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NBS Microstudy

A Study of NBS Impact on U.S. Standardization Activities

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A STUDY OF NBS IMPACT ON U.S. STANDARDIZATION ACTIVITIES

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Executive Summary

Engineering standards establish requirements to be satisfied by products, materials, systems, or processes. When properly developed, they can provide such benefits as increased productivity and efficiency in industry, conservation of resources, enhanced equity in the marketplace, and enrichment of the quality of life. A strong U.S. Engineering Standards System is important to the growth and prosperity of the U.S. economy and to the safety and well-being of the U.S. public.

The primary purpose of this study was to identify and classify NBS contributions to standards committees. This particular study does not address the broader and ultimately more important question of the impacts on society of the standards which NBS helps to develop. It does include a classification of examples of such impacts cited in the literature on standardization.

The major findings of the study are:

1. That approximately 400 NBS staff members (about 1/3 of the professional staff) currently serve on over 1,200 standards committees sponsored by nearly 100 different standards-writing organizations. Over half of the total NBS memberships are on committees sponsored by the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI).

2. That NBS standards committee participants come from each NBS Major Organizational Unit representing about 75% of the NBS divisions.

These participants spend about two weeks each year working on standardization activities. Sixty persent of these participants hold two or more committee memberships, and approximately 15% are committee officers. The median NBS participant is a senior staff member 45 to 49 years old, who has a Civil Service grade of GS-14 or 15, and who has been employed by NBS about 16 years.

3. That the standards committees supported by NBS participants are more often involved with nonproduct standards for terminology, symbols, and general test methods than with industrial or retail product standards.

4. That industrial groups are more often cited (by NBS participants) as the primary beneficiaries of the standards produced with NBS help than are government organizations, scientists and engineers, or household consumers.

5. That NBS participants characterize their contributions to standards committees as "technical" more often than editorial, administrative, protective of the public interest, or supportive of improvements in the U.S. standards system.

6. That most NBS participants view their standards committee work as beneficial primarily as a means of promoting the use of NBS-generated technical information.

7. That the number of references to NBS work in the published standards in the paper field appears to be a rough indicator of NBS'

technical input to the initial development of these standards, but does not reflect all of the technical input made by NBS staff.

8. That most of the available literature dealing with the impact of standards on society is slanted toward the economic benefits which accrue to the industrial sector. These benefits can be classified into three major groups, namely those which promote the efficient use of manpower, those which promote the efficient use of natural and physical resources, and those which promote efficient market transactions.

9. That the present mechanisms within NBS for the collection and dissemination of data on Bureauwide standards committee participation have failed to provide information of sufficient quality and completeness to be useful to NBS managers.

10. That present trends in standardization, such as the increasing importance of international standards, the use of standards as a means of implementing legislation, and the inevitable changeover to the metric system of measurement, point to increased demands for NBS assistance in the development of standards.

11. That except where NBS has a major program in a specific area of technology such as building construction or computer technology, there appears to be a lack of priority setting, cost/benefit analyses, and future planning for standards committee participation.

12. That the present annual reporting system has failed to provide a complete and accurate account of the time and money spent by NBS participants on standards committees.

It is therefore recommended:

1. That NBS should strengthen its program for collecting, analyzing and disseminating data on the nature, extent, cost, and justification for NBS' participation on U.S. standards committees. This program should strive to provide all levels of NBS management with information that will assist them in making decisions about the allocation of NBS resources for this important activity.

2. That NBS should undertake analyses of the societal impacts of standards themselves. Such studies would complement this report and could lead to a better understanding of the most appropriate role for NBS to play in the U.S. Standards System.

Contents

1.0 Introduction

1.1 Engineering Standards--A Definition - The standards referred to in this report are variously called engineering, product, industrial, or technological standards. Although these standards are developed in many different ways to serve many different purposes they are similar in that they are published documents which represent an agreement among interested parties as to a set of requirements to be satisfied by a specific product, material, system, or process. Not included in this discussion are standardization activities related to basic measurement standards or standard reference materials.

1.2 Importance of Standardization Activities - Standards are internationally recognized as essential tools for attaining economic and social well-being. They are employed to provide a common language for domestic and international commerce, to eliminate internal and external trade barriers, and to enrich the quality of life by improving public health, safety and welfare. Standardization has the potential of accomplishing a variety of socioeconomic objectives; however, it is significant that it also has the potential to do great harm. Improperly developed, untimely, or wrongly used standards can retard progress, establish artificial barriers to trade, and endanger health and safety. Therefore, it is not enough to simply develop standards. To achieve the greatest benefit from standardization, it is necessary to develop good standards at the right time using the best technical expertise available.

1.3 Study Objectives - The three major objectives of this study and the means which were used to reach these objective are as follows:

Objective 1: To develop a description of elements of the U.S. voluntary standardization infrastructure, prepare an overview profile of NBS committee participation in domestic voluntary engineering standardization activities, and provide information on standardization activities in which NBS is not participating.

Approach: Information on the nature and extent of NBS participation in U.S. standardization activities was gathered by analyzing data obtained from NBS records of committee participation (NBS Form 83, Record of Assignment) for FY-73 and FY-74. The description of the U.S. standardization infrastructure was developed from data obtained from major reports on U.S. standardization such as the Department of Commerce's LaQue Report[1], NBS's Suzuki Report[2] and recent reports issued by the Library of Congress and the American Society for Testing and Materials. Information on nonparticipation in standardization activities and the reasons for the lack of participation were collected from the Suzuki Report and from NBS experts in the standardization area.

Objective 2: To identify, categorize, and describe the major kinds of contributions made by NBS participants to standards committees, and

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[1]Report of the Panel on Engineering and Commodity Standards of the Commerce Technical Advisory Board. F. L. LaQue, Chairman. 1965.

[2]Report of the Voluntary Standardization Policy Study Group, George Suzuki, Chairman. 1970.

to develop methods for obtaining measures of NBS technical inputs to standards (one of the major kinds of contributions made by NBS participants) developed by selected standards committees.

Approach: Information on the types of contributions made by NBS was obtained by surveying a random sample of NBS participants in domestic standardization activities (see Appendix for detailed description of the survey). Preliminary lists of contributions and benefits were circulated to a small group of standards experts at NBS to obtain comments and suggestions for additions or deletions. The responses of the experts were incorporated into the final draft of the questionnaire. Prior to distribution, the questionnaire was submitted to Dr. June Cornog of the NBS Technical Analysis Division for a review of the appropriateness of its format and structure. In response to one of Dr. Cornog's recommendations, the questionnaire was sent out to a small number of committee participants for a pretest.

To examine NBS technical input to standards, a case study was conducted on NBS inputs to standards for paper. An attempt was made to trace the use of NBS research reports by the Technical Association of the Pulp and Paper Industry (see 4.2.1.10 for a complete description of this case study).

Objective 3: To identify and categorize technological, economic, and social impacts resulting from industrial compliance with voluntary engineering standards, and to analyze a standardization project case history to determine ways in which such impacts can be meaningfully quantified.

Approach: Information on technological, economic, and social impacts resulting from compliance with standards was gathered from books, pamphlets, reports, and speeches on standardization (see Appendix for bibliography). The data was then boiled down and categorized by type of impact and a potential economic impact grid was developed. A case study was made of an evaluation of the economic benefits which resulted from implementation of Nuclear Instrument Module (NIM) standards which NBS helped to develop. The economic benefits cited as a result of the use of NIM standards were assigned to elements on the impact grid.

1.4 Limitations of this Study - This study is only intended to be an initial step in a continuing program to define and evaluate NBS' participation in U.S. standardization activities. As such, it focuses on a narrow part of the total picture: the relationship between NBS and U.S. standards-writing and promulgating organizations. The other, and ultimately more important, aspect of NBS committee participation is the effect that it has upon society in general. NBS may have a significant impact upon a standards committee, but unless the standards developed by the committee produce a net positive effect upon society, NBS' time and effort may be wasted.

We have identified and classified some of the major economic effects of standardization for this study; however, we have not attempted to measure these effects as they apply to NBS committee participation. We need to know a great deal more about the negative as well as the positive effects of standardization before we can begin to measure the net effect of a standard. We plan to explore these effects in a separate study which is now in the planning stage.

2.0 Structure of the Voluntary Standardization System of the United States

2.1 Major Characteristics of the System - The concept of standardization is actually very simple and basic; however, the outstanding characteristic of the United States system for developing engineering standards is its complexity. First, there is no nationally recognized definition of an engineering standard. The definition given in this report is a composite of the thoughts of various experts. Second, the U.S. standardization system is usually characterized as a voluntary system because the choice of what to standardize is voluntary, participation in the development of a standard is voluntary, and the use of a standard is usually voluntary. However, as shown in figure 1 there are several ways in which a voluntary standard can become an obligatory standard. When a voluntary standard is incorporated into a legal document or regulation its requirements are binding on all parties concerned and are enforceable. A voluntary standard may become a de facto obligatory standard if its use becomes a custom or an accepted trade practice since failure to comply with the standard could affect a company's ability to compete in the marketplace.

Another important characteristic of the system that adds to its complexity is that there is no one standards-developing organization which is officially recognized by the U.S. Government. In contrast, most other countries have a national standards organization which is under direct or partial government control and, therefore, has official status.

WAYS IN WHICH VOLUNTARY STANDARDS BECOME OBLIGATORY

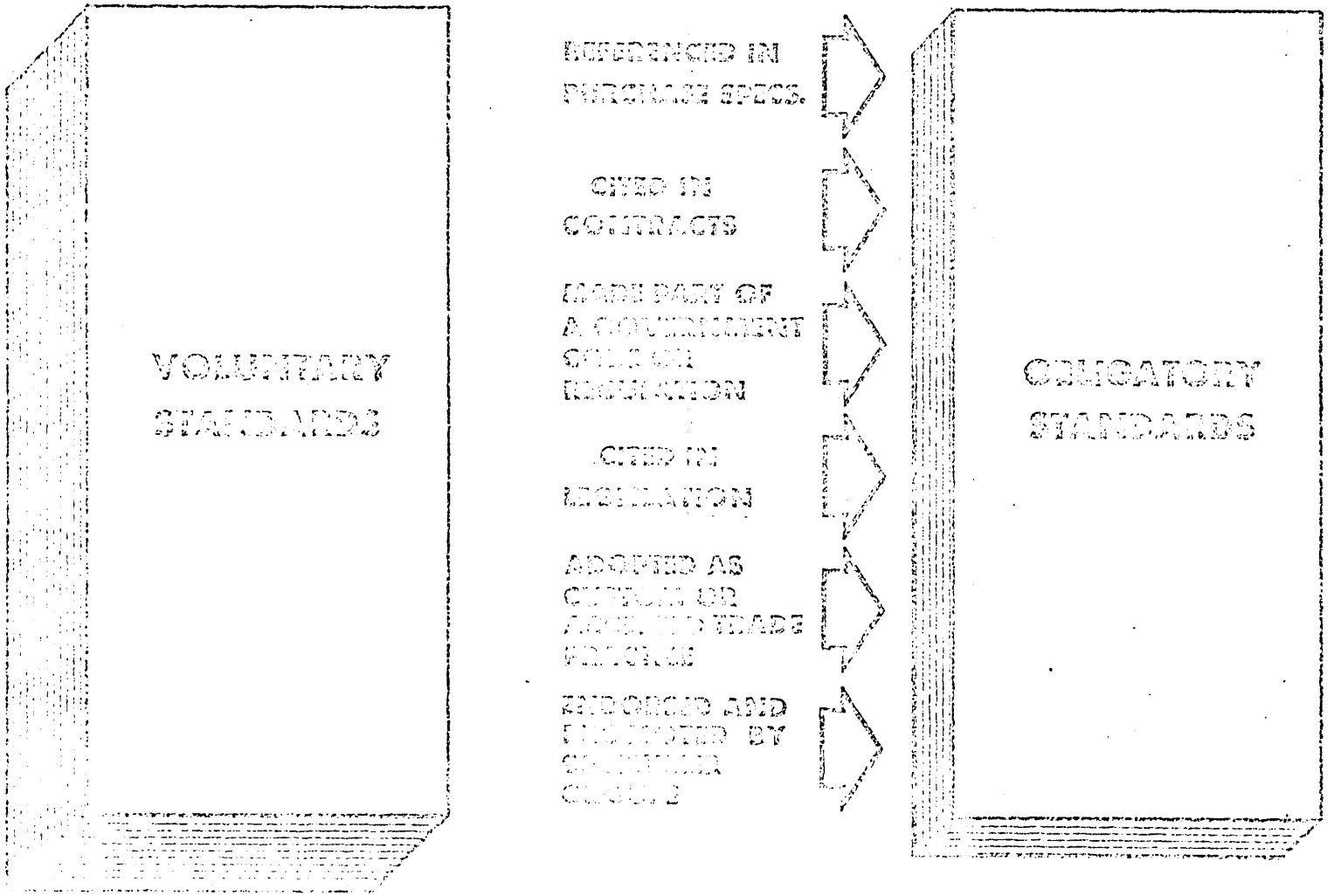

FIG. 1

The U.S. system is also characterized by the fact that there are many different groups developing standards in many different ways. Approximately, 400 standards-producing groups have developed some 23,000 U.S. engineering and product standards.

The actual number of standards documents is much greater than 23,000 because there is a good deal of duplication among standards groups. One standard, for example, may be recognized by several organizations and may be assigned a different numerical designation by each group. This situation exists because there is no single set of national standards.

2.2 Standards-Writing and Promulgating Organizations-- The nongovernment organizations producing or promoting the development of U.S. national standards can be classifed as follows:

A. Organizations concerned exclusively with standards - These organizations devote all or nearly all of their time to the preparation, approval, and publication of voluntary standards. The major groups in this classification are the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI).

B. Professional and scientific societies - These groups are composed of scientists and engineers who have joined together to advance their professions and the engineering and scientific fields. Examples of

professional societies are the Institute of Electrical and Electronic Engineers (IEEE), the Society of Automotive Engineers (SAE), the American Concrete Institute (ACI), and the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). The American Chemical Society (ACS) and the International Union of Pure and Applied Chemistry (IUPAC) are examples of scientific organizations.

C. Trade Associations - These organizations are created by manufacturers usually for the protection and profitable advancement of their products. Included in this classification are the Electronic Industries Association (EIA), the National Electrical Manufacturers Association (NEMA), the Aerospace Industries Association (AIA), and the American Petroleum Institute (API).

D. Listing bodies and safety code organizations - These organizations are primarily concerned with safety requirements and testing procedures. The "listing bodies" such as Underwriters' Laboratories (UL) and Factory Mutual Engineering Corporation (FMEC) operate laboratories for the investigation of materials, devices, products, equipment, construction, methods, and systems with respect to hazards affecting life and property. Items meeting the performance standards set by these organizations are listed by them and may be marked by the manufacturer with a special symbol to indicate that they are so approved. The safety code organizations such as the National Fire Protection Association (NFPA) and the various building code groups write standards which are published in model codes intended to serve as the basis for state and local regulations.

The organizations listed above are the source of the standards included in the count of U.S. domestic standards. In addition to these standards, there are numerous other standards documents which are not counted in the U.S. total but are significant because they may serve as the basis of a U.S. standard. These standards documents fall into two categories: (1) Intra-company standards, and (2) Purchase specifications.

Intra-company standards are those developed by a single company for its own internal use. They may be based on existing external standards or they may be the company's own solutions to its unique problems. Purchase specifications are developed by companies, trade associations, government agencies, and other purchasers to describe things they want to buy. Like company standards, specifications are usually written to fulfill a specific need of a particular user; therefore, they may not be applicable to other users. When either a specification or a company standards is found to meet the needs of others beyond the initial user, it may be used as the basis of a U.S. standard.

The distinguishing characteristic of standards generally recognized as U.S. standards is the degree of consensus represented by the creators and users of the standard.

2.3 The Consensus Principle - Consensus has been defined as follows: "substantial agreement of those concerned with the scope and provisions of a standard as judged by a recognized or duly appointed authority.

Consensus implies much more than the concept of a simple majority, but not necessary unanimity." It does imply a resolution of all technically sound objections.

This principle has become a basic element in the development of U.S. standards. It is employed to ensure that the major parties affected by a standard will have an opportunity to participate in the development of the standard. The basic concept behind the consensus principle is the same among the various U.S. standards-developing organizations; however, the method used to establish evidence of consensus and the degree of consensus vary from group to group. Methods of establishing evidence of consensus which are currently in use include: development of standards by committees consisting of a balance of interests, circulation of a draft standard to interested groups for approval, public call for comment on a proposed standard, and combinations of these approaches.

In regard to the approval of voluntary standards, four degrees of consensus are recognized within the United States today:

1. Company consensus - involving agreement among personnel in a particular company such as representatives of the company's technical, administrative, and management activities.

2. Industry consensus - involving agreement among various members of a particular industry trade association.

3. National consensus - involving agreement among representatives of all groups which will be significantly affected by a standard including

producers, distributors, users, consumers, government agencies and testing laboratories, as appropriate.

4. International consensus - involving agreement among member countries in an international standards organization.

The adequacy of consensus as a basis for voluntary standardization has often been questioned. Most recently a Library of Congress report on voluntary standards[3] noted that the consensus process may produce standards that are least offensive to the various interests involved, and for that reason may represent the least advanced sector of the technology at hand. In contrast, the report observed, "many Government standards are being drafted not as a ratification of existing technology, but to set new goals for technologies that are deemed to be sufficiently advanced."

2.4 The Government's Role in the System - The U.S. Government has traditionally played a secondary, support role in the development of national standards except in regard to procurement and mandatory standards and regulations for the protection of public health and safety. In its support role, the Government provides hundreds of skilled technical personnel to assist in the development of standards in the private sector. These technicians may serve on standards-writing committees, hold committee secretariats, or do the basic research needed to develop test methods for specific requirements of standards. The Government also provides information on national, international, and State standards to interested standards groups in an effort to prevent duplication of standards.

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[3] Voluntary Industrial Standards in the United States, An Overview of their Evolution and Significance for the Congress, July 1974.

U.S. Government regulatory agencies develop mandatory standards (regulations/codes) to protect public health, welfare, or safety. This role has steadily increased to the point where now some Government agencies and standards groups run the risk of duplicating each other's efforts. Regulatory agencies may work directly with the private sector standards-writing groups but the degree of cooperation varies from agency to agency. The U.S. Government presently does not have a uniform policy as to the acceptance of existing engineering standards or the use of the technical expertise and resources of the voluntary standards system.

The area in which the Government most actively develops standards and specifications is procurement. The Department of Defense (DoD) and the General Services Administration (GSA) are not only the Government's largest purchasers but also they are the largest standards and specifications writing groups in the world. Together they have developed approximately 40,000 specifications and standards (DoD - 35,000 and GSA - 5,000). Although DoD and GSA are nonregulatory agencies, their standards often serve as the catalyst for the development of voluntary engineering standards.

Within the Government, there is a small program that assists interested groups in the development of national voluntary standards which the private sector cannot or will not develop. This activity is known as the Voluntary Product Standards program. It is operated by the U.S. Department of Commerce, through the National Bureau of Standards. Voluntary Product Standards are developed according to a national

consensus procedure published by the Department of Commerce. After publication, the standards are usually submitted to ANSI for additional listing as American National Standards.

3.0 Status and Trends in Engineering Standardization in the United States

3.1 The Influence of International Activities - A phenomenon that is likely to have a profound effect on U.S. standardization activities in the future is the tremendous growth in international and foreign regional standardization activities over the last 10 years. According to Ralph L. Hennessy, Executive Director of the Standards Council of Canada, several factors combined to create a demand for international standards in the Sixties[4]: a. The removal of tariff barriers to trade spotlighted technical barriers such as discrepancies between national standards; b. Multi-national corporations found that their commercial activities were hampered by conflicting national standards; c. Developing countries created standards institutions which identified the need for a sound international basis for their national work; and d. One of the major international voluntary standards groups, the International Organization for Standardization (ISO), widened its scope to involve more and more people from different interest groups including, particularly, the consumer movement.

As a result, the major international standardization groups, such as the ISO and the IEC, experienced a surge in activity and an increase in status in the international community. In the past, standards

[4] ISO - The Making of a Viable Organization, Ralph L. Hennessy, ASTM Standardization News, Vol. 2, October 1974, No. 10.

developed by U.S. organizations such as the American Society for Testing and Materials have often received de facto international recognition because of the lack of truly international standards. Now that ISO and IEC are filling the void, the impact of U.S. standards will diminish.

Further evidence of the increasing importance of international standardization is seen in the formation of foreign regional standards groups such as the European Committee for Standardization (CEN), comprised of the standards bodies of the European Economic Community (EEC) and the European Free Trade Association (EFTA) countries, with Greece, Ireland and Spain as correspondent members.

The developments on the international scene raise several questions of importance to U.S. standardization, such as:

a. Does the current U.S. standardization system have the resources and manpower to insure that U.S. interests are adequately represented in international standardization activites?

b. How will the U.S. system respond to the imminent quality assessment and certification schemes now being developed by foreign regional standards groups?

c. What position will the United States take in regard to the adoption of international standards as national standards?

The increase in international standardization activities may necessitate a reevaluation of NBS' present level of participation in international standardization activities. It is likely that increasing numbers of

NBS participants on U.S. standards committees will be asked to represent U.S. views in international standards activities. This participation could require large investments of time and money.

3.2 Reference to Standards in Federal Legislation - There is an increasing tendency worldwide to utilize standards as a means of implementing legislation. One technique is to draft legislation or general requirements containing a "reference" to a standard or groups of standards which provide or illustrate the means of meeting such requirements; for example, the Flammable Fabrics Act of 1953 adopted Department of Commerce Commercial Standard CS 191-53 as the standard to be applied under the law. Another practice is to assign a Government agency the responsibility to oversee the development of voluntary or mandatory standards to solve a particular national problem. This technique was used in the legislation establishing the Consumer Product Safety Commission.

Within the last 7 years there have been numerous examples of this trend in the United States. In addition to the legislation dealing with flammable fabrics and consumer product safety as cited above, legislation involving fair packaging and labeling, occupational health and safety, and environmental protection has depended heavily on the development and use of standards as a means of implementation. The impact of this trend on NBS is already evident. Significant programs exist within NBS

to assist the Consumer Product Safety Commission, the Occupational Health and Safety Administration and the Department of Justice in fulfilling their responsibilities related to standards development. It is anticipated that similar demands will continue to be placed upon NBS in the future.

3.3 U.S. Adoption of the Metric System - This country is moving slowly but surely toward conversion to the metric system of measurement. This change will significantly affect existing U.S. standards containing nonmetric dimensional requirements. Many standards will need to be revised. For over 10 years NBS has followed an internal policy of using metric units in its formal publications. Because of their experience in metric usage, NBS staff are being asked to play a leadership role in metric conversion.

4.0 NBS' Role in the Voluntary Standards System of the United States

4.1 The Past - The Bureau's interest in engineering standards can be traced back to the early 1900's when it began testing products purchased by the country's largest consumer, the U.S. Government. As a result of testing electric light bulbs in 1904 and later testing such products as electric meters, chemical glassware, inks, and mucilages, the Bureau became more keenly aware of the need for proper specifications and appropriate tests to determine whether goods purchased complied with the specifications. The testing program highlighted areas where research was needed and led to expanded Bureau programs to explore the basic properties of materials such as wood, textiles, and lubricating oils. These research and testing programs brought the Bureau into contact with private industry groups and trade associations and eventually led to the participation of NBS staff members on standards-writing committees.

In 1921, Secretary of Commerce Herbert Hoover enlisted the help of the Bureau in his campaign to combat waste in industry. Hoover had learned of the magnitude of this problem when, as the President of the American Engineering Council, he appointed a committee of 18 prominent industrial engineers to study waste conditions in industry and to make suggestions as to possible remedies. The committee took a look at waste in six typical industries of the time and reported that preventable waste in those industries ranged from 29 to 64 percent. The committee estimated that 10 billion dollars a year could be saved through standardization and simplification alone.

Soon after the report was published, Hoover was appointed Secretary of Commerce. He developed a multifaceted program to eliminate waste which included two objectives within the special province of NBS:

1. The reduction of waste in manufacture through the establishment of standards of quality, simplification of grades, dimensions, and performance in nonstyle articles of commerce; through the reduction of unnecessary varieties; through more uniform business documents such as specifications, bills of lading, warehouse receipts, etc., and through

2. Development of pure and applied scientific research as the foundation of genuine labor-saving devices, better processes, and sounder methods.

To help accomplish the first objective, Hoover established a simplified practice unit in the Department. This unit, which shortly became a division placed organizationally under the Bureau of Standards, had the stated purpose of bringing producers, distributors, and users together to help eliminate excess sizes, varieties, types, and grades. Simplification of this type was first used on a large scale by the Conservation Division of the War Industries Board in World War I.

The primary purpose for wartime simplification had been to conserve scarce materials for the war effort; however, manufacturers discovered that simplification resulted in numerous economies in production and distribution. Being familiar with the success of the wartime program, Hoover modeled his Simplified Practice Division after the Conservation Division of the War Industries Board.

In the beginning, the NBS group led a nationwide drive for the elimination of waste through simplification. As this effort expanded, various industrial groups began to request help in developing standards which established quality requirements for products. Consequently, in 1927 the NBS program was broadened in scope by establishing a Commercial Standards unit to assist in the development of grade, quality, dimensional tolerance, and other specification requirements.

At the same time NBS was expanding its programs in standardization, efforts were made to encourage the growth of private standards groups, such as the American Society for Testing and Materials and the American Standards Association (ASA) now known as the American National Standards Institute (ANSI), so that these standards groups could eventually assume the leadership role in the national standardization effort.

NBS had been closely associated with the ASA's predecessor, the American Engineering Standards Committee (AESC) from its establishment in 1909. In 1919, the Bureau was instrumental in getting the AESC to widen its scope so that it could act as a better connection between Federal, State, and municipal agencies and the technical and commercial organizations concerned with engineering standards. At one time, ASA had a Washington Office at NBS to facilitate the cooperative work of the two organizations.

However, in 1948 NBS along with other Federal agencies dropped its membership in ASA after the association was incorporated under the laws of New York State. Members of the Bureau continued to serve on the council, boards, and technical committees of the association although active participation in the administrative affairs of ASA ended. As the ASA and other private groups got stronger, they assumed primary responsibility for initiating and coordinating the development of needed standards, and NBS was able to concentrate its efforts on providing technical assistance to standards-writing groups. The Department of Commerce's voluntary standards program was retained within the Bureau, however, as a supplement to the programs of the private groups.

Over the years, the Bureau's standardization activities and its role in the National Standards System have been periodically reexamined in various special reports. The first major report of this type was conducted in 1943 by C. L. Wilson, a special Commerce consultant. Wilson was asked to prepare a report on standardization with specific emphasis to be placed on the part that NBS should play in the development of consumer goods standards. Wilson concluded that the effective development of standards could not be left to the public or the private sector alone, but rather, it demanded a "collaboration" between the two groups. Private organizations, Wilson said, were to take the lead and handle such things as standards promotion, negotiation, and education, while Government would assist with technical problems. Wilson also recommended that the Secretary of Commerce with the aid of NBS' Visiting Committee plan a "conference of business executives and other leaders

interested in the future development of standards in the United States." This conference was held at New York's University Club in January 1945.

As a result of this conference, the Secretary of the Department of Commerce initiated another study by seven businessmen and educators under the leadership of Charles E. Wilson, President of the General Electric Company. The C.E. Wilson report, issued in June 1945, concluded that the NBS role was to aid in supplying consumers with the information they were entitled to and would need about the products they bought. In addition, the report concluded that the true functions of NBS in connection with standardization should be "those of basic research, furnishing of facts, measurement, and technical assistance in the development of adequate test methods."

Another major study was initiated in 1963 by Assistant Secretary of Commerce for Science and Technology, J. Herbert Holloman. Holloman appointed an advisory Panel on Engineering and Commodity Standards which was chaired by Francis L. LaQue, at that time Vice President of the International Nickel Company, Inc. The Panel was asked to review the broad requirements for industrial and commodity standards in the United States and to make recommendations as to activities important to meeting requirements for standards, with particular emphasis on the role of the Federal Government and the Department of Commerce.

The LaQue Report recommended "that the National Bureau of Standards expand the participation of its scientific and technical personnel in the activities of independent national standardizing bodies and provide appropriate assistance in these activities."

In 1970, an extensive in-house study was made for the purpose of exploring the issues associated with NBS policies for participation in private voluntary standards activities and to provide the basis for the formulation of new policies. The study was conducted by a Voluntary Standardization Policy Study Group appointed by the Director of NBS and chaired by George Suzuki of the NBS Technical Analysis Division. The Study Group noted that NBS had played a significant role in national voluntary standardizing activities; however, they felt that NBS could better manage participation by establishing a centralized management system for those activities. This management system would provide information, direction, and guidance to NBS managers and committee participants.

The Policy Study Group identified three specific roles that NBS might seek in its engineering standardization activities:

(1) NBS could seek to become the primary Federal Government Agency responsible for the viability and effectiveness of the system that

develops engineering standards (Standards System Effectiveness) (2) NBS could take primary responsibility for the availability and adequacy of standards that serve those not adequately represented in the voluntary standardization process (Social Need Standards Advocate); and (3) NBS could serve as the primary technical resource, the think tank, providing research support needed by the national standardization system (Research and Technical Support). The Policy Study Group recommended that NBS place heavy emphasis on the Effectiveness of the Standards System and Research and Technical Support roles, and place light (but not zero) emphasis on the Advocacy of Social Needs role.

In response to one of the Suzuki report recommendations, a Program Manager for Engineering and Information Processing Standards was appointed in the Spring of 1971. The Program Manager was placed organizationally within the Office of the Director of NBS, and was given the responsibility of monitoring and coordinating NBS participation on both domestic and international engineering standards committees.

In December 1974 the domestic standards program management was centered in the Standards Information and Analysis Section and the Standards Development Services Section of the Engineering and Product Standards Division in IAT while the international responsibilities were transferred to the Office of International Standards of the Associate Director for Information Programs.

4.2 The Present - Scope of NBS Participation in the Development of U.S. Engineering Standards

4.2.1 Overview of NBS Participation on U.S. Standards Committees - The actual data on NBS participation in U.S. engineering standardization activities changes from day to day as new committees are formed, old ones are terminated, and NBS staff members come on board or depart. However, data current as of October 14, 1975;[5] indicates that 414 NBS staff members participate on 453 committees, 381 subcommittees, 96 task groups and 47 working groups for a total NBS participation of 977 domestic standardization committees sponsored by nearly 100 different organizations.[6] Taking into account multiple membership on some committees--NBS staff hold 1,211 committee memberships.

Standards committee participation is truly a Bureauwide activity. As shown in figure 2, participants can be found in each major operating unit (MOU). Individuals in the Institute for Applied Technology (IAT) hold by far the most committee memberships (553) and individuals in the Office of the Associate Director for Information Programs (ADIP) hold the least number of memberships (7). Approximately three-quarters of the NBS divisions have at least one individual who is a participant on a standardization committee. Most of those divisions which do not have

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[5] The cutoff date for information going into the revised Directory of Committee Memberships of the National Bureau of Standards Staff on Engineering Standards Committees.

[6] Includes memberships held by the NBS staff in Boulder, Colorado.

NBS PARTICIPATION IN DOMESTIC STANDARDIZATION

DISTRIBUTION OF COMMITTEE MEMBERSHIPS AND PARTICIPANTS OVER MAJOR NBS OPERATING UNITS

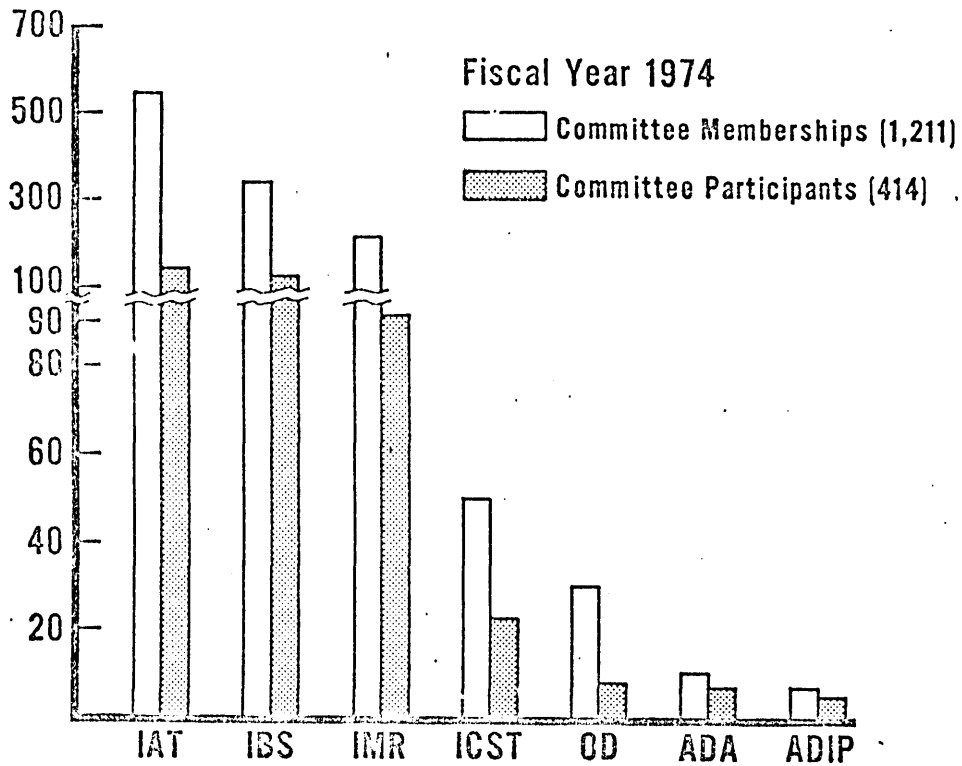


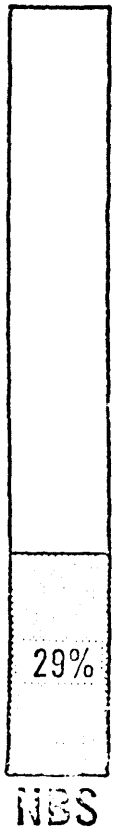
FIG. 2

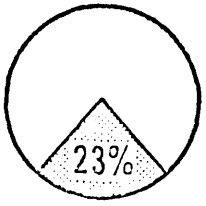
participants are involved in administrative or support activities rather than technical activities. Individuals in the Structures, Materials, and Life Safety Division in the Center for Building Technology hold the largest number of memberships for a single division: 29 individuals hold 133 memberships.

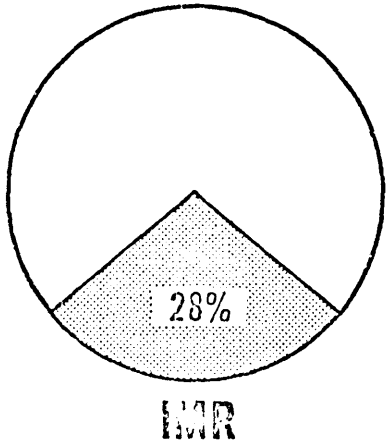
As shown in figure 3, nearly one-third of the NBS professional staff participate in U.S. standardization activities. In the Institute for Applied Technology and the Office of the Associate Director for Information Programs, over 40 percent of the professionals serve on standards committees. In the other major operating units, on the average about one-quarter of the professional staff participate in this activity.

4.2.1.1 Nature of Individual Participation - The Suzuki Policy Study Group surveyed over 300 standards committee participants in 1970. They found that the median committee participant was somewhat older than the median NBS professional employee. The median age group for committee participants was 45-49 and the median grade was GS-14. The findings of our survey, as shown in table 1, indicate little change. In addition we found that the average participant in our sample had been at NBS about 16 years.

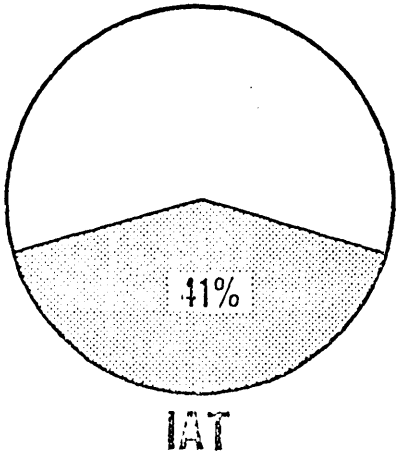
PERCENTAGE OF NBS PROFESSIONALS PARTICIPATING IN DOMESTIC STANDARDIZATION ACTIVITIES BY MAJOR OPERATING UNITS







- OD - 32%
- ADIP - 42%
- ADA - 14%



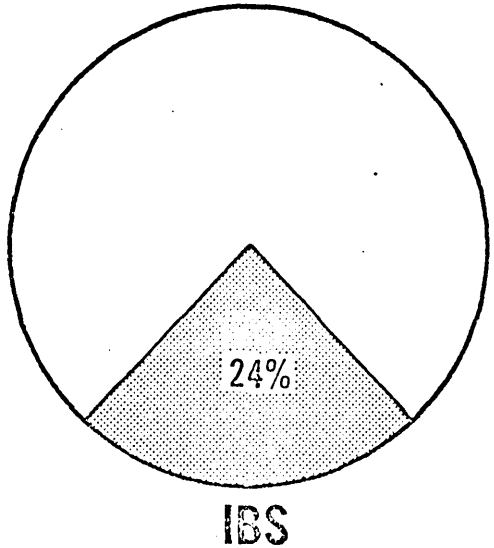


Table 1. Distribution of Survey Respondents by Age and Civil Service Grade

	Age Group									
GS Grade	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	TOTAL
9-11		1	1	3						5
12	2	4	4	2	1	2				15
13		7	5	4	2	6	3	2		29
14		4	5	6	8	3	5	3		34
15			2	6	8	6	6	7		35
16-17				1	8	2		1		12
TOTAL	2	16	17	22	27	19	14	13		130

Median Age Group: 45-49

Median Grade: GS-15

An individual's status on an engineering standards committee can vary from committee chairman to observer. Figure 4 indicates that the most common committee status of NBS participants in both FY-73 and 74 was that of "member." The total number of NBS committee memberships was 947 in FY-73 and 1,211 in FY-74 for an increase of about 28 percent. There was a 22% increase in the "member" category and a 47% increase in the "officers and others" category." It is interesting to note that the only major category to decrease between FY-73 and 74 was "Secretary." While the difference in the figures is not particularly significant, it may be that NBS participants are avoiding positions involving time-consuming clerical work in favor of positions where they can devote their time to technical input.

The membership status of participants in the various NBS MOU's is shown in figure 5, broken down by officers (Chairman, Vice Chairman, Director, Executive Secretary, Assistant Secretary, Secretary) and others (members, technical advisors, liaison representatives, etc.).

Most (approximately 60%) of the NBS committee participants hold 2 or more memberships. Figure 6 gives a breakdown of this multiple participation. The greatest number of committee memberships recorded for a single individual is 20. Although figure 6 indicates that 165 individuals serve on only one U.S. committee, it should be noted that over 50 percent of those individuals also serve on one or more international standards committees.

MEMBERSHIP STATUS OF NBS PARTICIPANTS ON DOMESTIC STANDARDS COMMITTEES

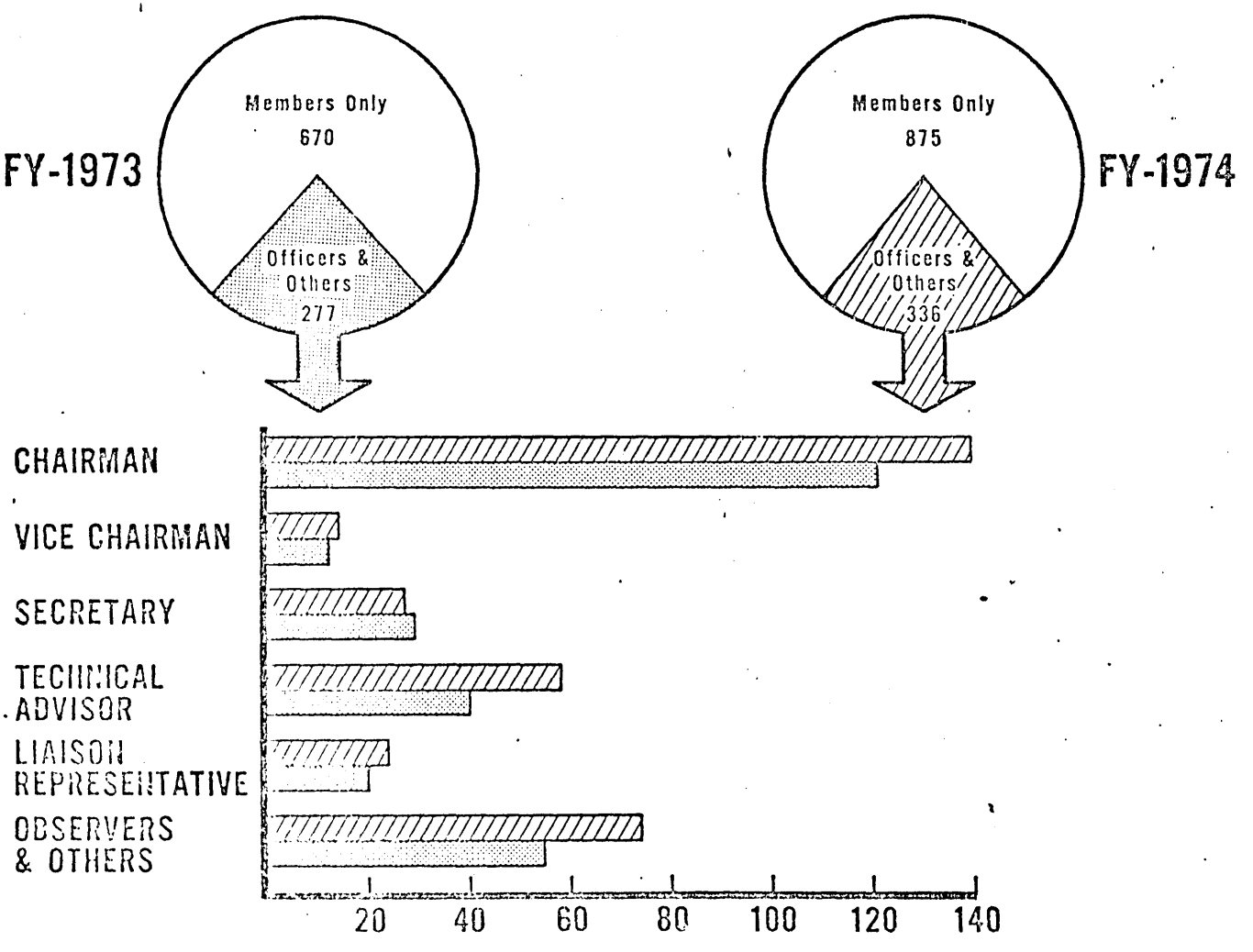


FIG. 4

DOMESTIC STANDARDS COMMITTEE MEMBERSHIP STATUS BY MAJOR NBS ORGANIZATIONAL UNITS FY 1974

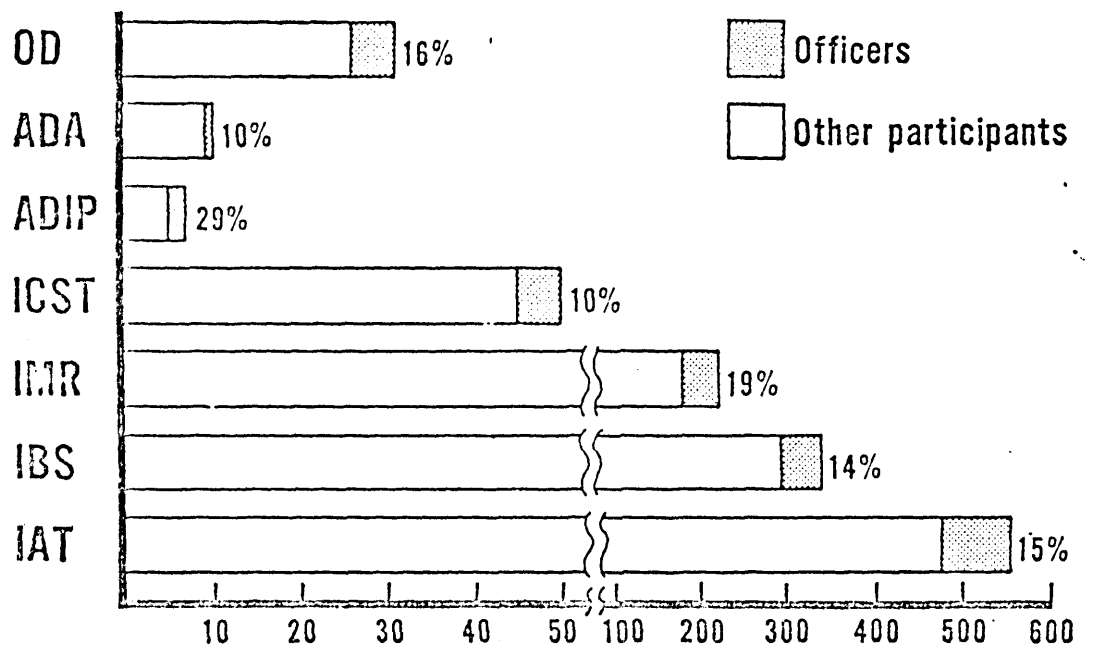


FIG. 5

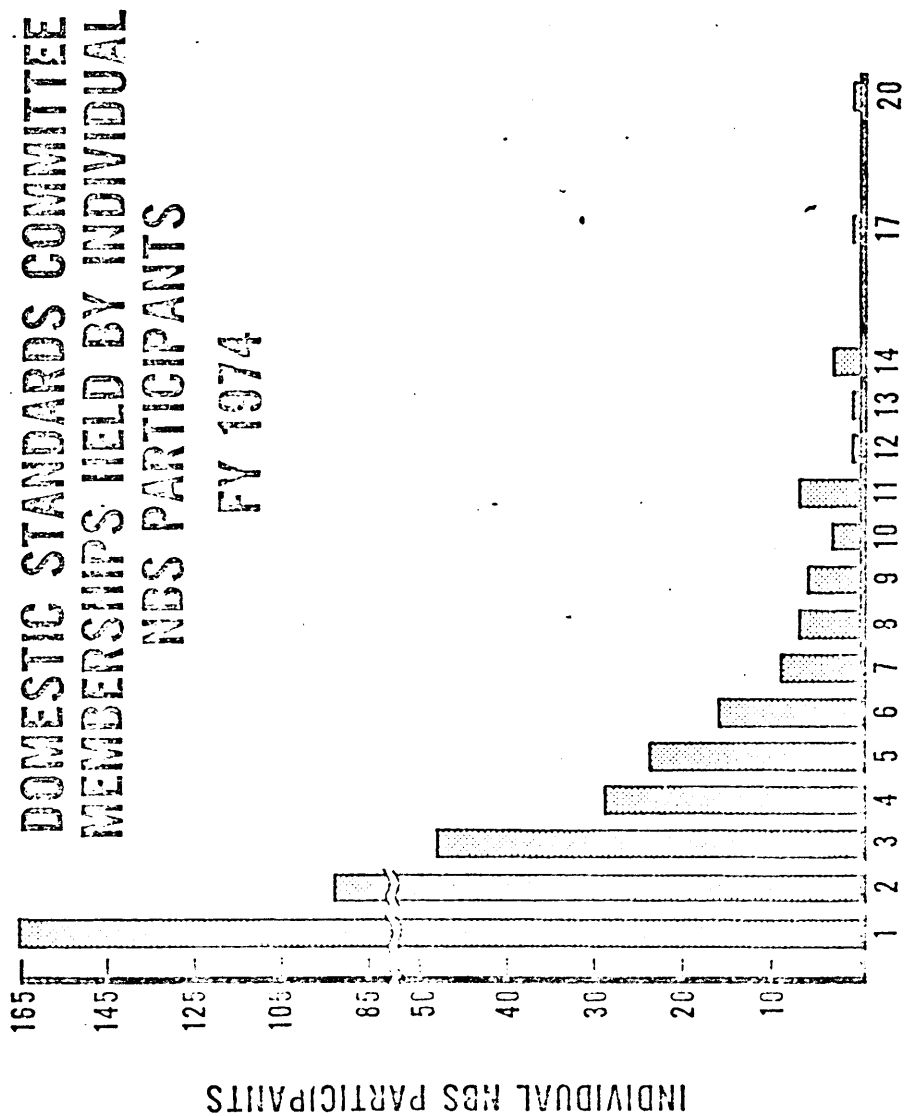

DOMESTIC STANDARDS COMMITTEE
MEMBERSHIPS HELD BY INDIVIDUAL
NBS PARTICIPANTS
FY 1974
INDIVIDUAL NBS PARTICIPANTS
165
145
125
105
85
50
40
30
20
10
1 2 3 4 5 6 7 8 9 10 11 12 13 14 17 20
COMMITTEE MEMBERSHIPS

FIG. 6

The Suzuki Group observed that participation on standards committees was for most individuals a very occasional activity. Participants in our survey indicated that they had spent some 17,000 hours on about 240 committees during FY75. Approximately 4,600 hours or 27 percent of the total time spent was out of regular working hours. There was no activity indicated in FY-75 for 55 committees (about 19% of the total committees covered by the survey). As shown below, NBS participants spent 40 hours or less on 60% of the committees:

Hours spent	No. of Committees	% of total committees for which some activity was reported
10 or less	53	22%
over 10 to 40	90	38%
over 40 to 100	61	25%
over 100 to 200	27	11%
over 200 (up to 1700)	10	4%

The average amount of regular working time spent on all standards committee activity in FY-75 by respondents to our survey was 92 hours (or a little over two weeks).

Except in a few cases, committee activity still seems to require only a small part of an NBS staff member's total working time. However, this conclusion was reached on the basis of the information provided by the participants themselves. Several survey respondents frankly admitted that they did not know the actual time spent. It is impossible to tell how many respondents simply guessed at the time spent on comittee work.

Periodic surveys of committee participants can at best only provide a rough estimate of the time spent on committee work. Because committee work is not a major activity for many individuals, we believe there is a tendency to under estimate rather than over estimate the amount of time spent.

The standards development activities of the U.S. standards system are for the most part carried out by part-time participants. Critics of the system note that this lengthens the development time for standards. It has been estimated that standards take from 1-1/2 to 2 years to develop. According to our survey, the committees on which NBS participants serve publish an average of 1.2 new standards or revisions per committee per year.

4.2.1.2 Types of Standards Developed - Another way of describing NBS participation in engineering standards activities is by classifying the types of standards which staff members help to develop. In their 1970 report, the Suzuki Group found it convenient to classify standards by the following types:

(a) Nonproduct technological standards--including standards of terminology, definitions, symbology, and general test methods applicable broadly to physical and chemical quantities.

(b) Industrial market product standards--including characteristics such as the following that apply to products intended primarily for industrial use: dimensions, design configuration, processes, materials, performance, safety, compatibility, interchangeability, labeling, classification, test methods, and acceptance levels.

(c) Retail market product standards--including the characteristics described in (b) above but applying to products that are sold primarily in the retail marketplace as entities.

(d) Obligatory standards--including standards relating to public health, safety, and welfare and applying to standards prepared voluntarily with reasonable expectation of becoming obligatory (binding in law or conscience, imposing, or of the nature of, duty or obligation).

The Suzuki Group developed this classification after they completed their survey; therefore, they were not able to obtain data on the distribution of NBS participation among these four types of standards. However, the recent survey of committee participants included a question aimed at obtaining this data.

Participants were asked which of the following terms best described the majority of the standards developed by their committee: nonproduct technological, industrial market product, or retail market product standards (since each of these types of standards could become obligatory we did not include "obligatory" in the choices of this question). The results were:

Type of Standard	Number of Committees
Nonproduct technological	124 (43%)
Industrial market product	96 (33%)
Retail market product	35 (12%)
Other*	33 (12%)

*In the "other" category, a number of respondents listed "obligatory" or "all of the above."

These results reflect the output of the U.S. standardization system. The majority of the standards produced to date have been nonproduct technological standards. Manufacturers have encouraged the development of this type of standard because it helps them solve recurring technical problems and facilitates communication with suppliers and customers without greatly limiting their choices in regard to such factors as design, quality, and variety.

The second most common type of standard developed is the industrial market product standard. Manufacturers concerned with the quality and interchangeability of the equipment they buy have promoted the development of these standards.

The U.S. standardization system has been criticized for its lack of activity in the area of retail market product standards. The number of these standards is relatively small because the average consumer has not played a significant role in standards development. However, increasing consumer awareness and Government interest in consumer product safety point to increasing numbers of these standards in the future. The percentage of NBS involvement in these standards can be expected to increase as a result.[7]

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[7] A discussion of policy issues arising from this type of activity can be found in the Suzuki Report under the topic of "Social Needs" standards.

In a separate question on our survey, participants were asked what the degree of probability was that the standards developed by their committees would become obligatory. The response was as follows:

Degree of probability	Number of Committees
Certain	24
Good	96
Unlikely	104
Unknown	40

We found it significant that the standards of approximately 45 percent of the committees were believed to have at least a good possibility of becoming obligatory. As explained earier, the U.S. standardization system is frequently described as a "voluntary" system in which standards are voluntarily developed and voluntarily used. Detractors of the present standards system have complained that the time and effort put into standards development is wasted because no one has to follow the standards once they are approved. It may be that the term "voluntary" is becoming less meaningful.

4.2.1.3 Beneficiaries of NBS' Standards Activities - The Suzuki Group found that the group mentioned most frequently as the primary beneficiary of NBS standards committee work was the scientific and engineering community. We included a question on beneficiaries in our survey to see if there had been any change in the intervening 5-year period. Our question was essentially the same as that asked by the Suzuki Group

except that we allowed participants to select up to three primary beneficiaries for each commitee rather than just one (as specified in the Suzuki survey). The findings of both surveys are:

Primary Beneficiaries	1970 Survey	1975 Survey
Household consumer	47	53
Industrial consumer	146	149
Manufacturer	48	149
R&D scientists and engineers	297	92
Government (local, state or Federal)	31	134
Other	88	44
TOTAL	657	621

It is risky to make direct comparisons between the two sets of data because our survey allowed more choices per committee and the groups surveyed were of different sizes. But in relative terms, it appears that NBS committee participants now perceive industry groups to be the primary beneficiaries of their standards work more often than the scientific and engineering community. Because few of the standards committees on which NBS staff serve are concerned with retail market product standards, household consumers are infrequently viewed as beneficiaries of standards work. The difference in the figures for "Government" may be the result of an increased awareness of the regulatory functions of state and local governments.

In the Suzuki survey, the "other" category frequently was marked to indicate that all or most of the categories listed were beneficiaries. Because our survey allowed more choices, we received only a few such responses. Instead we received several additional categories of beneficiaries including: judges and trial lawyers, architects and builders, scientific abstract services, the medical field, design engineers, and industrial workers.

4.2.1.4 Industries Affected by NBS' Standards Activities - In order to define the industries impacted by NBS committee work, an attempt was made to assign one or more Standard Industrial Classification (SIC) Major Group numbers to each standards committee based on the information provided in the title of the committee. This proved to be an impossible task since many titles such as "consumer product safety," "certification," "surface qualities," and "preferred numbers," were too general for us to attempt a classification. However, of the 460 committees for which we felt we could assign SIC numbers, the majority tended to fall in the following Divisions and Major Groups":

Division* and Major Group No.	Major Group Title	Number of Committees
D-38	Measuring, analyzing, and controlling instruments; photographic, medical, and optical goods; watches and clocks	115
D-35	Machinery, except electrical	84
D-32	Stone, clay, glass, and concrete products	79
D-34	Fabricated metal products, except machinery and transportation equipment	74
D-28	Chemicals and allied products	72

Division and Major Group No.	Major Group Title	Number of Committees
D-36	Electrical and electronic machinery,	72
D-29	Petroleum refining and related industries	36
D-30	Rubber and miscellaneous plastic products	27
D-22	Textile mill products	24
D-23	Apparel and other finished products made from fabrics and similar materials	18
D-39	Miscellaneous manufacturing industries	18
C-17	Construction - special trade contractors	16
D-26	Paper and allied products	12
D-27	Printing, publishing, and allied industries	10
C-15	Building Construction - Contractors, Builders	8
D-24	Lumber and wood products, except furniture	8
D-37	Transportation equipment	8
D-33	Primary metal industries	6
	Other	9

*Division: C - Construction
D - Manufacturing

SIC numbers were assigned on the basis of primary users of the standards involved and not on the basis of all possible beneficiaries. Consequently, most of the numbers assigned fall in the "Manufacturing" Division. This should not be taken as an indication that NBS standards work does not affect other Divisions such as "Retail Trade" and "Services."

4.2.1.5 NBS Contributions to Engineering Standards Committees - One of the primary objectives of this study was to identify and classify the types of contributions which NBS staff members make to U.S. standardization committees. Using input from the Suzuki Report, committee participants, and managers of committee participants, we identified 26 separate functions performed by NBS committee participants which we considered contributions to standardization work. We found we could classify these functions as follows:

a. Technical

b. Editorial

c. Administrative

d. Public Interest

e. Improvement of Standards System

In the "Technical" contributions category we included such activities as reviewing drafts for technical adequacy; alerting the committee to relevant reports, research, or reference materials; conducting laboratory research and development work; seeing to it that standards are updated as needed to reflect current technology; designing, conducting, or promoting the use of interlaboratory (round-robin) tests; and analyzing the data from interlaboratory tests to provide levels of precision for standards.

The "Editorial" category is comprised of the following activities reviewing standards for correctness of format, style, and definitions; writing initial drafts or significant portions of standards, and developing guidelines or standards for the writing of standards.

The "Administrative" category contains functions normally performed by committee officers such as coordinating the distribution of committee correspondence, preparing committee reports, running committee meetings, and taking minutes at meetings as well as encouraging the setting and following of priorities and assisting in the organization of new committees or subcommittees.

"Public Interest" functions consist of acting as an impartial third party to assist opposing parties in reaching agreement, representing government or consumer interests, and encouraging the committee to develop standards in national need areas such as health, safety, and protection of the environment.

The functions in the final category are those which tend to "Improve the Quality of the Standards System." These functions include encouraging the committee to avoid duplicating the work of others, encouraging them to strive for compatibility between national and international standards, urging the development of performance rather than design standards where practical, lending NBS credibility to standards, monitoring committee membership to see that all interested parties are represented, working within the committee to eliminate conflicting national standards, and urging the committee to develop standards only when a real need exists.

Participants in our survey were asked to select from the list of 26 activities all of the significant contributions they felt they had made to their committee in the last two years. The activities were not broken down into categories on the questionnaire. The totals for each contribution are given in table 2.

By far the most frequent contribution made to standards committees by NBS participants is the checking of draft standards to determine technical adequacy. This result is consistent with Suzuki report findings that the NBS participant's primary motivation to serve on a standard committee was to provide an unbiased opinion or technical assistance. However, the responses clearly indicate that NBS participants feel their contributions are not limited to the technical area. The average number of contributions indicated per committee was eight. Since none of the contribution categories contained more than seven items, the average participant made contributions in at least two categories. A classification of the contributions by category is shown in table 3.

A relative comparison of the overall frequency of occurrence of contributions in a particular category is as follows:

Category	Average No. of Reponses Per Contribution
Technical	113
Editorial	98
Improvement of Standards System	84
Public Interest	64
Administrative	56

As expected, technical contributions appear to be made more freqently than any other type of contribution. Editorial contributions which are closely related to technical contributions (i.e., to improve the technical adequacy of a standard it might be necessary to rewrite all or part of it) were second in frequency of occurrence. Contributions which tended to improve the quality of the standards system were a fairly strong third in frequency of occurrence. Public interest contributions came in a poor fourth despite special mention of this factor in the "Guidelines for NBS Participants in Voluntary Standardization Programs" issued in 1972. Administrative contributions occurred less frequently than any other type of contribution.

4.2.1.6 Relative Importance of NBS Contributions to Engineering Standards Committees--Participants' Views - To get a better idea of the participant's view of the relative importance of the contributions which he or she makes to the committee, we asked those surveyed to indicate, in order of importance, the three most important contributions (of those checked in the previous question) they had made to the committee in the last two years. In tabulating the responses to this question, we

Table 2. Contributions Made by NBS Committee Participants Listed by Frequency of Occurrence

Contribution	No. of Committees on which contribution is made	Frequency Ranks
Check drafts for technical adequacy	223	1
Alert committee to relevant reports, etc.	162	2
Review format, style, etc.	155	3
Lend NBS credibility to project	125	4
Write drafts of standards	107	5
Update standards	105	6
Promote compatibility between national and international standards	99	7
Discourage duplication of effort	90	8
Promote performance standards	85	9
Insure that a real need exists for standards	81	10
Represent government interest	81	10
Conduct R&D for committee	75	11
Develop "Round-Robin" lab test	75	11
Encourage development of national need standards	74	12
Encourage setting of priorities	72	13
Organize new committee or subcommittees	65	14
Prepare committee reports	64	15
Eliminate conflicting national standards	63	16
Act as impartial third party	52	17
Represent consumer interest	51	18
Run committee meetings	50	19
Distribute committee correspondence	46	20
Monitor membership	45	21
Take minutes	42	22
Analyze "Round-Robin" data	38	23
Write editorial formats	34	24
Other	18	

Table 3. Contributions Made by NBS Committee Participants Listed by Category

Category	Contribution	No. of Committees
Technical	Check drafts for technical accuracy	223
	Alert committee to relevant reports, etc.	162
	Conduct R&D for committee	75
	Update standards	105
	Develop "Round-Robin" lab tests	75
	Analyze "Round-Robin" data	38
Editorial	Review format, style, etc.	155
	Write drafts of standards	107
	Write editorial formats	34
Administrative	Distribute committee correspondence	46
	Prepare committee reports	64
	Run committee meetings	50
	Take minutes	42
	Encourage setting of priorities	72
Public Interest	Act as impartial third party	52
	Represent government interest	81
	Represent consumer interest	51
	Encourage development of national need standards	74
Improvement of Standards System	Discourage duplication of effort	90
	Promote compatibility between national and international standards	99
	Promote performance standards	85
	Lend NBS credibility to project	125
	Monitor membership	45
	Eliminate conflicting national standards	63
	Insure that a real need exists for a standards	81

weighted each response in accordance with the degree of importance indicated. For example, we determined the number of times a specific contribution was listed first in importance, the number of times it was listed second in importance and the number of times it was listed third. The first number was then multiplied by 3, the second number by 2, and the third number by 1. The results are shown in table 4.

As expected, "checking drafts for technical adequacy" is not only the contribution made most often, but is the contribution considered most important. In most cases, there was a reasonably close correlation between frequency of occurrence and perceived importance. However, there were a few notable exceptions. For example, urging the committee to develop a standard only when a real need existed was frequently noted as a contribution, but was rarely selected as one of the three most important contributions made. On the other hand, designing, conducting, or promoting the use of round-robin laboratory tests ranked higher on the importance scale than it did on the frequency scale.

To obtain a measure of the relative importance of the various contribution categories, we determined the average "importance" rank of the individual items in each category by adding all the rankings together and then dividing by the number of items. The results, rounded to the nearest whole number are:

Category	Average Importance Rank
Technical	6 (high)
Editorial	8
Public Interest	14
Improvement of the Standards System	15
Administrative	16 (low)

Contributions in the Technical and Editorial categories were usually judged to be more important than the other types of contributions. The differences between the other categories are not significant enough to make a firm judgment on the relative importance of one over the other; however, overall the administrative functions appear to be considered the least important of all types.

Contributions listed in the "other" category included: writing reports that influence committee work, supervising the work of other committees, working on analytical methods for SRM's or other reference materials, disseminating information, developing consumer information sheets, establishing liaison with other groups, developing standards to meet regulations, and contributing calculations and sets of data for incorporation into standards. One respondent noted that he had no contributions to report because there was no money to fund his participation.

Table 4. Contributions Made by NBS Committee Participants Listed by Relative Importance

Contribution	Importance			Weighted Value	"Importance" Rank	"Frequency" Rank
	1	2	3			
Check drafts for technical adequacy	96	28	22	386	1	1
Write drafts of standards	28	20	13	137	2	5
Review Format, style, etc.	6	33	11	95	3	3
Develop "Round-Robin" lab tests	20	9	14	85	4	11
Alert Committee to relevant reports, etc.	6	20	8	66	6	2
Update standards	5	14	12	55	7	6
Promote performance standards	12	5	6	52	8	9
Promote compatibility between national and international standards	5	13	4	45	9	7
Lend NBS credibility to project	3	8	18	43	10	4
Encourage development of national need standards	8	5	5	39	11	12
Represent government interest	4	3	15	33	12	10
Encourage setting of priorities	3	4	7	24	13	13
Analyze Round-Robin data	0	10	2	22	14	23
Organize new committee or subcommittee	3	5	3	22	14	14
Run committee meetings	2	5	5	21	15	19
Represent consumer interest	3	5	1	20	16	18
Discourage duplication of effort	1	5	7	20	16	8
Prepare committee reports	1	4	4	15	17	15
Act as impartial third party	2	1	7	15	17	17
Write editorial formats	2	2	4	14	18	24
Distribute committee correspondence	1	3	2	11	19	20
Eliminate conflicing national standards	1	3	2	11	19	16

Table 4. Contributions Made by NBS Committee Participants Listed by Relative Importance (Contd.)

Contribution	Importance			Weighted Value	"Importance" Rank	"Frequency" Rank
Take Minutes	1	2	0	7	20	22
Insure that a real need exists for a standard	0	1	3	5	21	10
Monitor membership	0	0	1	1	22	21
Other	11	1	1	36	-	-

4.2.1.7 Uniqueness of NBS Role - NBS is in a unique position to make positive contributions to the U.S. voluntary engineering standards system. In the technical category, NBS can provide a great deal of technical expertise which is not available elsewhere. For example, it has significant responsibilities and considerable expertise in two areas of particular importance to standardization activities: measurement and the characterization of materials.

In addition, NBS has major programs in important technological areas such as building construction, electricity, and electronics and in areas of national concern such as air pollution, fire, and energy conservation. In these and many other areas, NBS expertise is a valuable resource which should be used to the maximum extent to improve the technical quality of engineering standards.

NBS as a nonregulatory agency does not have a vested interest in the resolution of conflicting positions concerning standardization. Consequently, its staff members are in a good position to act in the public interest and serve as "third-party" arbitrators in cases of conflict between interested parties. This has frequently been cited as a government role on standards committees; however, since more and more agencies are being given regulatory authority over specific areas of standardization, few agencies can effectively play this role.

The NBS reputation for technical excellence has engendered a respect for the opinions of its representatives, who therefore, could be effective promoters of changes intended to improve the quality of the standards system.

Having the potential to effect the system and fulfulling that potential to the maximum extent are two separate things. The information gathered during our survey indicates that NBS experts are making numerous technical contributions to standards committees, with less emphasis on serving the public interest and improving the quality of the standards system.

4.2.1.8 Obstacles to Effective NBS Participation on Committees - The ability of an NBS staff member to participate effectively on a standards committee may be impaired by one or more of the following:

a. Lack of time - As the Suzuki Report noted, there is a tendency to consider committee work as a secondary activity; therefore, the "regular" Bureau work load may frequently be given precedence over committee work. The fact that over one-quarter of the time spent on committee work by the respondents to our survey was out-of-hours time seems to bear this out. In some cases, staff members may commit themselves to participation on several committees with the result that they cannot provide adequate attention to any of them.

b. Lack of money - A Government agency is allowed to provide funds for travel and other expenses of attendance at meetings which are concerned with the functions or activities for which it has received an appropriation.

Therefore, funds may be provided to support committee activities directly related to Bureau programs. Because there is no special fund to cover travel expenses to U.S. standards committee meetings, as for international committee work, committee participants must get funds from their individual program areas. Sometimes a lack of communication between participants and their managers in regard to the amount of funding needed for effective participation on a standards committee results in misunderstandings and inadequate support. The survey respondent who commented that he did not have time nor money for participation on his committee may have failed to clearly define and convey his needs to his manager.

A strange situation exists in regard to the payment of membership fees for committee participants. Section 5946 of title 5, United States Code provides that "Except as authorized by a specific appropriation or by express terms in a general appropriation...appropriated funds may not be used for payment of--(1) membership fees or dues of an employee...." Payment of such fees is often required before an individual is allowed to participate on a committee. Therefore, individuals may have to pay a membership fee out of their personal funds in order to serve on a committee in connection with an NBS activity. This situation is inconsistent with the policy to provide funds for travel to committee meetings if they are concerned with activities of interest to NBS. The difficulty produced by this situation has been overcome in the case of ASTM as described in 4.2.3.2.

4.2.1.9 Benefits to NBS Resulting from Committee Participation - It would be misleading to discuss NBS committee participation only in terms of contributions made to committees. Such participation may actually benefit NBS as much or more than the standards committee. For example, it is conceivable that a committee participant might not make any direct contribution to a committee but may provide NBS with valuable state-of-the-art information which would be useful in planning future research programs. In other words, participation often helps NBS to do a better job of anticipating national needs and responding to them. The benefits which NBS receives from committee participation accrue to the public in the long run.

Some of the specific benefits resulting from standards committee participation are:

a. Dissemination of NBS - generated technical information, e.g. on measurement, test methods, or metric usage.

b. Enhancement of NBS prestige (which strengthens NBS' ability to represent the public interest).

c. Savings on NBS resources through collaborative efforts with industry or other Government agencies.

d. Identification of industry or other agency needs to which existing NBS programs could be addressed or for which new programs should be established.

e. Promotion of NBS calibration or Standards Reference Materials Services (which in turn results in improvement in the quality of the national measurement system).

f. Advancement of the participant's professional growth (which makes him or her more valuable to NBS and to the standards activity).

g. Recruitment of skilled personnel for the NBS staff.

According to our survey of committee participants, the most frequent benefit received was the dissemination of NBS-generated technical information. If NBS research is to be of any use it must get out to the people who could put it to use. Standards committee participation is only one of several ways in which this can be accomplished but it is an important way because it is fairly direct and it usually provides a captive audience made up of a variety of interest groups. The extent of Bureauwide participation in these activities attests to the success of this avenue of information dissemination. A tabulation of the replies received when we asked participants to indicate those benefits which resulted from their committee work (in the last two years) is shown in table 5. In addition to information dissemination, the participants judged engancement of NBS prestige and identification of industry needs as among the more important benefits. In the "other" category, participants noted such additional benefits as: Maintain contact with manufacturers and other Government agencies, keep abreast of developments and capabilities of other laboratories, improve the use of government ADP resources, enable NBS to gain a better appreciation of the need for NBS participation in consensus standards activities, improve quality of chemical reagents, insure that results are compatible with NBS computer sciences and technology program, and cleared understanding of meaning and need as required of traceability of working standards to NBS standards.

TABLE 5: BENEFITS TO NBS RESULTING FROM PARTICIPATION ON STANDARDS COMMITTEES

BENEFIT	NO. OF REPLIES	PERCEIVED IMPORTANCE OF BENEFIT*			
		1	2	3	weighted value
Dissemination of NBS-generated information	185	107	45	9	420
Enhancement of NBS prestige	180	26	49	43	219
Advancement of participant's professional growth	130	7	12	45	90
Savings of NBS resources	102	18	27	16	124
Identification of needs	100	42	59	25	169
Promotion of NBS calibration or SRM services	76	11	20	19	92
Recruitment of skilled personnel	3	1	1	0	5
Other	23	–	–	–	–

*Rank assigned by participant ("1" being "most important"). Weighted value was obtained by multiplying the number in the first column by 3, the number in the second column by 2 and the number in the third column by 1 and then adding the three together.

4.2.1.10 Case Study - NBS Technical Impact on Paper Standards - In discussing NBS' contributions to committees and the resulting benefits to NBS we have been relying heavily on the information and opinions supplied by the participants themselves. We feel there is a good deal to learn from this source but we also realize that we must not stop at the committee participant to obtain a complete picture of NBS impact on U.S. standardization activities. For this reason, we intend to look for ways in which we can objectively measure the kinds and degrees of impact involved. We began this effort with the following case study.

Background: This study was initiated in an attempt to find some concrete method of measuring NBS technical impacts on domestic voluntary standards committees. The approach selected for the study was a citation search. Such searches have been made in various areas of science and technology and have provided interesting historical data. For example, citation studies have been used to pin-point articles which have served as the stimulus for extensive additional research.

Purpose: The purpose of the study was to determine the usefulness of citations to NBS work in published standards as a measure of NBS technical input to the standards.

Scope: The general area of standards for paper and paperboard was selected for this study because NBS has had programs in paper research for most of its history. In addition, Bureau staff members have served on committees developing test method standards for paper for many years, and it was felt that it would be

easier to observe trends in an area of significant involvement over a number of years. The study was limited to standards published by the Technical Association of the Pulp and Paper Industry (TAPPI). Originally the paper standards of the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI) were included in the study. However, because of the extensive duplication among TAPPI, ASTM, and ANSI (TAPPI standards are often adopted by ASTM and both TAPPI and ASTM standards are in turn approved by ANSI), the study was confined to the TAPPI standards.

Procedure: An Information Specialist in the Information and Analysis Section of the Engineering and Product Standards Division searched the TAPPI paper and paperboard standards (numbers 400 to 527) for direct references to NBS publications or programs in footnotes, text of the standards, and lists of references at the end of the standards. During the course of this search, it became clear that there were a number of references to articles by NBS staff members which did not specifically mention NBS. Therefore, after the initial search, a list of the names cited in the direct NBS references was compiled. Additional names were added to the list by NBS staff members who have been active in the paper area for a number of years. A second search of the TAPPI standards was made to locate citations referring to the names of NBS staff members on our list. The results of the two searches were reviewed by NBS staff members who are experts in the paper field.

Results:

1. Of the 113 active standards searched, 28 or approximately 25 percent, contained either a direct reference to NBS or an indirect reference to NBS (reference to an NBS staff member).

2. The 28 standards contained 25 direct references to NBS and 30 indirect references for a total of 55 separate references.

3. Several NBS papers were cited more than once; however, there were 48 unique references to NBS papers.

4. The publication dates of cited NBS papers broken down by decade are:

	1920's	1930's	1940's	1950's	1960's	1970's
references	9	21	6	6	10	3
papers	9	19	6	3	8	3

Interpretation: When the above results were discussed with NBS paper experts, it became apparent that citations are incomplete measures of NBS' technical impact. One expert went through each standard covered by the study and pointed out problem areas. His observations included:

a. It was difficult to determine the degree of the reference's impact on the standard. The mere fact that a paper is referenced does not mean that it significantly influenced the requirements in the standard.

b. Some of the more recent revisions of standards dropped the original references; therefore, early work done by the Bureau may be overlooked.

c. Several of the withdrawn standards had contained references to NBS papers.

d. At least two of the standards included references to non-NBS publications which in turn contained either direct or indirect references to NBS. These references did not show up in our study.

e. NBS had been responsible for the revision of several standards; however, there was no indication of the NBS work that went into the revision.

f. TAPPI has recently changed its policy in regard to references. To save paper, they are not including basic references in their new standards; they are only listing papers which are referred to in the text of the standard.

g. Some of the NBS staff members on the search list eventually left the Bureau, but continued to conduct research on paper; therefore, it is necessary to know when staff members began working for the Bureau and when they left the Bureau to insure that the indirect references are applicable to the study.

Although the data collected is inexact because of the above problems, it does show significant NBS technical input to paper test method standards. Additionally, it highlights periods of greater NBS activity in paper research and periods of lesser activity which appear to correlate with actual historical data. For example, the large number of papers cited in the 1930's can be explained as part of the output of a research program funded by the Carnegie Foundation on the permanence of paper and paper records. The drop in the number of references in the 1940's and 1950's is probably a result of the Bureau's specialized war work and the general decline in Bureau participation in voluntary standards activities following the war. The increase in the 1960's reflects the growing interest in technology and the Bureau's resumption of active committee participation. The decline in the 1970's can in part be explained by TAPPI's new referencing

policies; however, the information gathered from the NBS paper experts indicates other internal reasons for the decline.

Specifically, the number of people involved in basic paper research has been dwindling. In addition, much of the recent activity has been in an area in which TAPPI generally does not operate: specifications for paper. The specification work is carried on by ASTM; and, in this area, NBS has been working with the D6 Committee of ASTM. For the future it appears that the majority of the new references to NBS in TAPPI publications will be to the Bureau's Collaborative Reference Program for paper.

Discussions with NBS experts also revealed a very basic problem with the citation data: NBS staff members have not always been encouraged to seek recognition of their technical work in standards documents; in some cases, they have been discouraged from such identification. In one case, for example, a paper test method standard referenced a TAPPI standards committee report as the basis for the standard. The report was actually based on NBS research; however, because it necessarily contained a reference to a specific manufacturer's testing machine, NBS editorial policy would not allow it to be published as an NBS report. Instead it was allowed to be issued as a TAPPI committee report.

Conclusions and Recommendations: Although citations are incomplete measures of the impact of NBS work on engineering standards, they may be useful as rough indicators of NBS' technical input to standards committees and of the relative degree of activity of NBS in a particular area over a period of years.

Citation data, such as that collected and analyzed for this study, can be used to demonstrate NBS technical input to engineering and product standards. However, such data cannot be regarded as an accurate quantitative measure of NBS input. If NBS standards committee participants were encouraged to publish in technical journals the results of the technical work they conduct for their committees, then those articles could be cited in the published standards. Consequently, citation searches could provide data which would be more complete, and therefore, more useful.

4.2.1.11 Users - As previously noted, one of the characteristics of the U.S. national engineering standardization system is the large number of organizations which produce standards. It is estimated that there are currently nearly 400 U.S. organizations which issue standards. NBS staff members participate on standards committees sponsored by approximately 100 different organizations. However, as shown in table 6, NBS participation is primarily devoted to two large national standards-writing groups, the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI). Over half of the total NBS committee memberships are on committees sponsored by ASTM and ANSI. NBS participation in the standardization activities of approximately 60 groups is limited to only one committee membership. NBS holds 15 or more memberships in only 8 standards-writing organizations, but the total number of memberships in these organizations represents almost 80 percent of the total number of NBS memberships. Background information on the organizations in which NBS has 15 or more memberships is provided in table 7.

Table 6: NBS Participation in Domestic Standardization
Distribution of Committee Memberships Over Major NBS Operating Units and Standards-Writing Organizations

Domestic standards-writing organizations[a]	Major NBS Operating Units							
	OD	ADA	ADIP	IBS	IMR	IAT	ICST	TOTALS
Am. Soc. for Testing and Materials	12	1	2	85	164	238	2	504
Am. Natl. Stds. Inst.	11	8		82	14	123	37	275
Inst. of Electrical and Electronics Engineers				62		15		77
Am. Soc. of Heating, Refrigerating and Air-Conditioning Engrs.						26		26
National Fire Protection Association						22		22
Am. Concrete Inst.						18		18
Am. Soc. of Civil Engrs.				1	1	16		18
Soc. of Automotive Engineers				10		6		16
Other	8	1	5	101	40	89	11	255
TOTALS	31	10	7	341	219	553	50	1,211

[a]Organizations listed are those in which NBS has 15 or more memberships. The "Other" category is comprised of the total memberships in those organizations in which NBS has less than 15 memberships.

°NBS holds memberships in 102 domestic standards-writing organizations
°NBS holds only 1 membership in 60 organizations
°Approx. 2/3 of the NBS memberships are in ASTM and ANSI

TABLE 7: Profile of Major Groups Utilizing NBS Assistance in the Development of Voluntary Standards

Organization[a]	Members[c]	Staff[c]	Budget ($)[c]	Total No. of Stds.[b]	Remarks
Am. Soc. for Testing and Materials	21,000-22,000	150-160	over 1 million	5,353	
Am. Natl. Stds. Inst.	175-200 assoc. 900 companies	110-120	over 1 million	6,060	Most Am. Natl. Standards are developed by other organizations and are submitted to ANSI for recognition
Inst. of Electrical and Electronics Engrs.	160,000-170,000	250-275	over 1 million	266	
Am. Soc. of Heating, Refrigerating and Air Conditioning	30,000	45-50	over 1 million	36	
Natl. Fire Protection Association	31,000-32,000	150-175	over 1 million	237	
Am. Concrete Inst.	15,000-16,000 individuals 500-600 organizations	40-45	over 1 million	23	
Am. Soc. of Civil Engineers	70,000	110	over 1 million	-	ASCE develops stds. through ANSI & ASTM. Its members serve on 32 Am. Natl. Stds. Committees and 19 ASTM Comm.
Soc. of Automotive Engineers	26,000-27,000	125-150	over 1 million	3,000	

[a]Organizations in which NBS has 15 or more memberships.

[b]As of Jan. 1975

[c]According to the 1975 issue of National Trade & Professional Associations of the United States and Canada and Labor Unions, Columbia Books, Inc.

NBS' participation in ASTM and ANSI deserves further mention. ASTM and ANSI together have produced approximately 33 percent of the total number of U.S. engineering standards according to figures in the Suzuki Report. ASTM is the largest nongovernment standards-writing organization in the country. ANSI has assumed responsibility for serving as the clearinghouse for the approval of U.S. national standards although, as previously mentioned, it has never been formally recognized by the U.S. Government nor has it been totally accepted by the various elements in the standards system.[8]

About 68 percent of the committees on which NBS staff members participate are sponsored by ASTM or ANSI. Some of the reasons for the extensive participation in these groups are:

a. Historical Associations: There is a long history of cooperation between NBS and both ASTM and ANSI. This cooperation has been in technical and policy areas. NBS is currently represented on the Board of Directors of both ASTM and ANSI.

b. Unlimited Scope of Activities: Both ASTM and ANSI have a virtually unlimited scope of activities unlike trade associations, which are usually concerned with one specific product or class of products, or even professional and scientific associations, which are concerned with the advancement of a particular profession or area of science. Traditionally ASTM specialized in

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8 The Voluntary Standards System of the United States, An Appraisal by the American Society for Testing and Materials, April 1975, provides an excellent discussion of the strengths and weaknesses of ANSI.

material specifications and test methods, two areas of particular interest to NBS. Now, in addition, ASTM is developing standards for a variety of products. In its role as the clearinghouse for national standards, ANSI welcomes all standardization activities. By participating in these organizations, NBS can influence a broad range of products and technologies.

c. National Consensus Standards: The standards developed by ASTM and ANSI are national consensus standards. This means that they are developed by representatives of the various groups which will be affected by the standard. ASTM and ANSI have sought Government, including NBS, participants to serve on their committees to fulfill consensus requirements. By its strong support of ASTM and ANSI, NBS has, in effect, endorsed the principle of involving all concerned parties in standards development. Because of possible legal problems (in regard to antitrust violations), there has been an increasing tendency on the part of trade associations to submit their standards to the consensus procedures of ASTM or ANSI. This practice in some cases, obviates NBS participation in standardization activities at the trade association level.

d. Communication: Because standardization is a full-time activity for ASTM and ANSI they have been able to devote a good deal of time to the promotion of their various projects. Both groups have publications which are widely circulated (i.e., the ANSI Reporter and ASTM's Standardization News). Additionally, they send out letters of invitation to groups which may be affected by a proposed

standard.[9] Consequently, it is relatively easy for NBS to find out about projects in time to actively participate.

4.2.1.12 Nonclientele - In the standardization area, NBS' clients are usually acquired in one of three ways:

1. By chance: For example, an NBS staff member will join a professional society in his particular area of interest and become involved in its standardization activities.

2. By invitation: For example, an organization will have a need for NBS technical experts or NBS credibility, and will issue an invitation to participate in a standardization activity to an NBS staff member or organizational unit.

3. By design: For example, an NBS program having major responsibilities in a specific area of technology may seek out those organizations which have standardization programs in that area.

The extensive involvement of NBS in ASTM can be attributed to a combination of all three of the above factors. On the other hand, NBS does not participate in the standardization efforts of the Association of American Railroads (ARA), which was identified as a major standards-writing group in the Suzuki Report, probably because none of its staff members are members of ARA, ARA has not asked for assistance, and NBS does not have major responsibilities in ARA's area of interest.

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9 Within NBS, these letters are often received by the Engineering and Product Standards Division, which circulates them to other NBS Divisions that may have an interest in the activities described.

The present system has resulted in a mixture of committee assignments which have varying degrees of relevance to the achievement of national goals. The Suzuki Report recommended that one role of its proposed Engineering and Products Standards Council should be to establish priorities for the Bureau's involvement in voluntary standardization activities. This Council, which was originally established in March 1974, has not yet tackled the problem of priorities. Until a system is established to identify Bureauwide priorities and goals in standardization, it will be difficult to determine whether our present group of clients is sufficient or whether we need to seek out additional clients.

4.2.2 Alternate Sources - (See 4.2.1.7 "Uniqueness of NBS Role")

4.2.3 Funding Sources for NBS Services - Money for NBS participation on U.S. standards committees comes primarily from the Bureau's Scientific and Technical Research Services (STRS) funds. A small percentage of the money comes from other Government agencies or from technical or professional organizations. A search made of the NBS Form 83 information on 1,211 U.S. committee memberships resulted in the identification of only 117 memberships which were not funded entirely by NBS. Of these 117 memberships, 77 were funded by other Government agencies, 30 were funded by the individual or a technical or professional organization, and 9 were funded jointly by NBS and another organization (we do not know the funding source of the one remaining committee because it was not indicated on the Form 83).

In relation to funding, a real problem exists in identifying the total amount of NBS funds expended on committee participation because no systematic method has been developed to monitor these expenditures. In their 1970 report, the Suzuki Group posed the following questions: "How can there be any reasonable amount of program review, program direction, or program evaluation in the area of participation in voluntary standardization activities when so little is known about how many dollars we are spending? ...In addition, how could you justify additional dollar support for this program when you can't identify what is now being spent?"

These questions are still relevant and unanswered today. We do not have complete information on money spent in support of engineering standards activities. The NBS program structure identifies "Voluntary Engineering Standards" as an element in the program to provide services to improve application of technology (Subcategory C-2). Subprogram 3013, Domestic Standards Committee Participation, is one part of this element. It was hoped that the clear identification of this function would encourage NBS managers to establish and report their needs in this area. However, this has not happened. For FY-75, funds totaling only $305K have been requested under Program Code 3013. Actually this amount is only the tip of the iceburg. We know from the committee assignment forms that NBS staff members from approximately 48 divisions participate on standards committees and that most of this participation is funded by NBS. The $305K under Program Code 3013 represents the requests of only 7 divisions. In hopes of locating other NBS funds earmarked for standards work, we requested the Management and Organization Division to search their NBS project report (NBS-228) keyword file

for all those projects listing "engineering standards," "engineering specifications," or "building codes and standards" as technical or impact keywords. This search resulted in identification of 12 additional divisions which had allocated a total of $4,701K for projects in some way effecting standards, specifications, or codes. However, it was not clear how much of the allotted funds, if any, would be used to support participation on engineering standards committees. The divisions identified under Program Code 3013 and through the M&O Keyword file total 19. This means that 29 of the 48 divisions supporting committee participants do not specifically identify the funds used for these activities.

4.2.3.1 Cost Data From Committee Participants' Annual Reports

The Suzuki Report recommended that a reporting system for engineering standardization activities should be developed as well as a system for capturing costs associated with those activities. Consequently, the Program Manager for Engineering and Information Processing Standards requested an annual report from committee participants beginning with FY 1972. Participants were asked for the following data:

a. Name of the standards activity and the sponsoring organization
b. Number of meetings attended, location and date of each meeting
c. Results of participation (standards approved; ballot record)
d. Travel expenses
e. Time on travel
f. Estimated time on standards activity other than travel
g. Laboratory or miscellaneous costs (including cost of support personnel such as secretaries and lab technicians)
h. Comments or recommendations for management

The cost data from the reports for FY-72, FY-73, and FY-74 was computed for this study. The results are as follows:

Fiscal Year	Cost of Travel (dollars)	Days in Travel	Office Time Spent on Standards (hours)	Number of Participants Reporting	Avg. Office Time Spent on Standards (hours)
1972	64,600.82	1052	22,082	142	155
1973	61,570.01	714	18,446	97	190
1974	34,540.30	280	8,547	53	161

This information is not very useful in determining the true cost of NBS domestic standardization activities for the following reasons:

1. Response from committee participants was poor initially and got steadily worse. We know that over 400 NBS staff members participate on standards committees; however, the highest number of individuals reporting for a single fiscal year was 142. There are probably many different reasons for the poor response; for example, reluctance to send in a report that showed little or no activity, insufficient data on the requested items, assignment of a low priority to the report, lack of incentive for filling out the report, and lack of reprimand for not filling out the report. The main reason for the decline in the number of reports may be that no output resulted from the collection of the data. The Office of Engineering and Information Processing Standards had planned to computerize the annual report data, but had given first priority to the computerization of the information on the committee assignment form.

2. There were inconsistencies in the methods of compiling the cost of travel. Some individuals included the cost of their salaries in the cost of

travel and others included only the amount on their travel voucher. Apparently, more information was needed on the type of data required.

3. The data collected combines figures for international and U.S. standardization activities. It would be difficult, in many cases, to separate the data.

4. A few Divisions assigned one individual to compile the report for the whole Division. In at least one case there was no breakdown according to individuals, but only one group of figures for the whole Division.

The data supplied on laboratory and miscellaneous costs was minimal and what was given appeared to be of a questionable nature; therefore, it was not compiled.

After reviewing the annual report data, we are forced to conclude that we still do not have a complete picture of the impact of U.S. standardization activities on NBS in terms of the time and money spent by NBS committee participants. The present annual report system has failed to provide the data needed.

Various NBS operational units having significant responsibilities in the area of standards development such as the Center for Building Technology in IAT and the Institute for Computer Sciences and Technology have developed their own methods of capturing some of the costs related to standards committee participation. It may be possible to use resources such as these and develop new sources of information where needed to obtain cost data on a continuous basis over the year instead of requiring an annual report from committee participants. This possibility is now under investigation.

4.2.3.2 NBS Institutional Memberships in Professional Societies

In 1973, the NBS Executive Board ruled that it would be inappropriate for the Bureau (at any organizational level) to take an institutional membership in a professional society. Their decision was apparently based in part on the difficulty of determining where to draw the line between personal memberships maintained by NBS staff members and institutional memberships which imply the Bureau itself is represented. A second reason for the decision was the conscious desire of the Bureau to work with major standards-writing bodies which represent groups of industries or interests rather than individual societies or industry standards bodies.[10] The Board did provide, however, that exceptions might be granted on rare occasions, but only with the Board's prior approval.

To date, the only approved exception to the institutional membership policy is the Bureau's sustaining membership in the American Society for Testing and Materials (ASTM). The Bureau has held this membership since January 1, 1971. Since that time, NBS has paid an annual sustaining membership fee of $200 and an additional annual administrative fee of $25 for each NBS representative serving on ASTM standards committees, subcommittees, and special panels.

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[10] Memo from Paul H. Schrader to Richard W. Roberts, May 31, 1973.

Since NBS became a sustaining member of ASTM, the number of NBS participants on ASTM committees has increased from 110 in 1971 to 230 in 1975. The total cost of the ASTM/NBS administrative fee contract has increased from $2,950 in 1971; ($200 sustaining member fee plus 110 participants @ $25 ea.) to $6,195 in 1975; ($200 sustaining member fee plus 230 participants @ $25 ea. and 1 participant @ $10 ea. plus $235 owed on 1974 contract). The NBS policy of avoiding sustaining memberships except in the case of ASTM has raised questions both within NBS and on the outside. For example, NBS managers ask why NBS will not join other organizations so that it can set up an administrative fee arrangement with them (as mentioned earlier, NBS cannot pay membership fees for individuals and this situation makes it awkward for an NBS manager to suggest that a subordinate participate on a standards committee of an organization that requires participants to pay membership fees.) ANSI has asked why NBS is unwilling to make an arrangement with it that is similar to the one with ASTM.

4.2.4 Mechanism for Supplying Services - (See 4.2.1.5, "NBS Contributions to Engineering Standards Committees," and 4.2.1.11, "Users.")

4.3 Impact of NBS Services

4.3.1 Economic Impact of Major User Classes - In one sense, the users of NBS services for the development of voluntary U.S. standards could be said to be the 100 organizations in which NBS staff members hold committee memberships. In this sense, the major users of NBS services might be said to be the eight organizations in which NBS holds 15 ore more memberships (see section 4.2.1.11). These organizations, however, are merely vehicles used by the various segments of the economy to develop standards. In the U.S. voluntary standards system, it is not necessarily the development of standards which impacts society, but rather the use of standards. Therefore, it appears to be more relevant to talk about the economic impacts resulting from the use of standards than to discuss the economic impact of the major users of NBS services for the development of standards.

4.3.2 Impacts of Standards on Society

The major effort of this study has been to categorize and analyze the ways that NBS professionals influence the development of engineering standards through their participation in the voluntary standards-writing process in the United States. The tacit assumption is made that the engineering standards developed with NBS assistance are beneficial to society. Obviously such an assumption can and should be questioned. Certainly some standards are more beneficial than others. Some standards

affect relatively small segments of our society while others impact nearly everyone. It is probable that some standards have no impact because they are never adopted.

Clearly NBS professionals decide whether or not to become involved in a specific standardization project before they decide to what extent it is desirable to attempt to influence the content and scope of the standards which are to be developed.

These decisions are normally made by NBS professionals and their managers at the technical program level on the basis of a program manager's assessment of the benefits to be expected. While it is reasonable to assume that these program managers are the best judges of the technical considerations leading to such decisions, there is some question as to whether or not they are in a position to judge to the economic and social consequences or impacts resulting from the adoption of a particular standard.

Determining the potential economic and social impacts of engineering standards is a difficult problem which has not been analyzed in a systematic manner by NBS or any other organization in the United States. Nevertheless, the future effectiveness of the U.S. Voluntary Standards System, and the effectiveness of NBS' role in this system can be expected to depend significantly on a better understanding of these impacts.

A literature search for published information on the economic and social impacts of standards was undertaken as a part of this study. Most of the available literature has been authored by proponents of standardization and is therefore biased toward the positive or beneficial impacts of standards. The analysis of the information collected led to the following observations.

Historically the benefits of standardization have accrued directly to the producers of goods and services while the ultimate users of these goods and services have received indirect benefits. Consequently, most standardization literature deals with what could be called "Producers" economic benefits in the industrial sector.

In more recent times, the consumer movement has led to a greater emphasis on standards which directly impact the consumer in general. These standards are intended to save lives, protect health, or improve the environment, and most of the literature available emphasizes these social or "Quality of Life" impacts.

For the purposes of this study we have chosen to focus on the general class of industrial standardization and on impacts which are economic in nature. We have attempted to categorize these impacts in a logical and systematic manner. The primary purpose of this categorization effort is to organize a very diverse collection of related information in such a way as to facilitate further analysis.

4.3.2.1 A Categorization of Economic Impacts of Engineering Standards - The specific types of economic impacts which may be expected from the use of standards depend on several variables such as the timing of the development of the standard, the technical and editorial quality of the standard, and the degree of acceptance of the standard. Therefore, it is necessary to categorize "potential" economic benefits assuming appropriate timing, adequate quality and significant acceptance.

The principal economic impacts of industrial engineering standards are related to technological efficiency in three general areas.

Engineering standards promote:

A. Efficient use of manpower

B. Efficient use of physical and natural resources

C. Efficient market transactions

In order to follow this line of reasoning it is necessary to examine the first order effects of standards, that is, what things are standardized or specified by an engineering standard.

Engineering standards specify:

A. Meanings for technical terminology

B. Size and dimensional requirements for products and components

C. Material composition of products and components

D. Performance expected from products and components

E. Test methods for characterizing materials, products, and components

A given standard may specify one or more of the above items, and may have potential economic impacts (either positive or negative) in one or more of the impact areas (manpower utilization, physical and natural resource utilization, or market transactions). Table 8 on the following page illustrates this categorization approach. Fifteen grid elements are identified. For example, grid element (1,1) designates positive and negative potential economic impacts for standards which effect manpower utilization by specifying and standardizing the meaning of technical terminology; grid element (2,2) designates economic impacts on physical and natural resource utilization by standards which specify sizes or dimensions of products and components; and so on.

Our literature search identified a large number of potential economic impacts, most of which can be reasonably assigned to one or more of the fifteen grid elements of table 8. The following examples show how this is accomplished.

TABLE 8 : POTENTIAL ECONOMIC IMPACT GRID FOR ENGINEERING STANDARDS

+ = positive impact or benefit - = negative impact or disbenefit

Standardized Items	Areas Where Standards Effect Efficiency					
	Manpower Utilization		Resource Utilization		Market Transactions	
Technical Terminology	+	- (1,1)	+	- (1,2)	+	- (1,3)
Sizes and Dimensions of Products and Components	+	- (2,1)	+	- (2,2)	+	- (2,3)
Material Composition for Products and Components	+	- (3,1)	+	- (3,2)	+	- (3,3)
Performance Expected from Products and Components	+	- (4,1)	+	- (4,2)	+	- (4,3)
Methods for Testing Products and Components	+	- (5,1)	+	- (5,2)	+	- (5,3)

4.3.2.2 Economic Benefits Cited in the Standards Literature

Example A: Benefits Related to Manpower Utilization (grid elements 1,1 through 5,1)

1. Standards increase efficiency by:

   a. Reducing the time engineers spend on searching for information, designing, drafting, and writing specifications for products and parts bought or sold by a company, and consequently the time spent by clerks and typists on filing and typing

   b. Decreasing the number of technical decisions required of supervisory personnel in both production and utilization and reducing the hazards of technical error in judgment

   c. Reducing training time for machine operators and technical personnel

   d. Making possible the use of unskilled (even illiterate) workers to manufacture complex items such as automobiles

   e. Reducing time spent on testing and de-bugging and cutting down on rework

   f. Cutting down job related injuries and costs

   g. Eliminating practices that are merely the result of accident or tradition

   h. Facilitating interdepartmental communication such as between production and marketing divisions and reducing the need for special meetings among engineers, draftsmen, and production managers

   i. Allowing engineers to concentrate on practices which cannot be standardized

   j. Resulting in simpler, more effective and efficient inspection and testing because they permit:

      (1) greater uniformity of manufactured parts and products
      (2) use of automated inspection equipment
      (3) use of sampling and statistical quality control techniques

These examples could be further refined in order to specify individual grid elements in the manpower utilization category. For example,

Standardized terminology promotes the efficient use of manpower (grid element 1,1) in several items listed above.

Example B: Economic Benefits Related to Physical and Natural Resource Utilization (grid elements 1,2 through 5,2)

1. Standards increase efficiency by:

   a. Lowering, inventory costs by:

      (1) Reducing storage area
      (2) Reducing the number of items in inventory
      (3) Allowing savings from the use of stocked parts in lieu of nonstocked parts

   b. Decreasing the numbers and types of packing required and making possible the use of more effective packaging and materials handling techniques

   c. Reducing total capital investment in:

      (1) raw materials
      (2) semifinished stock
      (3) finished stock
      (4) jigs, dies, templates, and special machinery
      (5) repair parts
      (6) storage space

   d. Leading to greater interchangeability of parts, designs, and packages

   e. Allowing automatic data processing to be used in many ways; e.g., inventory control and reorder systems, management information systems and numerical control of machine tools

   f. Allowing quicker more reliable delivery and greater availability of products and parts since they can be produced and distributed in advance of actual requirements

g. Eliminating slow-moving stock, stabilizing demand and increasing turnover; thereby minimizing losses from stock depreciation, obsolescence, and changing market values

h. Limiting the number of items which reach the marketplace

i. Reducing the number of items rejected by buyers

j. Tending to reduce planned obsolescence since the standards can be used to differentiate between high and low quality goods

k. Increasing the useful life of products which reduces the draft on raw materials for a given level of demand

l. Tending to make lean use of any given resource by cutting down on engineering "over design"

m. Promoting materials substitutions, such as substitution of nonrenewable resources by renewable ones, since they shift attention away from the properties of materials per se and toward the functions which materials are to perform

Example C: Economic Benefits Related to Market Transactions (grid elements 1,3 through 5,3)

1. Standards increase efficiency by:

a. Providing consumers with "a set of virtual purchase specifications" for their needs which they can reference when ordering a product and thereby resulting in greater public confidence in products and a reduction in the time buyers need to spend on inspection, testing, and approval

b. Allowing more accurate labeling as to grade, type, class and size

c. Setting limits for one or more grades below which quality should not be allowed to fall and establishing appropriate tests to use as a means of determining quality

d. Improving communication between various groups and thereby reducing the possibility of error, litigation, lengthy negotiations, and misrepresentation as well as the need for specialized knowledge in judging quality

e. Providing the buyer with a definite and legal basis for return or redress and providing the seller with at least a potential defense in court in product liability cases

f. Establishing a thoroughly recognized basis for certification of products, advertising, and selling

g. Permitting selection of the adequate quality for a specific use (classifications of products which relate quality levels to specific uses provide buyers with a better understanding of how to use the product)

h. Eliminating the need in many cases for "restrictive" legislation or regulations by providing voluntary self-regulation in the commercial sector

i. Providing greater opportunity for newcomers to enter the field (the new business can benefit from knowing the minimum conditions it must meet, as well as the market created by the standard; also the small business will be less at the mercy of established reputations and expensively advertised trademarks)

j. Encouraging concentration by producers on essentials and intrinsic merits of products instead of confusing elements intended merely for sales effect and thereby tending to reduce superficial product differentiation and encourage product competition

k. Providing recognized basis for comparison of values which tends to broaden markets because of the increase in public confidence in both quality and utility

l. Providing authoritative and uniform criteria and methods of test for use in judging adequate performance and comparing values

4.3.3 Economic Benefits Identified in a Survey of Nuclear Instrument Module Standard Users -

In order to test the utility of the categorization scheme described in the previous section, selected results of a survey of major users of the AEC Nuclear Instrument Module (NIM) standard were studied.

The AEC NIM Committee which was chaired by an NBS staff member (Louis Costrell) was organized in March of 1964 to develop standard module specifications which would insure interchangeability of instruments within and among the various nuclear research laboratories in the United States. The first standards publication was issued in July of 1974. Since that time virtually all domestic nuclear instrument manufacturers in the U.S. and 24 foreign countries have undertaken the manufacture and sale of NIM Modules.

In May of 1967 Dr. Spofford G. English, who was then the Assistant General Manager for Research and Development at AEC, requested appraisals of the extent to which the NIM standardization effort had accomplished its purpose from the major nuclear laboratories in the United States. Of the responses received, only one attempted to estimate total economic benefits in absolute dollar terms. However, most of the responses indicated that economic benefits were real and significant, even if not easily quantified.

The stated objective of the NIM standard was to--"produce a standard module design such that modules would be interchangeable physically and electrically. Circuit design details as well as materials and methods have purposely been omitted."

From this stated objective we determine that this particular standard specifies sizes and dimensions of components and parts (grid row 2), and the electrical performance expected from components and parts

(grid row 4). Following our categorization scheme we would then expect to find examples of economic impacts in the individual grid elements of these rows in table 8. The following examples, taken from the responses to the AEC request, show that this can be done.

Examples Quoted From the Report Submitted by the Princeton - Pennsylvania Accelerator Group

1. Efficient Manpower Utilization:

   a. Resulting from standardized sizes and dimensions of products and components (grid element 2,1)

   "...the single system allows faster turn-around time both for required equipment and for experiment reconfiguration"

   "...since all packaging decisions are made, new designs can be executed very quickly."

   b. Resulting from standardized performance from products and components (grid element 4,1)

   "...the reason for the short useful life of in-house designs is that they were never thoroughly engineered. While those of us involved in the program can see many things wrong with NIM, nonetheless

when a problem arises it is immediately "beaten to death" by a major engineering effort. With an "in-house" design, a major problem (such as connector unreliability) usually results in discontinuance of use..."

2. Efficient use of Physical and Natural Resources

a. Resulting from standardized sizes and dimensions of products and components (grid element 2,2)

"...before we had the NIM standard special purpose modules often ended in the junk box often after only a single experiment. Now they are traded among experimenters and seem to have indefinite life."

b. Resulting from standardized performance requirements (grid element 4,2)

"...Experimenters arriving from other laboratories now come with some modules and some bins. We supply the rest, and there are simply no problems--except to have enough."

"...the better utilization afforded by NIM is estimated to allow us to instrument the present experiments with 120 fewer modules than would have been needed without NIM"

3. Efficient use of Market Transactions

a. Resulting from standardized sizes and dimensions (grid element 3,2)

"...prior to the NIM program we rarely received a discount--now the market is more competitive. ...because we need not fear obsolescence we can place large single item orders--most of our items are discounted from 8 to 20%."

b. Resulting from standardized performance requirements (grid elment 4,3)

"...were it not for NIM we would have been forced to stock our pool from a single supplier with the obvious loss of the advantage of competitive purchasing and the not so obvious risk of technical obsolescence or we could have bought from a number of different suppliers with the penalty of lower utilization."

The foregoing examples illustrate that the categorization scheme can be applied to the real economic benefits of the NIM standard; and afford some degree of confidence that the approach could be taken with other standards.

Finally, using the categorization scheme in this way helps point out potential economic impacts that might otherwise be overlooked.

4.3.4 Economic Disbenefits of Standardization

Negative economic impacts of voluntary engineering standards have received relatively little attention in the standards literature. The situation is much different for mandatory standards (regulations). While a great deal has been written about the negative economic impacts of regulatory standards, methods for estimating and predicting these impacts are not yet well developed. At the present time, most of the work in this area has been directed toward identifying the nature and extent of the problem. In a few cases (for example the automobile industry's studies of the economic impacts of pollution regulations) detailed analyses have been carried out. In this study we have not been able to attempt a detailed analysis of the findings of these studies. However, we should note that further study in this area can be expected to be significant and important to NBS for several reasons including the requirements of recent Federal legislation that economic impact analyses studies for proposed regulatory legislation be undertaken as part of the legislative review process. Since NBS professionals are involved in the development of many standards that serve as the basis for mandatory regulations, the potentially negative economic impacts of standards will become more and more a part of the NBS standards activities picture.

4.4 Evaluation of NBS "Program"

4.4.1 Strengths and Weaknesses of NBS' Standards Committee Participation -

The findings of this study support the thesis that NBS participants on standards-writing committees make significant technical and policy-related contributions to their committees. In some cases NBS employees assume leadership positions on standards committees and thereby initiate and sustain important standardization activities. Nevertheless critics of NBS' domestic standards activities cite the lack of an overall management approach to a coordinated standards participation program at NBS as a major weakness.

As a result of their March 1975 study of voluntary engineering standards activities, the NBS Program Office concluded that Voluntary Standardization Participation at NBS is not a "program," but rather is a "collection of related activities." This discription is an accurate one since a "program," is usually defined as a self-consistent set of activities which can be made the responsibility of a manager who has the authority to: (1) Develop goals and objectives, (2) Identify and assess clientele needs, (3) Evaluate outputs, impacts, cost/benefits, and (4) Allocate resources. No one individual or office has ever been given this type of authority over NBS voluntary standardization participation; therefore, NBS has never had a voluntary standardization participation "program." There seems to be general agreement that some sort of overall management of NBS standardization activities is desirable. However, there are conflicting views as to how it should be accomplished. One solution would be to appoint a Program Manager who

would have authority in the areas mentioned above. This alternative would involve the centralization of management responsibility for standardization activities and would create a standards committee participation "program."

Another alternative is to leave the responsibility for these activities with first and second level line managers who would deal with committee participation as a part of existing programs rather than as a separate entity. This second, decentralized approach appears to be more reasonable for the following reasons:

a. Participation on voluntary standards committees is not a selfconsistant activity, but rather it is an intergral part of many existing NBS programs. It has been recognized as an effective way of getting the results of NBS research out to the public and as a means by which NBS gathers state-of-the-art information for use in long and short range planning. Consequently, standards committee participation should be judged in terms of the program which it serves and not as a separate entity.

b. It is not feasible to centralize the financial management of voluntary standardization activities. The Suzuki Study Group pointed out several problems that could occur if this were attempted. They cited, for example, ICST's authority under the "Brooks Bill" to assist in the development of standards in the computer field. They explained that centralized funding would separate the Institute from its major source of funding since it normally got double duty from the funds, i.e., as a means of support for other related activities. Therefore, they stated that from the Institute's point of view, "central control would be,

and should be, totally unacceptable." Consequently, the Suzuki Study Group recommended that "the financial management system, except that involving foreign travel, should not provide for a central control of funds for standardization activities."

c. Even if it were possible to treat standardization activities as a unit and to centralize management of the funds for these activities, it would be extremely difficult to provide one individual with the information needed to make trade-off decisions concerning allocation of the Bureau's limited resources. It would be far easier to provide NBS program managers with the guidance and information they need to make trade-off decisions at their various management levels.

The present decentralized management of NBS' standards committee participation suffers from a lack of information flow in two directions: (1) The management chain above the Division Chief level is not well-informed, and therefore, is "uneasy" about how NBS is allocating its resources in standardization activities; (2) The management chain from the Division Chief down feels a lack of guidance from above, and is therefore "uneasy" about making resource allocations for standardization activities.

4.4.2 Review of Current Sources of Information on Standards Committee Participation - The major strengths and weaknesses of the present standardization activity information sources are as follows:

1. NBS Form 83, Record of Assignment (NBS staff members are required to fill out this form for each committee, subcommittee, and task group on which they serve):

a. Strengths - Identifies participation in engineering standards activities and provides useful information on the nature of the participation.

b. Weaknesses - Individuals do not keep their records up to date.

2. Annual reports (NBS committee participants are required to submit a report on their standards activities at the end of each fiscal year):

a. Strengths - Provides data on the cost of participation and provides the participant with an opportunity to assess the value of his or her participation.

b. Weaknesses - Response from participants is poor, data supplied if often incomplete, participants compute their costs differently.

3. Directory of committee participants (issued annually):

a. Strengths - Lists participants and committees on which they participate and provides a listing of keywords taken from the title and scope of the committees.

b. Weaknesses - Directory is out of date as soon as it is published, publication process takes from 3 to 6 months.

4. Quick-query system:

   a. Strengths - This computerized system based on the information included on the NBS Form 83 permits compilation of the data in a number of useful ways; for example, the system can be queried to obtain a listing of committees and participants according to committee auspices (the group sponsoring the committee, such as ASTM) or a listing of participants by their divisions.

   b. Weaknesses - The Quick-query system is only as accurate as the Form 83 file.

5. Guidelines for NBS committee participants:

   a. Strengths - Provides information on the individual's role on a standards committee as a member of the NBS staff and on his reporting responsibilities

   b. Weaknesses - The Guidelines for participants were last published in 1972; they need to be revised and expanded.

4.4.3 Improvement of Decentralized Management System - The key to the improvement of the present management of standardization activities is well-informed decision makers. Those who make the decisions which affect NBS participation in U.S. standardization activities include:

a. NBS committee participants

b. Section Chiefs/Division Chiefs

c. Institute Directors

d. NBS Engineering and Product Standards Council

e. NBS Director/Executive Board

f. Department of Commerce Office of Product Standards/Interagency Committee on Standards Policy

Each of these groups needs reliable up-to-date information if NBS is to achieve the maximum public benefit from its standardization activities.

4.5 The Future - U.S. standardization activities can be expected to grow in importance and scope in the future. The greatest growth will probably be in those areas which affect the quality of life (i.e., standards that affect health, safety, the protection of the environment).

The examples cited earlier of trends which will affect U.S. standardization activities point to increased demands on NBS for assistance in developing engineering standards. Since NBS has finite resources it may not be able to meet all of these demands. A program has recently been established in Standards Information and Analysis Section of the Institute for Applied Technology to continue the examination of current NBS impact on U.S. standardization activities. The objective of this program is to collect and disseminate information which will assist NBS participants and their managers in making decisions about committee participation in the future.

5.0 Summary and Conclusions

(See Executive Summary)

Appendix - Methodology of the Study

Survey of NBS Participants on Standardization Committees

Purpose: The general purpose of the survey was to determine the types of impacts NBS committee participants believe they have on their committees and who they feel they are affecting beyond the standards committees.

Sample: At the recommendation of our survey advisor in the NBS Technical Analysis Division, a random sample of committee participants was selected for the survey. Out of a total of about 400 NBS participants, 150 or about 38% of the total were selected. The names were selected from an alphabetical computer control file printout of committee participants which was dated February 3, 1975. The names of participants on U.S. standards committees were marked off in groups of eight and the second, fourth, and seventh names were selected. The sample selected included participants from 39 Divisions/Centers and from each NBS Major Operating Unit.

Procedure: Questionnaires (see Exhibit A) were mailed directly to participants on April 21, 1975. Participants were given a week to return them. They were asked to complete a questionnaire for each committee on which they served. By April 28, the deadline, only 25% of those surveyed had returned their questionnaires. Another 5-10% of the recipients had notified us that they had retired or were no longer on committees. Additional names were selected at random to replace those who were no longer on committees.

On May 6, a reminder notice was sent out to those who had not yet returned their questionnaires. The reminder succeeded in raising the response rate to 50% by May 9. We then started a telephone followup campaign. We were not able to reach our goal of 85% response until May 28 because of participant travel, illness, or heavy work load.

Response: In addition to the 130 participants on the sample list who returned questionnaires, several questionnaires were returned by participants who were not on our list. The response broken down according to NBS MOU was as follows:

MOU	Quesionnaires sent:		Questionnaires received:	
	No. of people	No. of quest.*	No. of people	No. of quest.*
OD	2	12	2	5
ADA	3	4	4	4
ADIP	1	2	0	0
IBS	47	111	41	82
IMR	33	67	29	52
IAT	55	213	49	137
ICST	9	15	8	13
TOTALS	150	424	133	293

Rate of response: 86%

*Participants were initially sent one questionnaire for each committee for which we had an NBS 83 Record of Assignment. Some requested additional questionnaires. Others returned only some of the questionnaires they were sent.

UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

Exhibit A

April 21, 1975

MEMORANDUM FOR

From: Gene A. Rowland
Acting Chief, Engineering and Product
Standards Division

Subject: Participation on U.S. Voluntary Standardization Committees

Our records show that approximately 400 NBS staff members participate on over 1,000 U.S. voluntary standards committees, subcommittees, and task groups. While we have data on the names, numbers, scopes, and sponsors of these committees, we know very little about the contributions which you and other committee participants make to the committees. Therefore, as part of a Bureauwide effort to assess the impact of NBS programs, we are making a study of NBS impact on U.S. voluntary standardization activities. To do this, we need your cooperation.

Attached is a questionnaire for each committee, subcommittee, and task group for which you have submitted an NBS Form 83, Record of Assignment. By completing and returning your questionnaires, you will greatly assist the study group in their task. Please follow the directions on the questionnaire, but feel free to add comments if the multiple choice is too constraining.

Would you please complete your questionnaires as quickly and accurately as you can and return them to Mrs. J. A. Koenig, Room B-162, Technology Building, by April 28, 1975. If additional questionnaires are needed, telephone Mrs. Koenig on Extension 2356.

Exhibit A
(contd.)

U.S. Voluntary Standardization Activities Questionnaire

(Please fill out a separate questionnaire for each committee, subcommittee, and task group or working group on which you participate excluding only those committees which are primarily concerned with the development of international standards.)

☐ Committee ☐ Subcommittee ☐ Task Group: Name and No. _____

_____

Organization: ☐ ASTM ☐ ANSI ☐ IEEE ☐ Other (please specify) _____

No. of yrs. on Committee _____ Offices held _____

Current Committee status: (Check all that apply) ☐ Voting ☐ Nonvoting ☐ Member ☐ Chairperson ☐ Secretary ☐ Other (please specify) _____

No. of standards issued by the Committee in the last 3 yrs. _____

No. of standards that you expect will be issued by the Committee in the next 2 yrs. _____

Type of Committee: ☐ Standards Development ☐ Standards Policy ☐ Other (please specify) _____

(The following questions apply to the Committee you have specified above)

1. In their report issued in 1970, the NBS Voluntary Standardization Policy Study Group identified four types of engineering and product standards:

(a) Nonproduct technological standards--including standards of terminology, definitions, symbology, and general test methods applicable broadly to physical and chemical quantities.

(b) Industrial market product standards--including characteristics such as the following that apply to products intended primarily for industrial use: dimension, design, material, performance, safety, compatibility, labeling, classification, test methods, and acceptance levels.

(c) Retail market product standards--including characteristics such as those described in (b) above but applying to products that are sold primarily in the retail marketplace.

(d) Obligatory standards--including standards relating to public health, safety, and welfare, and applying to standards prepared voluntarily with reasonable expectation of becoming obligatory (binding in law or conscience).

1A. Which of the following terms, as defined above, best describes the majority of the standards developed by your Committee?: (please check only one)

_____ 1. Nonproduct technological standards
_____ 2. Industrial market product standards
_____ 3. Retail market product standards
_____ 4. Other (please specify) _____

1B. What, in your opinion, is the probability that the standards developed by the Committee will become obligatory (as defined above)?:

_____ 1. Certain
_____ 2. Good
_____ 3. Unlikely
_____ 4. Unknown

2. Which of the following types of standards is the Committee most concerned with?: (please check no more than two)

_____ a. Product standards of the following type:
  _____ (1) Performance (describing the performance expected of the product)
  _____ (2) Design (describing the specific materials, sizes, dimensions for the product)
  _____ (3) Combination performance/design
_____ b. Test method standards
_____ c. Nomenclature standards
_____ d. Recommended practice standards
_____ e. Materials standards

3. Who are the primary beneficiaries of the standards developed by the Committee?: (please check no more than three)

_____ a. Household consumers
_____ b. Industrial consumers
_____ c. Manufacturers
_____ d. R&D scientists and engineers
_____ e. Governments (local, State, or Federal)
_____ f. Other (please specify) _____

4A. There are many ways in which NBS staff members can contribute to the standards committees on which they serve. Please indicate all significant contributions you feel you have made in the last 2 years to the Committee on which you serve by placing a checkmark next to the number of each appropriate statement in the following list:

_____ 1. Review draft standards for technical adequacy.

_____ 2. Alert the Committee to relevant reports, research, or reference materials during the development of the standard.

_____ 3. Conduct laboratory R&D work for the benefit of the Committee.

_____ 4. See to it that the Committee's published standards are updated as needed to reflect advances in technology.

_____ 5. Design, conduct, or promote the use of interlaboratory (round-robin) tests to determine the precision of test methods or performance of testing laboratories.

_____ 6. Analyze data from interlaboratory tests to provide levels of precision for standards.

_____ 7. Review standards for correctness of format, style, and definitions.

_____ 8. Write initial drafts of standards or significant portions of standards.

_____ 9. Help develop standards for the writing of standards (covering requirements for format, content, and other aspects of standards).

_____10. Coordinate the distribution of Committee correspondence.

_____11. Prepare Committee reports.

_____12. Run Committee meetings.

_____13. Take minutes at Committee meetings.

_____14. Encourage the setting and following of priorities for standards developed by the Committee.

_____15. Assist in the organization of new committees or subcommittees to meet recognized needs.

_____16. Act as an impartial 3rd party to assist opposing parties in reaching agreement.

_____17. Represent government interests especially in regard to standards affecting Federal procurement.

_____18. Represent consumer interests.

_____19. Encourage the Committee to develop standards in national need areas such as health, safety, and environment and to consider the impact of existing standards or standards under development on these areas.

_____20. Encourage the Committee to avoid duplicating the work of other national standards-writing organizations.

_____21. Encourage the Committee to strive for compatibility between relevant international standards and national standards.

_____22. Urge the development of performance standards instead of design standards whenever practical.

_____23. Lend NBS credibility to standards development projects.

_____24. Monitor Committee membership and recommend changes as needed to allow all interested parties to be represented on the Committee by competent individuals.

_____25. Work within the Committee to eliminate conflicting national standards.

_____26 Urge the Committee to develop standards only when it can be shown that a real need exists.

_____27. Other (please specify) _____

4B. Of the contributions you have checked in item 4A, please indicate in order of importance the three most important contributions you feel you have made in the last 2 years by placing the numbers of the relevant statements in the blanks below:

1. _____
2. _____
3. _____

5. The following is a list of benefits to NBS arising from participation in standards committee work. Please place a checkmark next to those benefits which you feel have resulted from your committee work in the last 2 years:

_____ a. Dissemination of NBS- generated technical information, e.g., on measurement, test methods, or metric usage.
_____ b. Enhancement of NBS prestige.
_____ c. Savings on NBS resources through collaborative efforts with industry or other Government agencies.
_____ d. Identification of industry or other agency needs to which existing NBS programs could be addressed or for which new programs should be established.
_____ e. Promotion of NBS calibration or Standards Reference Materials services.
_____ f. Advancement of your professional growth.
_____ g. Recruitment of skilled personnel for NBS staff.
_____ h. Other (please specify) _____

6. Of the benefits you have checked in item 5 above, please indicate in order of importance the three most important benefits you feel have resulted from your Committee participation in the last 2 years by placing the letter of the appropriate statement in the blanks below:

1. _____
2. _____
3. _____

Name _____ Div. & Sec. _____

GS-Grade ____ Age _____ Years at NBS _____

Hours spent on the work of this committee during FY-75: _____ (regular working time) _____ (out-of-hours time)
No. of committee meetings attended during FY-75: _____

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