:

> In global competition, a country must be viewed as a platform and not as a place where all of a firm's activities are performed.

Ibid.

84 As Gilpin has pointed out, the ke, factors accounting for the expansion and success of this vertical form of multinational enterprise are similar to those that led to the domination of the Nation's economy by large oligopolistic corporations. Gilpin, op. cit., footnote. 9, p. 241.

85 As cited in Robert Reich, "Who is Them?" op. cit., footnote 79, p. 78.

86 Interview, EC Commission staff. This position is understandable from Motorola's point of view. The European Community requires that all Community procurements be based on European standards. Motorola hopes to capture the European market for cellular digital radio. If its standard is adopted, its competition will be excluded in a situation where the winner takes all.

making them question whether the United States has a hidden agenda.[87]

The policies pursued by multinationals abroad may also have an impact on the United States policymaking process. Many in the environmental community fear, for example, that the Uruguay Round of the GATT allows large corporations to make key environmental decisions, not on the basis of environmental criteria, but rather according to criteria such as economic growth, profit maximization, and deregulation.[88] Some even believe that multinationals have a conspiratorial bent, insofar as they avoid dissident groups by circumventing the traditional policymaking process and working through the Office of the U.S. Trade Representative. For this reason, these groups have begun to redefine themselves as translational organizations. They now encourage their members to bypass domestic decisionmakers, going directly to international standards organizations. If transnational environmental and consumer groups join multinationals to set policy internationally, the U.S. Government will have a diminished voice.

Multinational corporations may also generate greater tensions within domestic standards development bodies, especially ANSI. ANSI has always had a difficult time balancing the multiple interests that constitute its membership. Juggling these interests will likely be even more difficult in the future, when some companies are confined to working through ANSI and others have the advantage of working through regional and other national standards making bodies. Reportedly, a number of large companies have left ANSI within the past few years, and ANSI has had to be especially diligent to prevent the departure of others.[89]

Trend Towards and Information-based, Knowledge Society

The United States and other advanced industrial countries are rapidly evolving into information-based, knowledge societies, where the creation, use, and communication of information plays a central role. In the economy, information now serves as a primary resource, an important factor of production. It is becoming, moreover, a prerequisite to the development and allocation of other resources. As such, it is treated less and less as a free good, and more and more as a commodity to be bought and sold in the marketplace. And, as the economic value of information increases, so too will the economic rewards of those who have the greatest access to it. This trend will greatly affect standards developments. Standards embody information, and like any other information commodity, their future availability and use will depend increasingly on market forces.

This trend towards an information-based economy results in part from the development and widespread deployment of information and communication technologies. The emergence of these technologies has increased the speed at which information can be communicated; increased the quality of information that can be collected, stored, manipulated, and transmitted; increased access to information; and enhanced our ability to use information to account for past actions and to predict future events.

These technologies provide numerous ways of improving efficiency, increasing productivity, and thus engendering growth. Information is, for example, reusable and, unlike capital resources such as steel and iron, it requires very few physical resources for its production and distribution.[90] Moreover, information can now be used not only to substitute

87 Particularly confusing to the Europeans is the fact that USTR has seemed to support Motorola in this position. Some explain this, saying that many of Motorola's executives were once employed by the USTR. Ibid.

88 Interviews Patricia Bauman, Bauman Foundation Fran Weber, Audubon Society, and Mare Ritchie, Institute for Agriculture and Trade Policy. See for one discussion, Steven Shrybman, *International Trade and the Environment* (Toronto, Ontario: Canadian Environmental Law Association October 1989) . For a European Perspective, see *Gatt, Agriculture, and Environment: Towards a Positive Approach,* report of a conference organized by the Center for Agriculture and Environment, held in the Netherlands, on Sept. 14-15, 1990.

89 ANSI memo to bored of directors.

90 See Harlan Cleveland, "The Twilight of Hierarchy: Speculations on the Global Information Society," Bruce R. Guile (cd.) *Information Technologies and Social Transformation (Washington* DC: National Academy Press, 1985), p. 56.

more efficiently for labor; it can also be used to improve the overall efficiency of the productive process itself. As productive processes become increasingly complex, the largest reserve of economic opportunities will be in organizing and coordinating productive activity through the process of information handling.[91]

This growing importance of information to the economy is evident from the continued growth of the information sector of the economy, a trend that has been paralleled in other advanced industrialized societies. In fact, it was to highlight such changes that terms such as the "information society' and the "information age' were first employed.[92] The most recent analysis estimates that the information sector constitutes 34 percent of GNP, and accounts for about 41.23 percent of the national labor force.[93]

The changing economic role of information can also be seen by examining how information technologies are being used by business and industry. Businesses are now applying computer technology to almost all of their activities: from recruiting to laying off workers, from ordering raw materials to manufacturing products, from analyzing markets to performing strategic planning, and from inventing new technologies to designing applications for their use. These technologies, moreover, are being applied not just to traditional tasks; the diffusion of new technologies is also being used to reconfigure the nature of the business process itself.[94]

Because of its new economic and managerial importance, information is becoming much more commercially valuable. Businesses have always been willing to pay for information such as market research and economic forecasts. Today, however, they are not only buying more; they are willing to pay much higher prices for it. For example, American business firms might pay $800 per year for a monthly professional information service, or perhaps $15,000 for a market research report shared by others in the industry.[95]

The new technologies provide new ways and opportunities to meet these burgeoning information needs. They allow information to be processed in a variety of new ways, adding value to it from the point at which it is created or composed to the point at which it is assimilated or used. As the opportunities for creating new information products and services have increased, so too has the number of commercial providers. Taking advantage of the increased demand for information, the new technologies have spawned a rapidly growing industry. This industry is relatively young, having developed hand in hand with the new technologies. More than half of the companies that comprise it were formed since 1970. Nevertheless, it is one of the fastest growing industries in the economy.[96]

Given its increased value, information will most likely be exchanged less freely. This shift will create tensions and problems in a society such as ours where information serves critical social and political purposes as well as economic ones. Consideration must be given, and perhaps new decisions made,

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91 Charles Johnshur, "Information Resources and Economic Productivity," *Information Economics and policy 1* (North Holland: Elsevier Science Publishers, 1983), pp. 13-35.

92 Fritz Machlup was one of the first to note these changes; and to measure the information sector in his pioneering work, now a classic, The Production *and Distribution of Knowledge in the United States,* Others have followed this tradition, By far, one of the most ambitious efforts to date has been the innovative work of Marc Uri Porat for the Office of Telecommunications in the Department of Commerce. In 1967, according to Porat, information activities accounted for 45.2 percent of the GNP 25.1 percent in the "primary information" sector (which produces information goods and services as final output) and 21.1 percent in a "secondary information" sector (the bureaucracies of non-information enterprises).

93 Michael Roger Ruben and Mary Taylaor Huber, The Knowledge *Industry in the* United States: *1960-1980.* This volume updates work done by Fritz Machlup. In their breakdown of the information sector of the economy, Rubin and Huber note that, leaving education aside, the contribution of knowledge production to GNP increased from 17.9 percent in 1967 to 24.5 percent in 1980. The contribution of education, on the other hand, fell from 16.6 percent to 12.0 percent during the same period, a decline that accounts for the fact that knowledge production's overall contribution remained relatively stable at about one-third of GNP.

94 See Eric K, Clemons and W. Warren McFarlan, "Telecom: Hook Up or Lose @~" *Harvard Business* Review, July-August 1986, pp. 91-97; see also Peter G.W. Keen, *Competing in Time: Using Telecommunications for Competitive Advantage* (Cambridge, MA: Ballinger Publishing CO., 1986); Donald A. Marchand and Forest W. Horton, Jr., *Infotrends: Profiting From Your Information Resources (New* York, NY: John Wiley and Sons, 1986); and James J. Cash, Jr., F. Warren McFarlan, and James L. McKenney, *Corporate Information Systems Management: The Issues Facing Senior Executives* (Homewood, IL: Irwin, 1988).

95 Christopher Burns, Inc. Th, Economics *of Information,* contract report prepared for the Office of Technology Assessment, U.S. Congress, 1985.

96 Ibid.

about intellectual property rights and the rules governing information dissemination, [97]

These tensions are also becoming increasingly apparent in the standards world. Standards share many characteristics of information, and standards developers are similar to publishers in a number of ways. Many are dependent on information sales for their existence. And, like the new breed of information providers, they have much to gain in an information-based economy, where the value of their product is greatly enhanced. Like information providers, moreover, they can use information and communication technologies to distribute and add value to their products. These opportunities, however, also create conflicts, since standards are developed both voluntarily and by committees. Equally, if not more, important, standards are public goods, whose purpose is to be shared.

The case of "Project Bruno" illustrates this conflict. Pressed to speed up the delivery of standards, the International Telecommunications Union (ITU) began a program to put standards "online." ITU staff estimated that the project would take 8 years. In October 1991, the ITU commissioned an experiment, asking a group of volunteers, led by Carl Malamud, to put International Telephone and Telegraph Consultative Committee (CCITT) and International Radio Consultative Committee (CCIR) standards (including the 19,000 page Blue Book) on the Internet-a world-wide communication network comprised of over three million users (see box 4-A). The experiment was open ended in terms of time. Within a few weeks, these standards were listed on 22 computer servers around the world, where they could be accessed by Internet users. The project was extraordinarily successful, so much so, in fact, that after 90 days Pekka Tarjanne, Secretary General of the ITU, abruptly called it to a halt.[98] Tarjanne explained the termination of the project saying, 'We know what can and cannot be done. " Reportedly, however, "politics," financial concerns, and concerns about intellectual property rights played a major part in the ITU'S decision.[99]

Competition among standards organizations to sell of standards will also be more intense. Domestic standards bodies will be competing, not only with one another for an increasingly lucrative market; they will also be facing standards developers from other countries who, taking advantage of communications and information technologies, will be able to compete on a global scale. Although increased competition may, in some cases, help to lower the costs of standards, it will also create problems. Standards tend to be underfunded, since they are quasipublic goods. If competition is too intense, the limited resources available for developing standards will be spread too thin. Competition will also be detrimental, if standards bodies become so preoccupied with sales that they fail to meet the needs of their clients and the Nation.

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97 For a general discussion of these issues see, U.S. Congress, Office of Technology Assessment, *Intellectual Property Rights* in *an Age of Electronics and Information* OTA-CIT-302 (Washington DC: U.S. Government Printing Office, April 1986).

98 personal communication Carl Malamud and correspondence between Carl Malmud and Secretary General Tarjanne. See also, Carl Malamud, "Are Secrets Standards? Even ANSI Secrets," *CommunicationsWeek*, Oct. 7, 1991 and Sharon Fisher, "ITU Standards Program to End," *CommunicationsWeek*, Dec. 23.1991, pp 3,39.

99 As interpreted by Malamud:

> The reason for this abrupt reversal in policy is a lesson in bureaucratic politics. Tarjanne wanted to make the ITU more relevant to the world, and what better way than making its work available to an internetwork of 4 million people, growing at 15 percent to 20 percent per month? The bureaucracy fought this move every step of the way. They felt threatened., If we gave away the standards, there would be fewer jobs at the ITU. There would be less control over distribution and more pressure to start responding to the realities of engineering in the rest of the world.

Carl Malamud, "ITU Decision Turns Back the Clock. *CommunicationsWeek*, Dec. 23, 1991, pp. 3,39.

Box 4-A—ITU Standards Available Via Global Network

Thanks to a major state-of-the-art project undertaken by the Digital Resources **Institute at the** University of Colorado, thousands of CCITT and CCIR standards are now being provided through the worldwide open network-of-networks known as the Internet.

How To Get the Standards

- **Direct Internet access.** Anonymous FTP via the Internet to: (bruno.cs.colorado.edu);IP address is (128.138.243.151)
- **E-Mail message.** Send an E-Mail message to: (infosrv@bruno.cs.colorado.edu)

Follow the instructions in the attached annex for either FPT or E-Mail access

Notes

1. You can also send mail to (infoserve@bruno.cs.colorado.edu) and put the word HELP in the body of the message. You will get back instructions.
2. There is no charge for this experimental service.
3. Additional servers will be operational at several other locations throughout the world over the coming months. The standards of other organizations are expected to be available on servers. Advanced search routines are being developed.
4. Questions may be directed to Carl Malamud at the University of Colorado (carl@malamud.com) or Tony Rutkowski at the ITU (amr@cernvax.cern.ch), tel: +41 227305207. E-Mail is preferred

Who Is Bruno?

The server being used at the Digital Resource Institute at the University of Colorado is named after Giordano Bruno.

Giordano Bruno (1548-1600) was a member of the Dominican order. The Dominicans had kept alive the Greek secrets of memory, first perfected by the poet Simonides of Ceos (c.556-468? B.C.). Before the printing press, mnemonic methods for remembering verse or other forms of knowledge were the only ways to pass that information on.

Bruno, after mastering the Dominican secrets, revealed them to the rest of the world in his classic, *Shaddow of Ideas (1582).* A noted advocate of free thought, Bruno was accused by the Inquisition in 1592 of various acts of heresy, including making bad jokes about God. He was convicted and burned at the stake in 1600.

SOURCE: *Friends of Bruno Newsletter, No.* **I-B, Oct. 21, 1991, via e-mail.**

Appendixes

Appendix A
A Framework for Assessing Standardization Issues

To approach the discussion of standards objectively, one must begin with a sound conceptual idea of what constitutes a standard and how standards come about. This kind of analytic framework provides an objective basis for interpreting stakeholder viewpoints and adds rigor to the analysis. By identifying the key relationships in the standards setting process, it suggests the questions and issues that must be examined.

What Is Meant by Standards

An analytic framework must begin with definitions, since definitions determine the scope of analysis. Moreover, the choice of definitions can have significant policy implications. How the term ''standards' is used in this study, for example, will determine the terms of the debate and the range of government options developed for dealing with problems in the standards setting process.[1] The role for government may differ, for example, depending on whether one's reference is product standards or safety and environmental standards.

Broad definitions used in everyday speech are generally not helpful. They are too vague to guide analysis. Precision is sacrificed for the sake of comprehensiveness. This is clearly the case for standards definitions. They tend to be exceedingly broad, in order to cover the full range of standards found throughout society. Included among the definitions of standards in Webster's Dictionary are:[2]

> "something established by authority, custom, or general consent as a model or example," and
>
> "something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality. "

Although these definitions provide an overall notion of what constitutes a standard, they do not help focus the analysis. For this reason, researchers operationalize their definitions in accordance with the specific questions to be asked and problems to be solved. Economists, for example, generally seek to know how and under what circumstances standards are set in the marketplace. Accordingly, they tend to view standards as an agreed upon set of specifications that define a particular product or that allow products to interoperate. Anthropologists, on the other hand, focus on the question of how individuals relate to their cultures. Thus, they consider standards to be the accepted rules of behavior that facilitate social interactions and that help individuals find their places in the world. Government bureaucrats are likely to view standards as the means to address a societal concern or to achieve a social end. They often equate standards with regulations.

This study asks how U.S. standards and standards development processes might affect U.S. trade. Thus, it needs to consider all standards and standards processes that influence national economic performance. For this purpose, three different kinds of standards are relevant. These include product standards, control standards, and process standards.

Types of Standard

Product Standards—Product standards embody information. By specifying the characteristics of a product, they allow for product identification, interoperability, and quality control. Product standards can have a number of economic effects, both negative as well as positive. For example, by reducing consumer search costs, product standards will likely promote trade. On the other hand, when standards serve to limit product offerings, they may have the reverse effect. Product standards will also have an impact on innovation rates. If adopted prematurely, standards may inhibit technology improvements. But, when they allow for the development of competing, complementary products, standards can serve to encourage innovation.[3] When applied to the internal production process, standards can help increase efficiency and assure quality, thereby improving the overall competitiveness of a firm or industry. Whether or not standards effects will be beneficial or not in any given instance will depend on factors such as market structure[4] and the pace of technology change.

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1 As Ross E. Cheit notes in quoting Charles Lindblom and David Cohen:

> . . .we do not discover a problem 'out there,' we make a choice about how we want to formulate a problem. That choice reflects certain values and in turn constrains the realm of possible solutions.

Ross E. Cheit, Setting *Safety Standards: Regulation in the Public and Private Sectors* (Berkeley, CA: University of California Press, 1990), p. 150.

2 Webster's *New Collegiate Dictionary* (Springfield, MA: G&C Merriam Co., 1977), p. 1133.

3 See Paul A. David, ''Some New Standards for the Economics of Standardization in the Information Age,'' Partha Dasgupta and P.L. Stoneman (eds.), *The Economic Theory of Technology Policy* (London: Cambridge University Press, 1987), ch. 8; and Paul David and Julie *Ann Bunn, Information Economics and Policy, vol. 3.*, fall, 1988, pp. 165-202.

4 For discussions of the impact of market structure on standards see, Marvin Sirbu and Steven Stewart, "Market Structure and the Emergence Of Standards' (mimeo), Carnegie Mellon University, October 1986; and also Timothy Bresnahan and Amit Chopra, "Users Role in Standard Setting: The Local Area Network Industry," in *Economics of Innovation and New Technology,* vol. 1, No.1/2, 1990.

Control Standards-Control standards are designed to address a societal hazard or problem. They generally define a range of acceptability with respect to the design, performance, and/or use of a product. Often taking the form of regulations, they range from such things as building codes to fuel economy standards.

Control standards have a number of economic impacts, and hence a potential to influence trade. They affect the supply and demand of a product, through their impacts on costs of production, price, and consumer perceptions. Fuel economy standards and airbag requirements, for example, not only increase the cost of automobile production, and the price consumers have to pay for cars; they may also create new marketing opportunities and new bases for competition that the market had overlooked.[5]

These impacts are global in their effects. Where U.S. standards are more stringent than those in other countries-as in the case of U.S. standards regulating tuna harvesting to protect dolphins-they may be perceived as nontariff trade barriers.[6] On the other hand, where-as in the case of fuel economy standards-foreign manufacturers are better prepared than their U.S. counterparts to meet U.S. requirements, standards can serve to make U.S. firms more vulnerable to foreign competition.[7]

Process Standards—process standards facilitate and support socioeconomic transactions and interactions. They define roles and relationships, establish the rules for interpreting behavior, and specify the way in which a particular procedure or process is executed. Process standards are inherent in all social interactions. Interpersonal relations cannot occur without some degree of mutual expectation. Language, itself, is based on a common understanding, as are simple gestures.[8] Shared expectations give coherence and meaning to social life. They are necessary for cooperation. When reenacted and reinforced over time, such normative expectations give rise to "standards" of behavior.[9]

Process standards also serve to govern economic interactions. In preindustrial societies, for example, economic interactions were often regulated by family relationships and codes of human behavior.[10] Bureaucracy provided a parallel function in more complex social organizations.[11] And the assembly line process was critical to the mass production of standardized products.[12] Moreover, when with the development of the railroad and other forms of modern transportation trade was extended over vast regions, procedures for exchange

5 It is interesting to note, for example, that the United States is now a net exporter of airbags to Japan. Clarence Ditlow, Center for Auto Safety, personal communication.

6 See, for one discussion, Keith Bradsher, "U.S. Ban on Mexico Tuna is Overruled," *The New York Times*, Aug. 21, 1991, pp. D1 and D3.

7 See for one discussion Rob Atkinson and Les Garner, "Regulation as Industrial Policy: A Case of the U.S. Auto Industry," *Economic Development Quarterly*, vol. 1, 1977, pp. 358-373.

8 Irving Goffman, *Frame Analysis (New* York, NY: Harper and Row, 1974).

9 Norms " . . designate any standard or rule that states what human being should or should not think, say, or do under a given set of circumstances.' Judith Blake and Kingsley Davis, "Norms, Values, and Sanctions," Robert E.L. Faris (cd.), *Handbook of Modern Sociology* (Chicago, IL: Rand McNally, 1964), p. 456. They guide the behavior of individuals belonging to a group. People conform to norms not only for fear of punishment, but also because norms are internalized, *so* people believe *they* correctly define *the right thing to do.* John And Erma Perry, *The Social Web: An Introduction to Sociology (New* York, NY: Harper and Row, Publishers, 1979), p. 95.

lo For a *discussion* of the relationship between social and economic interactions in preindustrial times, see Neil J. Smelser, *Social Change in the Industrial Revolution: An Application of Theory to the Lancashire Cotton Industry 1770-1840* (London: Routledge and Kegan Paul, 1970).

11 As James Beniger notes,

> One example from within bureaucracy is the development of standardized forms. This might at first seem a contradiction, in that the proliferation of paperwork is usually associated with a growth in information to be processed not with its reduction. Imagine how much more processing would be required, however, if each new case were recorded in an unstructured way, including every nuance and in full detail, rather than by checking boxes, filling blanks, or in some other way reducing the burdens of the bureaucratic system to only the limited range of formal, objective, and impersonal information required by standardized forms.

James R. Beniger, *The Control Revolution: Technology and the Economic Origins of the Information Society* (Cambridge MA: Harvard University Press, 1986), pp. 15-16.

12 As described by Radford,

> . . . a uniform product is most economically obtained by making all the contributory processes equally uniform, as nearly as may be with consistency to the requirements of manufacturing economy. Weaving a piece of cloth on the loom is a continuous process of assembling various standardized elements or like parts. It can hardly be called interchangeable work, because there is no possibility of interchanging parts after the goods are completed. Yet the general principle of standardization of process holds. It is advantageous commercially and technically to hold the process to uniform standards withispecified limits or allowed variations.

G.S. Radford, *The Control of Quality in Manufacturing (New* York: NY: The Ronald Press Co., 1922), p. 275.

also came to be standardized-as in the case of bills of lading.[13]

As we move into an information-based, networked economy, economic interactions will likely be governed by standardized electronic procedures, such as electronic data interexchange (EDI). EDI standards not only establish communication protocols for business interactions, they also determine the role relationships between suppliers, manufacturers, and consumers (see box A-l).

Standardization Processes

Just as there are three different kinds of standards, so there are also three different methods of achieving these standards. Standards can be set in the marketplace on a de facto basis; they can be developed within the organizational framework of a standards setting body, and they can be established through administrative or regulatory processes.

The De Facto Standards Setting Process—De facto standards are set in the marketplace, through the process of exchange.[14] They evolve from the bottom up, in accordance with the forces and mechanisms that drive the market.[15] How well the standards process works depends largely on the functioning of the market.

When the market operates effectively, appropriate standards will emerge at the right time through the process of supply and demand.[16] Producers will agree on the "best" standard for a product in the face of competition from other suppliers and the demand of users. Producers may press for the adoption of their own standards. Or they may select strategically from among other competing standards, evaluating each in terms of its potential impact on costs of production, profitability, and market share. Users will demand standards that reduce purchasing prices, improve utility, and are easily integrated with other products and systems.

The market is said to fail when appropriate standards—measured in terms of efficiency-do not emerge in a timely fashion. Economists point out that market failures can occur for several reasons, some of which are directly related to the nature of standards themselves. Standards, for example, exhibit some of the characteristics that economists call 'public goods. 17 Public goods are those goods whose benefits are available to everyone and from which no one can be excluded. Thus, no one can fully

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13 As noted *by* Kirkland:

> A national railroad system required business innovations facilitating joint and through operations. Passengers must make connections with tolerable certainty and ease; the freight cars of a corporation must not come to a stop at some corporate terminus where an agency would have to unpack their cargo and transfer it to the cars of another carrier, like as not just across the street. Almost unchronicled and undated, the railroads introduced through bills of lading, and though shippers still carped at their limitations, these bills became the accepted method of freighting in the seventies;

Edward C. Kirkland, *Industry Comes of Age: Business, Labor, and Public Policy (New* York, NY: Holt, Rinehard, and Winston, 1961), p. 49.

As Karl Polany notes, in preindustrial societies trading relationships were governed by standards relating to magic, etiquette, and norms of reciprocity. See Karl Polany, *The Great Transformation: The Political and Economic Origins of Our Time* (Boston, MA: Beacon Press, 1957 cd.), p. 57.

14 Exchanges are reciprocal transfers of valued things between two or more autonomous units within a system. Societies have developed major institutional mechanisms to facilitate exchange transactions. The generic institution is, of course, the market, but there area variety of other political and social institutions that carry out parallel functions. Underlying all exchange concepts of social behavior is the concept of goal or outcome- some configuration of system elements that is valued and sought. See for discussion, G.C. Homans, *Social Behavior: Its Elementary Forms (New* York, NY: Harcourt Brace and World, 1961); P. Blau, *Exchange and Power in Social Life* (New York, NY: John Wiley and Sons, 1964); and W. Ouchi, "Markets, Bureaucracies, and Clans," *Administrative Science Quarterly,* vol. 25, 1980, pp. 129-42.

15 As Garth Saloner describes:

> Typically, de facto standards emerge as more and more agents adopt a focal alternative. The bandwagon process builds on its own momentum as the set of adopters of the standard grows making it even more attractive for others. Eventually the standard is so widely adopted that it is self enforcing. The benefits of going with the crowd become irresistible.

Garth Saloner, "Economic Issues in Computer Interface Standards," *Economic Innovation & New Technology, vol.* 1, No. 1/2, 1990, p. 147.

16 In a well functioning market, economic relations are governed by self interest, so it is self interest that drives outcomes. Accordingly, producers seek higher profits; workers better wages and improved quality of work life; investors higher returns on their investments; and consumers higher quality products at lower prices. The market is considered to work well when it maximizes the goals of efficiency and economic growth. This situation is most likely to occur when each individual and each group in the system carry out rationally conceived, specified roles that, taken together, are designed to maximize production. The goal of efficiency is achieved by economizing; decisions are made on the bases of cost/benefit analyses, and technology is applied to substitute more efficient processes for less efficient ones. The market will work most effectively when it replicates a state of perfect competition in which each producer selects the combination of factors of production that will maximize profits and each consumer seeks to maximize preferences. See, for discussions of the assumptions and values that underlie the marketplace, Duncan MacRae, *The Social Function of Social Science (New* Haven, *CT:* Yale University Press, 1976), especially chs. 5 & 6. See also Robert Heilbroner, *The Nature and Logic of Capitalism (New* York, NY: W.W. Norton and Co., 1985).

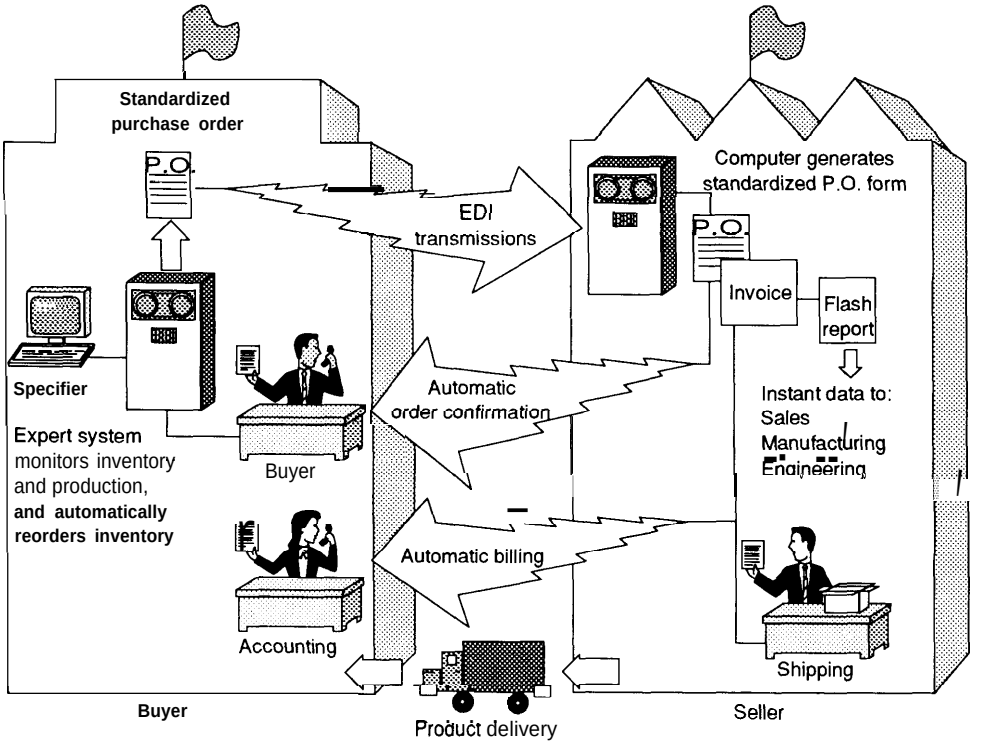
17 Pure public goods will not be produced privately. There are only a few pure public goods, one example being national defense. Other goods, like education and standards, are impure public goods. These combine aspects of both public and private goods. Although they serve a private function, there are also public benefits associated with them. Impure public goods may be produced and distributed privately in the market or collectively through government. How they are produced is a societal choice of significant consequence. If decisions about impure public goods are made in the market, on the basis of personal preferences alone, then the public benefits associated with them may not be efficiently produced or equitably distributed. See Edwin Mansfield, *Macroeconomics Theory and Application (New* York, NY: W.W. Norton, 1970)

Box A-l—Electronic ***Data Interexchange***

Electronic data interexchange (EDI) is a notable example of how information and communication technologies are emerging as important strategic tools for efficient and effective business operations. EDI is essentially the modern, computer-based method by which companies order, invoice, and bill their products and services. Such common transaction functions as invoices, shipping notices, and bills, which traditionally have entailed the transfer and processing of paper documents, are replaced by electronic transfers between the businesses' computers.

Electronic data interexchange improves the efficiency and effectiveness of operations by empowering businesses to purchase supplies and to produce and distribute products precisely when and where they are needed. The company's computer system, for example, will initiate a purchase order and execute the purchasing transaction when an item is requested and removed from the inventory. The price, terms, and conditions of the contract are all stored in the computer. In addition to the considerable savings gained as inventory costs are reduced, EDI also minimizes human clerical error and the considerable processing costs involved with paper transactions. By reducing or eliminating the prolonged and often error-plagued paper trail, large retailers and manufacturers are able to gain a competitive advantage by streamlining transactions with their suppliers and buyers.

SOURCE: Office of Technology Assessment, 1992.



How electronic data interexchange internally and externally expedites business transactions.

SOURCE: Reprinted from *Datamation,* Mar. 15, 1988 Copywrite 1990 by Cahners/Ziff Publishing Associates, L.P.

appropriate the benefits. As a result, public goods are underproduced. Standards often fall into this category.[18]

Other market failures may also weaken standards development processes. If the most efficient standards choices are to be made, all interested parties must have access to accurate and timely information.[19] However, information about standards. like standards themselves, is a public good, and is therefore likely to be underproduced. Even when standards-related information can be pack-

18 C. Kindelberger, "Standards as Public, Collective, and Private Goods," Kylos, vol. 36, pp. 377-395; see also Sanford Berg, "Technical Standards as Public Goods: Demand Incentives for Cooperative Behavior, ' ***Public Finance Quarterly, 17,*** **January 1989, pp. 35-53.**

19 For a discussion of market failures due to lack of information, see **Joseph** Farrell and Garth Saloner, **"Coordination Through Committees and** *Markets, ''RandJournal of Economics,* **vol. 19, summer 1988, pp. 235-252; and Joseph Farrell and GarthSaloner, "Standardization Compatibility, and Innovation" Rand Journal of Economics, vol. 16, spring, 1985, pp. 70-83.**

aged for sale like other commodities, thus yielding an adequate return, its price may limit distribution so that people have insufficient information to make sound decisions.

Some kinds of technologies are subject to greater market failures than others. For example, networked technologies—such as information and communication technologies-often have large installed bases, making it particularly costly for users to shift to a new, more technologically advanced standard. Thus, they may fail to adopt the socially optimal standard, due to what economists call ''excess inertia."[20] At the same time, these technologies also exhibit "increasing returns to adoption," a situation that occurs when the benefits to the user of a technology increase with the number of users. Under these circumstances, the wrong standard might be chosen due to "excess momentum. " Not wanting to be left off the network when a major adopter moves to a new standard, users may rush too quickly to jump on the bandwagon.

The Voluntary Consensus Process—Standards can also be set through organizational processes that reduce transaction costs and facilitate information exchange and negotiation among key players.[21] Such processes can provide for better coordination than the market when levels of uncertainty are high, when there are frequent recurring exchange activities among the parties, and/or when information exchange is complex.[22] These three conditions often occur in the area of standards development.

Just as markets function in a somewhat predictable fashion, so too do organizations.[23] Moreover, organizations, like markets, facilitate exchange transactions.[24] However, whereas marketplace participants act independently of one another, those involved in organizational activities are joined together and cooperate to achieve their respective goals.[25] To understand organizational behavior, therefore, one needs to look at organizational goals and the norms and role relationships that are designed to achieve them. The more formal the organization, the more defined these relationships are.[26] But, even in informal organizations, stable, consistent relationships eventually develop as behavior, attitudes, values, and criteria come to be associated with specific activities. Organizations can survive only so long as they continue to fulfill the needs and expectations of their members.[27]

In the United States, standards setting in voluntary consensus bodies is nonhierarchical. As in the case of the marketplace, decisions tend to rise from the bottom. Because relationships are somewhat fluid, these standards

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20 Joseph Farrell and Garth Saloner, "Horses, Penguins and Lemmings,'' H. Landis Gabel (cd.), *Product Standardization and Competitive Strategy* (Amsterdam: North Holland, 1987), p. 11. As the authors note:

> Excess inertia arises when not enough users are willing to go out on a limb by adopting the new technology. This is most likely when network externalities are strong and there is a great deal of uncertainty about whether a lead would be followed.

21 As noted by Saloner:

> . . .another major advantage of the committee system over de facto standard setting is that the committee is more likely to lead to the adoption of a single standard whereas with de facto standardization rival "standards" can battle out in the market place, diminishing the network externalities on both. Moreover, committees are able to workout technical compromises, performing a useful function in the process. On the other hand, committees are often criticized for their slowness; consensus building takes time and participants with a lot to lose after their preferred standard is not adopted may delay adoption of a rival standards.

Saloner, op. cit., footnote 15, 1990, p. 147.

22 Oliver E. Williamson, *Markets and Hierarchies; Analysis and Antitrust Implications* (New York, NY: The Free Press, 1975); See also, Robert E. Parks, "Economics and Standards: Sharing the Cost of Doing Business," *Optics and Photonics News,* January 1992, p. 59.

23 As defined by social psychologists Daniel Katz and Robert L. Kahn:

> All social systems consist of the patterned activities of a number of individuals. Moreover, these patterned activities are complementary or interdependent with respect to some common output or outcome.

Daniel Katz and Robert L. Kahn, *The Social Psychology of Organizations (New* York: John Wiley& Sons Inc., 2nd cd., 1978), p. 21. See also Karl E. Weich, *The Social Psychology of Organizing (New* York, NY: Random House, 1979).

24 See, for a discussion, L.B. Mohr, "The Concept of Organizational Goal,'' *The American Political Science Review,* vol. *67, 1973,* pp. 470-81.

25 Each participant has a goal or criteria for judging the successor failure of each transaction. However, loyalty to an organization often supercedes personal goals. As Duncan MacRae has pointed out:

> [Exchange theory] cannot account for the devotion of a particular member of a group when self-interest might dictate that he leave, remaining in it even as its prospects decline, out of loyalty to the organization, his fellow workers and members, and its symbols.

Duncan MacRae, op. cit. footnote 16, p. 225.

26 As described by Blau and Scott, for example:

> Formal organizations exist when the goals to be achieved, the rule the members are expected to follow, and the status structure that defines the relationships between them (the organizational chart) have not spontaneously emerged in the course of social interaction but have been consciously designed a priori to anticipate and guide interaction and activities.

P.M. Blau and W. R. Scott, *Formal Organizations (San* Francisco, CA: Chandler, 1962), p. 5.

27 As noted by Katz and Kahn:

> As human inventions, social systems are imperfect. They can come apart at the seams overnight, but they can also outlast by centuries the biological organisms that originally created them. The cement that holds them together is essentially psychological rather than biological. Social systems are anchored in the attitudes, perceptions, beliefs, motivations, habits, and expectations of human beings.

Op. cit., footnote 23, p. 37.

bodies depend on participants acting within the organizational norms that define the purpose of group participation and interaction. Most American standard development bodies are governed primarily by norms relating to due process and voluntary consensus. When the gap between individual behavior and these norms becomes too wide, these standards bodies will lose their legitimacy and the support not only of their members but also of the larger society of which they are a part.

People participate in the voluntary standards development process for a number of reasons. They may, for example, want to influence the development of standards,[28] or they simply may want to keep abreast of technological developments.[29] However, participation is not without costs. In voluntary organizations, members must not only cover the administrative costs of the organization; they must also provide the personnel needed to develop standards. These costs are considerable, so members expect a return for their investment. Continued participation requires observable--if not measurable--membership benefits. When benefits appear to be lacking, voluntary standards bodies will become ineffective and eventually fail.[30]

The incentive to participate will likely vary in different industries. In industries such as telecommunications, for example, the incentive to participate in standards setting will likely be high. If communication systems fail to work together, there can be no services to sell. Support for standards setting will also be greater in industries comprised of a few large companies. They are more likely to see a return on their investments, since there are fewer to share the benefits.[31] This has been the case, for example, in the automotive and petroleum industries. Industries subject to government regulation are also likely to be actively involved in standards setting, if only for preemptive reasons.[32]

Regulatory Standards Processes—Standards can also result from political choices. Standards developed in the political arena are often referred to as regulatory standards. In contrast to market standards, which are based on exchange relationships, regulatory standards are based on authority relationships.[33] They are established by legitimate government authorities and mandated from the top down.

Standards might be set in the political arena for a number of reasons. For example, if the market structure for standards setting is uncompetitive, economic outcomes will be inefficient. Some market decisions might fail to incorporate or account for environmental, safety, and other social externalities.[34] In some cases, standards decisions entail conflict of values and policy trade-offs. Their resolution may require abroad-based consideration of values. Timeliness may also be a factor. Decisions based on authority can be very efficient, because, once established, the marginal cost of exercising authority is generally very low.[35]

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28 As Marvin Weiss has pointed out, businesses may support voluntary consensus processes if they believe they can exert more influence in this arena than in the market place. See, for a discussion, Martin B. H. Weiss, Comparability Standards and Product Development Strategy, unpublished paper, Telecommunications Program, Department of Information science, University of Pittsburgh, Pittsburgh, Pennsylvania, Mar. 24, 1988; William Lehr, "The Case of Two Data Transport Standards: IEEE's 802.6 Man Versus the Ansi X3'S FDDI Interface," presented to the 19th Annual Telecommunications Policy Research Conference, Solomon Island, Maryland, September 30, 1991.

29 With the shift towards anticipator *standards, this* is an increasingly important rationale. As noted by Sirbu and Hughs:

> As standards become more frequently developed in advance of well defined market demand, the process comes to resemble the act of innovation in which firms struggle to develop new technologies to satisfy unclear needs. Firms frequently misapprehend either the technology, the market, or both. The complexity of the issues being addressed mean that much of the effort in the development of standards lies in the process of educating the participants to a common perception of the problems to be solved.

Marvin Sirbu and Kent Hughs, "Standardization of Local Area Networks," Department of Engineering and Public Policy, Carnegie Mellon University, (mimeo) April 1986.

30 Noting that little research has been done looking at such failures, Paul David suggests that:

> future work should assess the costs born by private companies, and the incentives that appear to justify the resource expenditure entailed in having personnel participating regularly in standards-writing groups. Moreover, the literature on coordination could be linked better to the micro-institutional arrangements of the voluntary standards organizations.

Paul David, op. cit., footnote 3, pp. 28-29.

31 See for a discussion, Mancur Olsen, The *Logic of Collective Action: Public Goods and the Theory of Groups* (Cambridge, MA: Harvard University Press, 1971).

32 For example, flamiability standards in the upholstered furniture industry were only developed by the industry trade association after a notice of proposed rulemaking appeared in the Federal Register. See Harvard Business School, The Upholstered Furniture Flammability Issue (Boston, MA: Intercollegiate Case Clearing House, 9-680-084, 1980). Ross E. Cheit, op. cit., footnote 1.

33 One can say that authority relationships exist whenever "one, several or many people explicitly or tacitly permit someone else to make decisions for some category of behavior.' Charles E. Lindblom, *Politics and Markets: The World's Political- Economic Systems (New* York, NY: Basic Books, 1977), pp. 17-18.

34 See for a discussion, Robert Kuttner, The *Economic* Illusion: *False Choices Between Prosperity and Social Justice* (Philadelphia, PA: University of Pennsylvania Press, 1984).

35 Charles Lindblom, Politics and Markets, op. cit., footnote 33.

Relations based on authority, however, require legitimacy;[36] people must explicitly or tacitly allow decisions to be made for them. In democratic societies, political authority is based on the rule of law. Thus authority is exercised through laws, rules, and regulations, setting forth who can exercise control under the circumstances.[37] In the United States, standards decisions must be made in accordance with the Administrative Procedure Act, which requires that the decisionmaking process be open to all interests and prohibits ex parte proceedings. Executive Orders also require government standards makers to base their decisions on cost-benefit criteria.[38] In addition, Office of Management and Budget (OMB) Circular A-19 directs regulatory agencies to use private sector standards whenever "feasible and consistent with the law. "[39]

As in the market place, and the voluntary consensus process, standards setting in the political arena can fail. The process may breakdown if regulatory agencies are ineffective and fail to achieve public interest goals. This could occur, for example, if regulators are 'captured' by special interest,[40] or if complex bureaucratic processes and procedures stifle the regulatory process. At a more fundamental level, regulatory standards can lose legitimacy.[41] As happened in the late 1970s, the public may challenge the government's right to set regulatory standards in certain areas.[42] Problems may also arise, if the government is unable to agree on standard goals.

The Standards Universe

Taken together, these three kinds of standards and three kinds of standards processes can be paired to form a matrix that scopes the standards universe and the standards setting processes and problems to be analyzed in this study (see figure A-l). It illustrates that all three kinds of standards can be established in any one of the three standards processes. The particular process by which standards are established is often the result of historical circumstances and/or political and cultural choice. Thus, this matrix can be used to highlight temporal and cross national comparisons.

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36 The notion of legitimacy as a basis for authority was developed by Max Weber. See for a discussion *Max Weber Economy and Society: An Outline of Interpretive Sociology* (cd.), by Guenther Roth and Claus Wittich (New York, NY:Bedminster Press, 1968, especially ch. 10, "Domination and Legitimacy.' See also, Robert A. Nisbit, *The Social Bond: An Introduction to the Study* of Society (New York, NY: Alfred A. Knopf, 1970), especially ch. 6, "Social Authority. "

37 A primary feature of democratic or representative government is that government decisionmakers can and should be held responsible to elected officials and ultimately to the electorate for decisions made and policies followed. It is this accountability, rather than the good will of the decisionmaker, that must be served as the basis for assurance that activities are conducted in the public interest. To assure such accountability, it is necessary that the public and its representatives have information regarding the means by which a decision is reached, the bases for that decision, and the means by which action can be taken to modify or reverse that decision. See, Government Regulatory Activity: Justifications, Processes, Impacts, and Alternatives, Report to the Congress by the Comptroller General of the United States, June 3, 1077, PAD-77-34, p. 43.

38 See, for one example, Executive Order 12291, 1981.

39 OMB Circular No. A-1 19, sec. 6(A) (Oct. 26, 1982),

40 For the classic discussion of regulatory capture, see Marver H. Bernstein, *Regulating* Business by *Independent Commission* (Princeton, NJ: Princeton University Press, 1955); See also, Bruce M. Owen and Ronald Braeutigan, *The Regulation Game: Strategic Use of the Administrative Process* (Cambridge, MA: Balinger Publishing, 1978); and George J. Stigler, *The Citizen and the State: Essays on Regulation* (Chicago, IL: The University of Chicago Press, 1975).

41 Regulatory standards are also less aligned with market forces and the incentives of the relevant economic actors. Garth Saloner, Op. cit, footnote 15, 1990, p. 148.

42 For a discussion of one such a shift in the public's mood, see Michael Pertschuck, RevoltAgainst Regulation: The Rise and pause *of the Consumer Movement* (Berkeley and Los Angeles, CA: University of California Press, 1982).

Figure A-l—Standards Universe

Type of Standard by Goals

Standarization mechanism	Control	Product/quality	Process/interoperability
De Facto	Warner-amex Database-privacy standards	VCR standards	Language customs Bills of lading Computer interface standards
Feguiatory	Auto safety regulations Fuel economy standards	NSA encryption standards Department of Agriculture Product classification standards	Open network architecture standards ETSI standards for European telecommunication standards
Voluntary Consensus process	Standards for medical devices Pressure vessel standards Petroleum standards	Refrigerator standards	Map-top protocols for OSI/standards Standards evolving legislation Electronic data interexchange standards

The three kinds of standards and three kinds of standards processes can be paired to form a matrix that scopes the standards universe and the standards setting processes and problems to be analyzed in this study.

SOURCE: Office of Technology Assessment, 1992.

Appendix B
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