Improving the Standardization Process

"From Courtship Dance to Lawyering: Working with Bulldogs and Turtles"

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1. Introduction

Standards, particularly information technology(IT) standards, have been the subject of much attention over the last few years. The proliferation of computing devices, the dramatic increase in the extent of network connections, and the varied applications of information technology have all intensified the need for a comprehensive and consistent set of standards. The importance of standards has been highlighted in the planning for the National Information Infrastructure and by the High Performance Computing and Communications Initiative. Interest in standards has also grown with the increasing attention to global commerce. In particular, the success of the GATT talks in eliminating many of the traditional trade barriers has increased the attention on standards as a mechanism by which free global trade can be restricted, or enhanced (Garcia, 1992).

Along with this increased attention to IT standards has come discussion and debate about the mechanisms and processes by which the standards are developed. Standards such OSI and ISDN have raised questions about whether or not it is possible in an era of rapidly evolving information technology to develop standards in anticipation of markets for them. The emergence of consortia and other ad hoc mechanisms replacing the traditional Standards Development Organization (SDO) processes has raised questions about the importance of due process and end user involvement in standardization. Finally, while there is some evidence that Europe is moving away from govern-

ment controlled standardization toward a more free market, i.e. industry controlled, approach to setting standards, discussions continue in the United States about the need for more government control in the process to reduce inefficiencies. All of these developments have been noted by the traditional information technology SDOs in the U.S. -- X3, IEEE, T1, X12, etc. These organizations and the ANSI have engaged in strategic planning efforts with an eye to determining what standards will need to be developed over the coming years and how they might be most efficiently developed.

In April of 1993, the Long Range Planning Committee of X3 met at the University of Pittsburgh. Among other topics, the committee examined relations between X3 and the academic research community.[1] The committee discussed undertaking a study of the characteristics of successful technical committee chairpersons with an eye to improving the process. This study represents an initial effort to provide some answers to the question of how the standards development process might be improved with a particular focus on intervention through training of chairpersons and members.[2]

The study seeks to identify ways to improve the traditional standards development process so as to improve the quality of the standards developed and the efficiency of the development process. Data was gathered from four sources, experts in the field of standardization, existing and former chairpersons of technical committees, members of X3 technical committees who could be contacted by e-mail, and readers of selected internet newsgroups who had participated in standards development efforts. Data was gathered from technical committee chairs and experts via structured phone interviews. Data from committee members was gathered via an electronic survey.

Analysis of the interviews and the surveys generally confirms several beliefs about the traditional standards development process and yields insights into several mechanisms that might be used to improve the process. The study strongly suggests not only specific foci for training of chairpersons and members of standards committees, but also highlights mechanisms by which the traditional SDO process may be modified within the constraints imposed by due process to improve both the speed and quality of the development process.

[1]Attending the meeting with the X3 members were Drs. Marvin Sirbu from Carnegie Mellon, Joseph Farrell from the University of California at Berkeley, and Martin Weiss and Michael Spring from the University of Pittsburgh. Drs. William Lehr from Columbia and Shane Greenstein from the University of Illinois, Urbana-Champaign made written contribution, but were unable to attend the meeting.

[2]The investigators wish to thank the X3 Long Range Planning Committee and its chair, Carl Cargill of SunSoft for supporting this effort. The study would not have been possible without the interest, support, and hours of work put in by Don Loughry of Hewlett-Packard. He not only provided the introductions and endorsement that opened the doors to many of the very busy individuals who agreed to talk with us because of his request, but he spent time with the researchers reviewing early versions of the questionnaires and later with the interview teams as one of the interviewees.

2. Background

Standards may be achieved through market forces - de facto standards, government regulation -- de jure standards, or voluntary consensus. Early on, IT standards were dominated by defacto standards -- those set by IBM. Over the last twenty years, X3, the CCITT, ISO, and the IEEE have played a major role in the development of voluntary consensus standards. Over the last few years, the standards development process has been impacted by the changing commercial market fueled by rapid technology progress, an increasingly open global market, increasing participation in the standards development process by user groups, and competition among traditional and new standards development organizations -- see (Rutkowski, 1991, Besen&Farrell, 1991, Farrell, 1993).

Voluntary consensus standards are usually developed by a small group of individuals representing the vendors of the technology. In the U.S., the Standards Developing Organizations (SDOs) in the information technology area include X3, X12, Z39, EIA, IEEE, and the IETF; internationally, the CCITT, IEC, and ISO are the dominant SDOs (Cargill, 1989, Spring, 1991a, Weiss&Cargill, 1992). These SDOs operate in an open, voluntary public fashion (Greenstein, 1992), observe a form of due process and make decisions through consensus (Besen, 1990, Farrell&Saloner, 1988). The process is "a hybrid of a technical discussion and a political negotiation" (Farrell, 1993). Standards development processes based on due process and the consensus principles are time-consuming. The average time to develop an IEEE standard is seven years. Months of public reviews and successive ballots within X3 produce standards between three to seven years. The development time for an ISO standard may exceed seven years. In the ITU, the use of quadrennial meetings for processing proposals has now been streamlined by changing circulating and voting procedures (Farrell, 1993, Besen&Farrell, 1991). Beyond the time delays, SDOs have experienced attrition of voluntary participants. Presumably, this is due the current fee structure, requisite travel, and other expenses associated with participation in the traditional standards development process (Cargill, 1989, David&Greenstein, 1990, Lehr, 1992).

Each of the SDOs has a structure within which technical standards are developed. For example, the X3 development process involves technical committees (TCs) and subordinate technical groups (TGs) preparing draft standards within assigned areas of expertise (Cargill, 1989, Lehr, 1992). The X3-style of standardization incorporates open participation by volunteers and the enforcement of "due process" and "consensus" (Robinson, 1988). This is done to ensure the creation of functional standards that address market needs and user requirements. The formal negotiation process also minimizes the possibility of adopting incompatible standards. Traditionally, in the IT industry, vendors have self-certified standards compliance. Thus standards developed by traditional SDOs are not developed with testing in mind. It is usually left to providers or some other third party such as the National Institute for Standards and Technology to implement testing and confirmation.

While this study focuses on improving the efficiency of the traditional SDO process, other approaches to standards development are emerging:

1. The technologically based approach to network standards development used by the Internet Engineering Task Force (IETF) has been looked at as a new model, particularly in light of the growth of the Internet and the acceptance of the standards on which it is based. The IETF has guidelines for validation and extensive testing of draft standards prior to adoption. It is based on a predominantly electronic mode of

operation with very open membership and participation rules.

2. Consortia created by vendors and industry-specific special interest groups have accelerated the standards setting process by limiting membership and by working within a limited area. A consortium recently formed by Intel, Microsoft, Novell, HP, IBM and other large firms (Didio, 1993) recognizes the need to prevent any duplication of efforts and promote consistency in product development. The proliferation of consortia may signal a move toward the development of implementation/product oriented standards in this manner.

3. As demonstrated by X/OPEN, a consensus process involving vendors and users may be used to efficiently develop and adopt commercial de facto standards (Dolberg, 1993). X/OPEN has been particularly successful incorporating specifications from Microsoft in this fashion.

While these and other mechanisms are attractive, they are not without detractors. When consortia become involved in the development of base standards, or grow in size, some of the same delays noted in the traditional process begin to emerge. Similarly, while the IETF has been very successful in development of the Internet through its standards, it is important to note that these standards did not appear overnight. The IETF and its predecessors have been at work for more than 25 years on the development of the Internet standards with much of the initial cost borne by the Department of Defence in the initial stages of the ARPAnet.

The traditional SDOs have initiated several efforts aimed at improving their processes. Recognizing the duplication of effort in developing parallel national and international standards they have adopted "fast track" procedures to move national standards to the international arena, or international standards into the national arena. To overcome the difficulties of developing consensus, the European Telecommunications Standards Institute (ETSI) has successfully employed a "weighted majority voting" rule to expedite the setting of standards (Besen, 1990). There has been an increased interest in using public specifications (e.g. Microsoft Corp.'s Windows).[3] Government involvement has been considered as a means to insure timely standardization with minimal duplication of effort.[4] Anticipatory standards have been suggested as a mechanism that would place standards development before product development (Meek, 1988). X3's FDDI (Fiber Distributed Data Interface) standard and CCITT's ISDN are both examples of anticipatory standards.[5] Finally, there are mechanisms aimed at improving the efficiency of the process. Electronic meetings, videoconferencing, computerized group decision-making laboratories, and electronic mail are all means that allow a wider participation on a more timely basis. Somewhat less discussed are methods that would structure the standard and testing process more formally. Formal Description Techniques (FDTs) may be used to specify standards unambiguously and aid the development of conformance

[3]While public specifications look attractive, there is some concern that there is no explicit or implicit commitment in the public specification to maintenance of the standard.

[4]On the negative side, there is concern that government involvement may inhibit the development of competitive alternatives by industrial segments.

[5]It should be noted that there is growing data to suggest that the rapid rate of technological change is seldom accounted for by anticipatory standards. For example, OSI was based on a set of assumptions that were established before the birth of the PC and that clearly did not anticipate the significant impact of personal computers and workstations.

tests. On the other hand, the high level of expertise needed for FDTs may hinder and further delay the development process.

As traditional SDOs address the issues of coordination and collaboration to ensure the timely development of standards in line with market needs and user requirements, all of these mechanisms are being considered. A number of authors (Spring, 1991b, Cargill, 1989, Garcia, 1992) point to the importance of improving the traditional SDO process in light of the new demands. This study focuses on improving the technical committee process as it is used by traditional SDOs. The questions addressed are:

1. What can be done to overcome the slow pace of committee work which delays the introduction of new services? (Besen&Farrell, 1991)
2. What can be done to insure effective coordination of committee activities avoiding sabotage by participants harboring hidden agendas to serve their own market segments and protect or promote vested interests (Farrell, 1993, Farrell&Saloner, 1988)).
3. What can be done to avoid the introduction of irrelevant standards due to inappropriate strategy and management? (Besen&Farrell, 1991);

3. Methodology

The Long Range Planning Committee of X3 initially suggested a study of the characteristics of chairs of Information Technology (IT) standards committees in order to determine how to improve the quality and efficiency of standards and the standardization process.[6] The broad goal was to better understand the factors and processes that contribute to successful standardization efforts within the traditional standards development organizations (SDOs). It is hoped that the results of this study and the resultant recommendations may guide the development of a training program for chairs and participants.

The study focuses on the human dimensions of standards development (e.g., behavior, skills, group dynamics) with the goal of determining the characteristics of human behavior and the related standards development process steps that contribute to the effective generation of quality standards. Quality implies such factors as; shortest possible development time, a focused endeavor that results in widely used products based on the approved standards, and a high degree of satisfaction among the standards participants and the organizations that sponsor them. The data was analyzed to find mechanisms for improving the process in the areas of management skills and personal characteristics that might be influenced via training.

In consultation with Donald Loughry of the X3 Long Range Planning Committee, it was decided that it would be inappropriate at this point in time to attempt to identify standards committees that might be labeled "successful" and "unsuccessful" and then to conduct a comparative analysis of the members, chairpersons, and processes. It was agreed that at this early stage, it would be more useful to select successful chairpersons and to try to capture data about what made those

[6]Throughout this paper, the term technical committee refers to an X3 technical committee or an IETF working group. When a distinction is important in how operational committees function in these two organizations, specific reference to the differences will be made.

efforts particularly successful. It was also decided that the study should be expanded to include representatives from the IETF and IEEE.

In order to capture more broad based data about problems the standardization process, it was decided to interview several individuals who had made significant contributions to the theory and practice of standardization. Because such a small sample is susceptible to biased views, we decided to gather survey data from a broader community of individuals involved in the standardization process that could be used to corroborate or qualify the view of experts and chairpersons.

Four groups of researchers were formed. One group focused on a review of the literature related to group dynamics generally and standards development processes specifically. The data gathered by this group was used by the other three teams as a framework. One group worked on the development of survey instruments to be used with participants in the standards process. The remaining two groups worked on the development of structured interview materials for use with technical committee chairs and experts in the field of standardization.

3.1. Development of the Instruments

To develop questions that would identify ways in which the committee process could be improved, questions were designed to solicit information in the following areas:

- Roles in the committee
- Characteristics of the process
- Committee composition
- Member characteristics
- Chairperson characteristics
- Decision making processes
- Conflict resolution
- Training and preparation

The research groups developed questions for each of the audiences with this general framework in mind. The interview questions intended for the experts were the least structured. Those intended for technical committee chairpersons were focused on specific techniques they used or had had experience with. The survey instruments were structured to provide demographic data and the perspective of committee members. After the various instruments had been drafted, they were compared and the questions harmonized to the extent possible.[7]

3.2. Conduct of the Interviews

The experts and technical committee chairpersons were interviewed via telephone for a period of approximately 1 to 2 hours. Prior to the interviews the interviewees were contacted by e-mail and provided with a release statement, a statement of the project goals, and a copy of our questionnaire setting forth the topics for discussion. All interviewees were encouraged to volunteer issues they considered relevant. As indicated above, situational constraints made it difficult to do a con-

[7]The questions used with the experts are shown in appendix A. Those used with the technical committee chairs may be found in Appendix B. A copy of the e-mail survey is included as Appendix C.

trolled study of how various factors contribute to successful and unsuccessful standards efforts. However, every effort was made to gather baseline data on which to ground future studies.

3.2.1. Experts Interviewed

A series of individuals who have made theoretical and practical contributions to the field were selected for interviews.[8] These were chosen from well known authors, facilitator and activists in the standards arena. Experts were accorded more leeway to deviate from the prepared questions. Included were:

- James Burrows, National Institute of Standards and Technology
- Dave Crocker, Silicon Graphics
- Carl Cargill, Sun Microsystems
- Michael Hogan, National Institute of Standards and Technology
- Tony Rutkowski, Internet Society
- Jim Melton, Digital Equipment Corporation

3.2.2. Technical Committee Chairpersons Interviewed

Six TC chairs -- three who have moved on to management committees and three who are current chairs, were interviewed.[9] In the interviews, the areas discussed included rules and procedures of standards development, human behavior and skills, group dynamics, and techniques used to facilitate this process. This data was used to develop a pragmatic perspective on the most effective standards development techniques and modes of operation that lead to successful standards. The interviewees, who were from X3, IEEE, and IETF, included:

- Fred Baker, IETF
- Roger Fujii, IEEE
- Phill Gross, IETF
- Donald Loughry, X3
- Richard Steinbrenner, X3
- Leonard Tripp, IEEE

3.3. Survey Administration

Surveys were distributed by posting to internet newsgroups, through posting by Dr. Don Deutsch to the members of X3H2, and through a number of technical committee chairs in X3 to the members of their X3 committees.[10] Respondent's e-mailed the completed questionnaire to the research team at the University of Pittsburgh. Three weeks were allowed for responses. Respondent's desiring total anonymity or those without e-mail were provided a U.S. mail

[8]The interviews of experts were conducted by a team of graduate students from the department of Information Science led by Christal K. Grisham and including Rochelle Ballard, Lisbeth H. Heggen, Asle Rokstad and Mark J. Weixel

[9]The interviews of chairpersons were conducted by a team of graduate students from the department of Information Science led by Jon O'Donnell and including Yuvall Cohen, Itsung Huang, John Martinez, Ingjerd Skogseid, George Tarr

[10]The Internet, and X3 e-mail surveys were conducted by a team of graduate students from the department of Information Science led by Andrew Snow and including Mohammad Al-Qasem, Sang-Jin Cho, Simen Hagen, Jeffrey Jones, Revathi Mani, Peg Moulton, and Peihan Wang

address.[11] The survey questionnaire was identical for both the X3 Committees and Internet Groups. In order to facilitate data analysis, a code was placed on the survey form to identify what group was responding.

3.3.1. Internet Groups Surveyed

One hundred Internet groups were culled from the more than 2500 Internet Newsgroups. After discussion and review 13 Internet "comp.*.*" groups were selected as those most likely to be read by standards committee participants. The questionnaire was posted directly to these news groups by the research team.[12] The questionnaire was posted to the following groups:

- comp.database.oracle
- comp.dcom.isdn
- comp.dcom.lang
- comp.mail.mime
- comp.std.c++
- comp.unix.osf.osf1
- comp.dcom.fax
- comp.dcom.lans.ethernet
- comp.lsi
- comp.protocols.tcp-ip
- comp.std.unix
- comp.windows.x.pex
- comp.std.misc

3.3.2. X.3 Committees Surveyed

As indicated above, the questionnaire was distributed to X3H2 by Dr. Don Deutsch. In addition, X3 provided access to a number of TC chairs and asked them to consider cooperation in this study by redistributing the questionnaire to members of their committees and encouraging them to complete it. The survey questionnaire was sent to thirty-four (34) different X3 Standards Committee Chairs. The chair of each Standard Committee was encouraged by the X3 secretariat to ask their members to participate in the survey. Questionnaires were sent to the X3 chairs via e-mail. The willing committee chairs then forwarded the questionnaires to their members with instructions to cooperate in completing the survey. The actual adherence to this protocol on behalf of the chairs is unknown.[13] The committee chairs to whom the survey was distributed were:

- Donna Fisher , Database Systems Study Group, DBSSG
- Jim Owens, Optical Disk File Structure and Labeling, X3B11.1
- Peter Bono, Computer Graphics, X3H3
- A Jerry Winkler, Information Resource and Dictionary, X3H4
- Don Schricker, Cobol, X3J4
- J. G. Van Stee, Object Oriented Cobol, X3J4.1
- Gary Kohls, Dibol, X3J12

[11] Of the responses, only two (2) were received via the US mail.

[12] As some of the groups were moderated, it was not possible to control the posting of the questionnaire.

[13] While X3 was able to provide e-mail addresses for the chairs, it is not known how many of the X3 committees actually use e-mail for communications.

- Dmitry Lenkov, C++, X3J16
- Edwin Hart, Codes and Character Sets, X3L2
- John Sharp, Data Interchange, X3T2
- Paul Fessler, Fault Isolation, X3T8
- William Davis Jr., Text Description and Programming Languages, X3V1.8
- William Rinehuls, Operational Management Committee, OMC
- Rudolf Riess, Text, Office, and Publishing Systems, X3V1
- Ken Zemrowski, Open Systems Interconnection, X3T5
- James Converse, X3
- John Hill, SC22 TAG
- Rex Jaeschke, C, X3J11
- Marc Schnapp, XBase, X3J19
- Fritz Whittington, Audio/Picture Coding, X3L3
- John Lohmeyer, Lower Level Interface, X3T9.2
- Roy Pierce, Office Machines, X3W1
- Carl Cargill, Long Range Planning Committee
- Roger Cummings, Device Level Interface, X3T9.3
- Don Deutsch, Database, X3H2
- William Kent, Object Information Management, X3H7
- John Klensin, PL/1, X3J1
- Hsi-Ming Lee, Data Communication, X3S3
- Yen-Ping Shan, Smalltalk, X3J20
- Henry Tom, Spatial Data Transfer, X3L1
- Guy Steele, Common LISP, X3J14

4. Results

The study generated a wealth of data for analysis. While the diverse data sources make it difficult to establish clear parallels, the places where there was intense disagreement or significant agreement stand out clearly. This sections presents an overview of the data collected. It begins with a few of the very tentative observations that may be made about the demographics of the standards committees and the members of those committees. We then turn to discussions of the standardization process, the composition of the committee, and the role of the chair. Three specific issues that were identified are addressed next -- conflict resolution, working with casual participants, and using technology. The results section concludes with a dozen observations made during the interviews and through the surveys that suggest pragmatic techniques used by successful TC chairs.

In the discussion that follows, we commend to the reader five points which were emphasized again and again in the study. They form the underlying theme which was constant throughout the discussions:

1. The success of any given standardization effort is tightly coupled with the quality of the leadership provided. While it is possible that this leadership will come from an individual other than the chair of the committee, it is most likely that this responsibility will fall to the formally appointed/elected chair.

2. The characteristics expected of the chairperson of a standards committee differ significantly from the characteristics of members of the committee. While it is anticipated that members will be technically competent this characteristic is subservient in the chairpersons to leadership, diplomacy, and negotiating skills. In general, com-

mittee members have a positive view of the chairs of their committees.

3. The single most important problem that must be addressed by the chairperson is the resolution of conflicts which may be technical, political, or personal in nature. The approaches suggested for resolving conflicts are as diverse as the personalities of the chairs.

4. There was little agreement about the role or importance of users in the process. While it may reflect biases of the investigative teams, we did note that "users" were less of an issue for technical committee chairs than for the expert group. This is not to say that TC chairs didn't care about users. Rather, while experts had strong opinions about the value of users, chairs tended to accept users as members of the committee, albeit members who had less to contribute if they were not technically oriented.[14]

5. There was general agreement that technology is being underused in the standardization process as a tool to overcome the slowness and generally unstructured nature of the process.

4.1. Demographics

There were fifty-four (54) responses to the survey from individuals participating in nineteen (19) standards committees, the majority of which were from X3 committees. The most represented committees were from computer language standards with twelve from X3.J16-C++, six from X3.H2-SQL and five each from X3.J4.1-Cobol and X3.J11-C. There were four or less responses from each of the other fifteen committees. The distribution represents a fairly diverse response, with the possible exception of the twenty two percent response of the C++ Group. While the survey sample was small, a few observations can be made about the responses. In general, these confirm anecdotal data:

1. Committee meetings occur with an average frequency of four (4) times a year.

2. Seventy Five percent of the respondents describe their job function as either Research & Development(20/54) or Product Development(20/54).

3. Ten percent identified themselves as users(6/54). The other categories having responses included marketing/sales(1), operations(1), system integration(3), consultant(2) and government representative(1).

4. About fifteen percent of the participants (8/54) devote fifty percent or more of their time to standards development. Conversely, about seventy-two percent of the participants (39/54) devote less than twenty percent of their time to standards development. (Complete data is shown in Figure 4-7 on page 7.).

5. The most often named personal contribution to the process is "attention to technical detail".

6. Standards participants are fairly senior with about seventy-five percent having more than ten years experience. Also, on average, one-half of this experience is directly related to the standard.

[14]Particular problems related to delays and voting were noted in terms of users, observers, and casual participants. These are addressed in the sections on casual participants (see page 7) and users (see page 5).

7. Stated motivations for participation are strikingly altruistic, with fifty percent of the respondents indicating "curiosity" or a "desire to influence the future" as a major motivation.
8. Leadership, diplomacy and monitoring are the most desired and observed combination of chairperson characteristics.
9. Technical skills, doing the work themselves, and killing ideas are the least desired and observed combination of chairperson characteristics.
10. Participants are generally satisfied with the product quality and chairperson and somewhat dissatisfied with the efficiency of the standards process.

4.2. The Development Process

The chairs agreed that more structure would help the committee process. Whether this would take the form of formal meetings -- Robert's Rules of Order -- or simply agreement about the goals of the activity was less clear. Almost all chairs agreed that an effective practice is to first define the problem and then the solution. The scope and purpose of the group can be set before any hard bargaining begins. Generic objectives should be established then incremental reviews and milestones set-up with the focus on the pertinent issues. In line with running the meeting in a more business oriented fashion, there is a need to set priorities, identify resources, establish agendas, assign homework, and set periodic review dates. It was also suggested that a decision log should be kept of all major issues including the reasoning behind any resolutions. Roger Fujii defined five stages in the development process. The first is the "courtship dance" where each member tries to figure out the others position and their hidden agendas while the chair outlines the scope of the project. The second phase involves creating a draft "outline" where the document structure is crafted. The third step is to generate a first, complete, "written draft". The fourth stage is "quality time". Here various levels of flexibility and generality are added to standard. The final stage is the "lawyer phase", where the legality of the document must be studied phrase by phrase and any visible ambiguities resolved.

By one estimate, a standard that is produced over four years actually included only four months of work, including the preparation and research time. This "muddling" time could be reduced to a large extent, if meetings could be scheduled more often (perhaps bi-monthly) or the quarterly meetings could last longer (perhaps two weeks).

4.2.1. Due Process

The primary strength of the traditional SDOs is a consensus based process with the assurance of due process in development, approval, and publication. While the interviewees were clear about the importance of due process to insure consensus, participation, and adoption, there seemed to be some feeling that the strict adherence to due process rules is largely responsible for slowing standards development. The paper and signature based processes limit the ability to distribute information and perform balloting in a timely fashion. This "paper chase" ultimately limits the ability to meet more often.[15] The process of development, approval, and publication is too long relative to

[15]For example, a mail ballot must be allocated 30 days for review. Similar limitations exist on how much notice is required to schedule a meeting.

current technology evolution. As a result of this slowness, there has been an increase in the number of consortia bringing standards to market. As the number of consortia grow, the influence of the traditional standards making bodies is weakened. It may well be that SDO's will respond to this by using a "fast track" approach to recognize the work of the consortia while maintaining due process in the final approval. The dichotomy between remaining staunchly consensus oriented and reducing time to market limits the realm of possible recommendations for process improvement. However, there is growing agreement that the pendulum must swing more to favor speed, even at the expense of some due process rules.

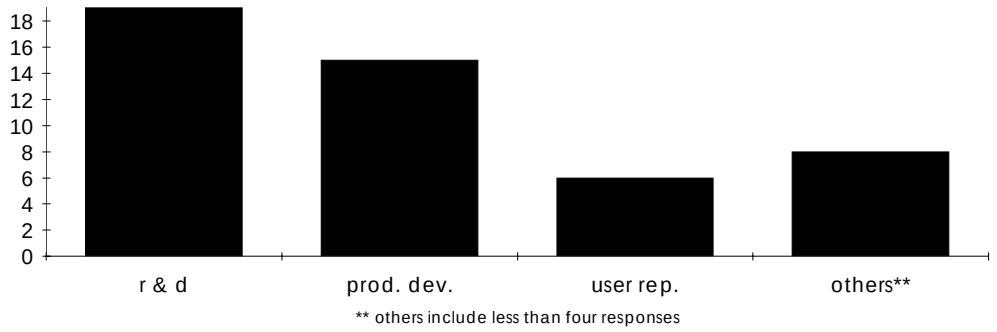
4.2.2. Final Corrections

Once a draft standard has been approved by open balloting and a factual or grammatical error is found, the chair and editor of the standard should be trusted to make the change. They would decide on whether or not another formal ballot is necessary before publishing.[16] Streamlining the process for minor corrections could save a year in the development process.

4.3. Committee Composition

In general, the consensus was for small committees, meaning a group of 10 to 20. It was recognized that when the standard is of significance to a particular constituency, a smaller group will tend to be more successful while for a standard of general interest, a larger number of people will be involved. With larger committees, factions can form. Smaller committee may be easily dominated by one person. Some suggested that committees in the range of 20-40 members are able to accomplish significant amounts of design work if they are homogenous. There should be enough divergence of opinion, but at the same time enough commonality so that all work towards a goal. However, once size exceeds 40, it was generally agreed that communication becomes very difficult. As indicated previously, and as shown in Figure 4-1, the committees tend to be dominated by technical personnel.

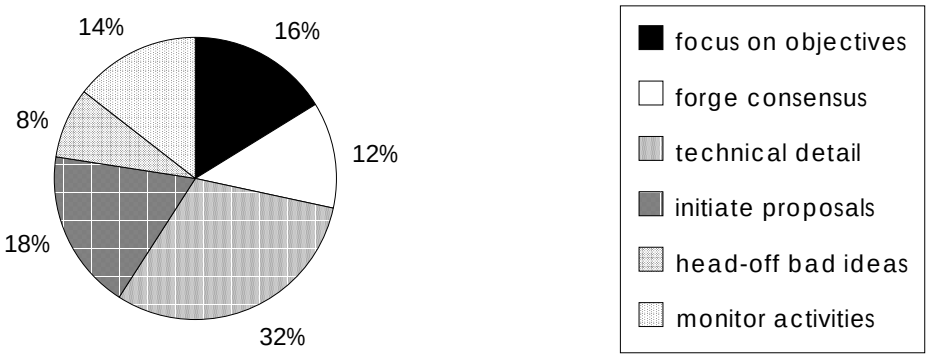
Figure 4-1: Job Functions of Committee Members



[16]Only in very rare cases is there a covert attempt to add features to a document after it is approved but before it is published.

Survey respondents were asked to pick a statement that best described their personal contribution to the standards process. The statements were selected to correspond to characteristics of leaders, diplomats, perfectionists, doers, obstructionists and observers. As shown in Figure 4-2 thirty-two percent may be characterized as perfectionists -- "attention to technical detail" while eighteen percent may be characterized as doers -- "ability to initiate proposals to get things moving". Six percent viewed themselves as leaders -- "ability to focus on objectives" and thirteen percent viewed themselves as diplomats -- "ability to forge consensus". Fourteen percent of the respondents characterized themselves as observers -- "ability to listen attentively and monitor activities to ensure process is going in the right direction" and another eleven percent described themselves as obstructionists -- "ability to actively head-off bad ideas". Although human beings often defy one dimensional characterization, these results generally confirm other observations about the existence of "intelligence gatherers" and obstructionists. The optimal mix for a committee is not clear and may be dependent upon the point in the development lifecycle. Further, it is not clear that group composition can be controlled. However, understanding the composition of a committee will be important to the chairperson in developing strategies to improve the efficiency of the standards process.

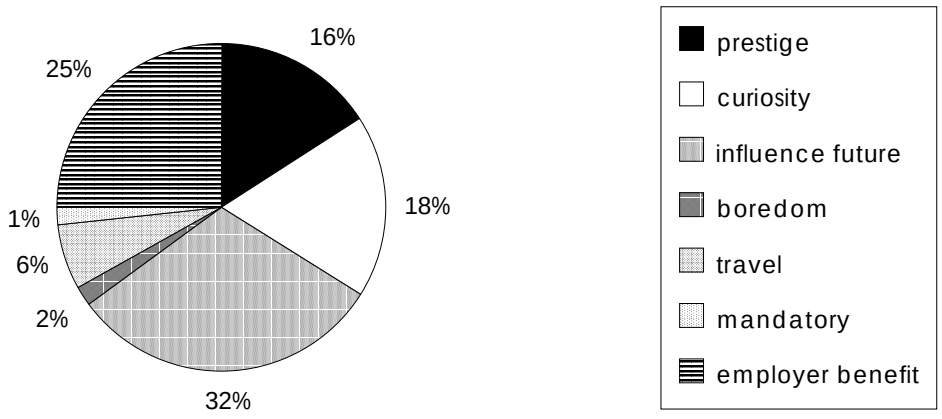
Figure 4-2: Most Important Contribution of Committee Members



The stated motivations for participation were quite varied. As shown in Figure 4-3, personal prestige, curiosity and the desire to positively influence future events accounts for sixty-six percent of the stated motivation for participation. Boredom, liking for travel and forced participation accounted for only nine percent of the stated motivation. Participation for the purpose of benefiting the one’s employer was the response of only twenty-five percent. This would appear to be a favorable situation for standards development, as the participants tend to take a broad altruistic view.

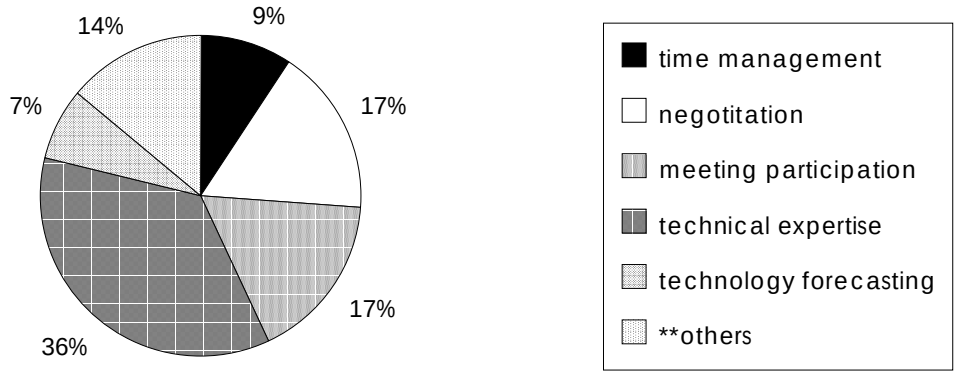
As shown in Figure 4-4, the most important skill for individuals participating in the standards process is technical expertise. With thirty-six percent selecting it as the most important skill, technical expertise was selected twice as often as any other category. At the same time, 43% of the important skills are in non-technical areas such as time management, negotiation, and meeting participation. This suggests that training for standards participants in areas such as effective

Figure 4-3: Motivation of Committee Members



strategies for participation and negotiation would probably be well received. It is interesting to note that technology forecasting was given a ranking of only seven percent. Others including less than five percent each include formal presentations, marketing, international relations, foreign language proficiency and product management. This suggests that it would be more difficult to convince participants that training in these areas was important.

Figure 4-4: Skills Required of Committee Members



Experts and chairperson had suggestions about committee composition and the training of committee members. First, there was strong agreement among the TC chairs that all members must be educated on what standards are and are not. Training should stress that a good standard is a victory for all companies and not just a marketing tool for one or even a few. Every member should understand how to accept and hold views without being judgmental or critical too early in the "idea" stage. In addition to these general observations, there are specific suggestions about the role

of editors and users on a committee, which are discussed briefly below.

4.3.1. The Editorial Role

Several interviewees mentioned the importance of the editor and the editorial process. The position of editor seems to have particular importance in today's standards arena. Some suggested the real delay in standard's development lies not in the balloting procedure, but in the intervening period when the document is supposedly coming together. A good editor or editorial group greatly enhances the standards process and should therefore be sought out and encouraged. Unfortunately, it seems that the task of correcting hundreds of pages of material between committee meetings is causing high attrition among editors, as they have trouble defending to their superiors at home additional time spent working on the document. It is not easy to identify individuals with a mastery of language and a desire to oversee the assembly of a report. They need a degree of freedom that allows them to work diligently towards completion of the document. It would seem that training in editing might be offered to interested members along with appropriate recognition in the process. Chairs should be alert for candidates for the editorial role.

4.3.2. User Representation

Representation of "users" was an issue on which there was little agreement. Most of interviewees agreed that manufacturers dominate the process, meaning that users involve themselves only peripherally. Some concern was expressed about representation in the form of standards "bagmen" who carry their company or government position into committee meetings. Because of their partisan interest, these types tend to impede consensus. Furthermore, "they displace knowledgeable people who could make a worthwhile contribution."

The most serious observation made about users related to voting. One of our experts indicated that the "intelligence gatherers" have a tendency to vote "yes" to ballots merely to avoid justifying their answers, thereby skewing results. Thus, whereas most see the "intelligence gatherers" as fairly harmless, this observer considers them a danger and feels that the standards process would be better with their elimination.

It was generally agreed that many end users lacked the technical knowledge to participate in the standards development process in a meaningful way. Some would suggest that engineers dominating "is a feature, not a bug" With few exceptions,[17] academic involvement in the process was seen as too idealistic. In general, there was a feeling that users should be more involved, but not at the expense of slowing down the process.

There was some sentiment for a specified role for users. Users need to be consulted in the conception of a specification and in periodic review to insure that development stays on track. One chair suggested creating the committee according to a planned distribution; he indicated that a distribution of sixty percent implementors (vendors), thirty percent users and ten percent government has worked for his committee.

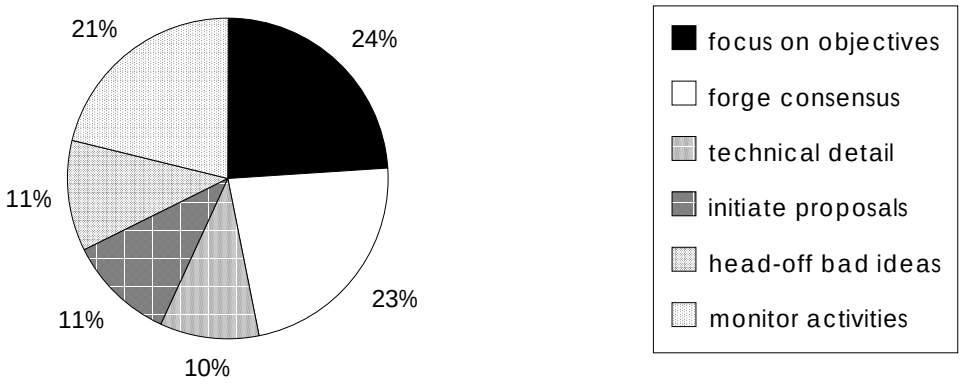
[17]The research team was convinced that at least during the conduct of the current study, we were considered one of the few exceptions!

4.4. The Chairperson's Role

The process of developing standards is one of getting highly educated, highly opinionated people to agree on trivial things. The chair of the committee acts as a facilitator with little power to legislate. While there are rules and procedures related to the approval process, there are no absolute rules for running meetings. The chair must be knowledgeable about the subject but also know how a standard may be used by various segments of the industry. It is important for the chair to know what does and does not belong in the standard and to think in generalities rather than specifics.

Respondents were queried as to their views on necessary chairperson characteristics. In contrast to the skills expected of a committee member (see Figure 4-4) the surveys identified a very different skill mix for the chairpersons as shown in Figure 4-5. A chairperson should be a leader-diplomat-observer, in equal proportions. Also, the chairperson should not be a doer, perfectionist or obstructionist. This is consistent with the view of the chairperson as a skilled leader with strong negotiation skills who delegates.

Figure 4-5: Ideal Characteristics of a Chairperson

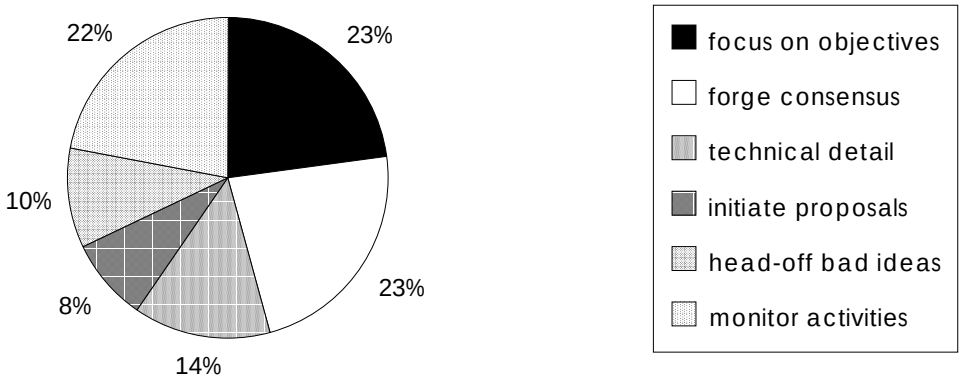


There was a close match between ideal (Figure 4-5) and observed (Figure 4-6) characteristics of the chairperson. The greatest deviation between ideal and observed characteristics was a slight tendency of the chair to be a perfectionist -- while only 10% identified attention to technical detail as a characteristic of the ideal chair, 14% identified it as a characteristic observed in chairpersons. The responses indicate that most members have the kind of chairperson they want.

The interviews suggested several skills that might be developed in chairpersons:

1. Skills in problem definition so that underlying issues are uncovered, without forcing excessive constraints that favor a given solution.
2. Skills in avoiding conflict, such as identifying the problem before proposing solutions, maintaining open communications, and avoiding back-room decision making.
3. Skills in group dynamics to help identify:

Figure 4-6: Actual Characteristics of the Chairperson



a. when to rein things in and avoid conflicts,

b. how to develop win-win situations by getting agreement on pieces of the problem and then piecing their way back to a solution,

c. how and when to coax shy members into giving their opinions and when to control others so they do not disrupt the rest of the group.

There was also a suggestion that a mentoring program should be available for chairpersons that would involve an "expert" (perhaps an experienced peer) sitting-in on meetings to provide advice.[18]

4.5. Issues to be Addressed

Three issues not yet addressed emerged frequently in the discussions and in the written comments on the survey. Far and away, the number one issue was the matter of conflicts in the committees and the role of the chair in avoiding or managing these conflicts.[19] Other issues that were mentioned were the role of "casual participants" and the use of technology in meetings. These three issues are discussed below.

[18]This has been done to a limited extent in the past with excellent results. The expert would be available but only sit-in if a chairperson requests the assistance. The mentor approach might well serve to ease the "break-in" for new chairs.

[19]After conflict, the most significant issue mentioned was the slowness of the process which is addressed elsewhere in this report

4.5.1. Conflict Resolution

It was not surprising that differences in technical opinions served as the basis for some conflicts. There were widely varying opinions about the value of these conflicts -- some saw them as valuable to the process, others saw them as disruptive. Another source of conflict mentioned was "hidden agendas" which were most often related to corporate interests. The final, and most often mentioned source of conflicts appear to be due to unprofessional behavior or personality clashes. A sense of the extent of the negative feelings about unprofessional behavior and personality conflicts is provided by a sampling of the comments from the surveys:[20]

- "Frequently this would end in bad faith accusations against other committee members. A threat that "I will take my marbles and go home" seemed to pervade the thinking of most attendees from this one company."
- "One alternate suffers from a lack of BASIC manners."
- "A very few influential individuals had an abrasive interpersonal style, which hurt progress greatly."
- "At times, some members suggest that other member's motives are "impure" or perhaps simply foolish, to varying degrees. At other times, some members infer such ad hominem attacks where none was intended."
- "Some (few) members have had a tendency to engage in personal attacks on and challenge the motivation of some other members."
- "Failure to Listen! Inability to Cooperate!"
- "Refusal to negotiate; stubbornness; hanging onto and re-discussing an idea after it has been rejected by the rest of the working group."
- "The need to perfect something that is good enough. The personal need to make a noticeable contribution."
- "People who criticize other peoples' proposals, but have none of their own."
- "Inability to compromise; egotistical; too political."

A person who dominates and disrupts a meeting against the majority opinion of that group is termed a "bulldog". It was estimated that between eighty and ninety of TC's include at least one bulldog. At best they have a disruptive effect on the process. At worst, these individuals will destroy the "team" approach and negatively affect attendance at meetings. This is a particular problem for the Internet Engineering Task Force (IETF) where there is no formal vote on the acceptance of a standard. An energetic bulldog can completely implement their ideas. The resulting standard, not developed by consensus, may be ignored. In the X3/IEEE process, a vote can stop a bad standard moved by a bulldog, but at the cost of valuable time lost.

In part, committee members attend meetings to guard the the financial interests of their sponsoring organization. Usually, their interests are not mutually exclusive. A problem arises when there are products already being developed, perhaps by more than one organization, that do not

[20]To preserve our own sanity we do not include the observation of negative behavior that stated "perfectionist/purist, academic researchers" !

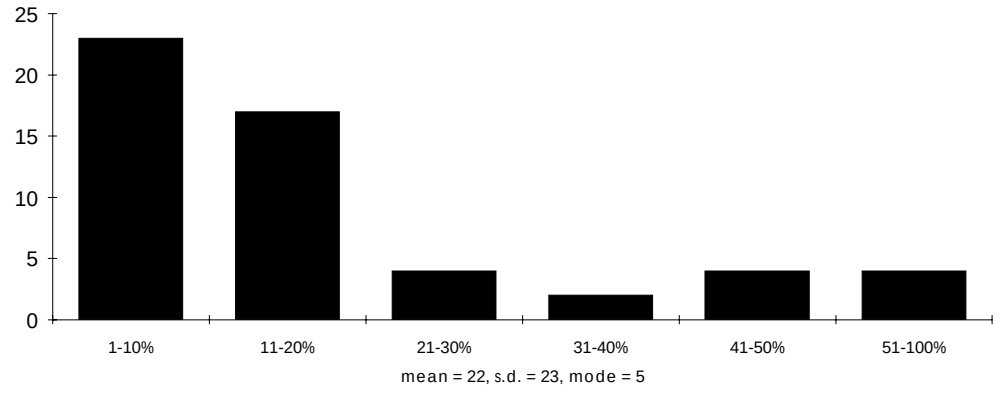
concur with the opinions of the rest of the committee. Some organizations use the standardization process to gain advantage over their competition. Representatives of an organization that want to slow down the development of a standard to let their product get ahead thus gaining market share, are termed "turtles". It was estimated that twenty-five to thirty percent of the committees include turtles at some point in the development process. This estimate is consistent with the twenty-two percent of participants who saw their contribution as observers or obstructionists (see Figure 4-2) and the twenty-five percent who identified their major motivation as employer benefit (see Figure 4-3).

Whether conflicts are personal, organizational, or technical in nature, it falls to the chairperson to address them. Although most chairs are highly competent in technical areas and many are skilled diplomats and negotiators, it is likely that a high percentage would benefit from training that enabled them to identify and address various sources of conflict. At one level, it may be enough for the chairs to be sensitive to the fact that these conflicts will likely arise and need to be dealt with. The interviews suggested that while each chair is different, all are highly skilled individuals who have developed techniques for working with people over the years. On the other hand, recognizing that most technical committee chairs have a strong technical background and orientation, it may be important to offer them an opportunity to learn and hone a set of skills in the areas of group dynamics and organizational communications.

4.5.2. Casual Participants

Most committees, regardless of their size, are directed and driven by a small group of individuals; usually ten percent or fewer. As shown in Figure 4-7, the vast majority of those responding to our survey indicate a very small percentage of their effort devoted to development. In most

Figure 4-7: Percentage of Work Effort Devoted to Standards Development



committee meetings, approximately twenty-five percent of the members are attending for the first time. This is true four meetings per year, year after year. With that much turnover, it is difficult to maintain momentum. It is also necessary to take time at every meeting to explain some of the rules of order and bring new members up to date on progress and passed decisions. One estimate was

that 40 minutes of every meeting was required to orient newcomers on past topics and outcomes.

In the discussion of the process (see section 4.2 on page 11), mention was made of the suggestion that a decision log be kept. One important use of such a record could be to provide background to new members. In some committees, a new member is not permitted to speak until they have read the review log. This avoids the time wasted at meetings rehashing prior decisions. This log could be made available to new members prior to the first meeting they attend.

Another issue to be addressed related to casual participants was addressed in section 4.3.2 on page 15 in discussing the voting patterns of users. It was indicated that those not deeply involved in the technical issues, who also might be characterized as casual users, have a tendency to vote "yes" to ballots merely to avoid justifying their answers, thereby skewing results. It is difficult to know what the best solution is to this problem -- it may well be a matter of making individuals feel comfortable with abstaining if they are simply observing.

4.5.3. Appropriate Use of Technology

Without exception, those who mentioned technology were in agreement that it was underused in the process and could be used to improve the process in one way or another.

4.5.4. E-mail

Electronic mail (e-mail) was suggested for document distribution and balloting. Using e-mail may require some due process rules to be relaxed (e.g. 30 day balloting times and requirements of signatures in some cases). IEEE sponsored a study on the effects of e-mail on standard development while working on the IEEE 1012 standard. The study concluded that electronic mail saved more than a year in development time. The study found that there is a roller-coaster of interest generated around the standard, peaking around meetings and plummeting in between. E-Mail bridged the gaps by maintaining constant contact between committee members.[21]

The IETF handles the bulk of its intra-group interaction via e-mail. Major work is no longer done at the tri-annual meetings, but rather over mailing lists. This notion of dealing principally over e-mail met with great support among interviewees. At the same time, it was noted that meetings are still the primary locus of productive activity for X3. Some concern was expressed about losing the benefits of interpersonal debate by conducting meetings in a medium that encourages users to delete anything that they wish to avoid.

4.5.5. Electronic Document Management

It was suggested that a networked document handler that allows for multiple annotations would be invaluable to the editing process, as all participants of a given group could bind their comments to a single copy of a working paper. Both the IEEE and X3 are working on documentation automation projects. These projects may reduce the number of times information is re-keyed in new documents and save money in duplicating and distribution costs. A standard methodology for document

[21]One of the issues that will have to be addressed with e-mail is the cost. When, at the end of the study, the IEEE decided to no longer reimburse members for e-mail charges, the usage of e-mail plummeted.

preparation should be employed across all SDO's to insure the compatibility of the standards documents they produce. It was suggested that a defined document style would assure uniformity throughout the writing of working papers and aid in the final production of the standard.

All standards that IETF working groups produce are made electronically available. Rutkowski considers this practice critical for wide scale acceptance, indicating that having to buy a hard copy of a standard from an international organization deters user interest. Whether documents can be made available electronically by X3 and the IEEE will be a matter of organizational policy, and will have a significant impact on financing.

4.5.6. Tools in Meetings

Interviewees were divided on the matter of technology based tools for meetings. At the most basic level, formal rules may be viewed as a tool in meetings. One expert indicated that employing some set of parliamentary rules runs counter to the notion that standards meetings are supposed to be cooperative. For another expert, a judicious use of rules of order is the best way to insure that everyone gets a chance to speak. He makes it clear that he does not condone "rules for rules' sake," saying that when a topic begs discussion, the protocol should be temporarily lifted.

We note that none of the interviews touched on the use of Formal Description Techniques (FDTs) as a tool for improving the process. Whether the lack of such mention is due to a lack of interest or the focus of the interviews is not clear. Future study might seek to determine the extent of the use of FDTs such as ASN.1, TTCN, LOTOS, and Estelle in committee work and the impact of such tools on the process.

In terms of hardware that can enhance a meeting, a number of suggestions were made from overheads to PCs to aid in the editing of a committee's documents in real time, speeding up the process. Similarly, a PC might be used to queue and list individuals waiting to speak to a topic. On the other hand, one expert noted the key is to promote communication within the group and avoid a "lecture" style presentation. In this experts opinion, overhead slides are a mistake in that they promote a lecture style.

4.6. Techniques and Insights

We asked the experts and chairs to describe strategies they used or recommended in managing the committee process.[22] The following "rules of thumb" emerged from the discussion:

Two Hats — When the chair needs to shift from a management focus to make a technical point, put on a baseball cap with the company logo and move from the head of the table to another seat, signifying that he now wishes to be seen as taking a "company" position on a particular issue. This makes it very clear where he stands and eliminates confusion

[22]The researchers sought out these techniques as a result of initial discussions with Donald Loughry who impressed the research team with a number of ideas about effective management -- including "two hats" and "focus-focus-focus". The technical committee chairs, including Don Loughry, Richard Steinbrenner, Roger Fujii, and David Crocker were particularly helpful in developing these ideas.

	about what role he is fulfilling at the time. When at the chair's position, he is perceived as wearing the chairs' hat by default.
The Duelists	When two individuals are vehemently opposed or dead-locked on an issue and it appears to be disrupting the group process, send them off to a separate room. The winner will come back to present their position which has been "forged under fire". A similar suggestion would have the chair form ad hoc groups out of parties in conflict forcing disputing stakeholders together and charging them with resolving their disagreement as a precondition to the committee proceeding with development of the standard. This places the burden on the antagonists to subordinate their individual differences to that of the group.
Judicious Breaks	Break time may be used to diffuse conflict. This time can be used by the chair or third parties to address disputants and caution them to exercise restraint or otherwise cease inappropriate behavior in a manner that is non-threatening.
Meta-issues	When there are two valid points in opposition, the strategy is to move the group away from polarity. This can be done by raising the meta-issue -- "Does the group believe that a decision needs to be made?". Agreement on that question focuses the group on reaching consensus to resolve the impasse.
Lobbying	In contrast to separating antagonists, the chair should make efforts to minimize back room lobbying wherever possible, particularly when that discussion should be a part of the broad committee deliberations.
Hidden Agenda	Force members to bring hidden agendas into the open through "role playing" where the members have to work through an issue by stepping into the shoes of a member with a different perspective or point of view.
What it Ain't	Educate members on what standards are and are not!
Win-Win	Look for situations, issues, and positions that make everybody a winner. Avoid cornering anyone or backing an individual into an untenable position.
Focus, Focus, Focus	First define the problem fully and only when it has been fully and clearly defined and accepted by all parties, define and implement the solution.
Creeping Featurism	Avoid add-ons, new features that would be "nice" as opposed to "necessary" -- features that get added after the die has been cast.

5. Summary Recommendations

Training is currently provided for X3, IEEE, and IETF committee chairpersons. This training generally takes the form of a short, focused seminar on the standardization process. Because the chair is responsible for insuring that no policy breeches occur in the meetings, training is concentrated on procedural issues and due process. This study suggests that this training may be extended to provide additional information to new chairs about how to be successful in managing this intensely human activity.

Currently no formal training exists for X3 or IETF members. (The IEEE does provide an orientation session and training for committee members.) It seems that there would be some benefit in providing an orientation for new committee participants. While it may be difficult to require this training or conduct it in a special setting, it is possible that some positive impact could be achieved through paper or video based training. It was felt that a good training program could result in a 25 to 50 percent improvement in terms of time to market and quality of the standard produced.

Finally, beyond improving human skills, this study highlights some potentially simple procedural changes that could have a significant impact on standards development. Each of these three areas are discussed below.

5.0.1. Chairpersons

In an ideal world, the selection process for chairs would seek to identify technically competent individuals with leadership, conflict management and negotiation skills. The effectiveness of the chair can probably be increased by adding a component to their training that includes some of the techniques discussed in this paper.

Video tapes might be used effectively as a means of demonstrating various techniques for handling conflicts and managing "turtles" or "bulldogs". They would also make it easier to handle some aspects of chairperson training on an individual basis.

Finally, there was some sentiment for a mentoring program that would involve an "expert" (perhaps an experienced peer) sitting-in on meetings to provide advice to a new chairperson. There was an indication that this has been done before and might well be a preferred way to ease the "break-in" for new chairs who experience difficulty managing the process.

5.0.2. Training of members

Training should be standard for members, not only for chairs. Although skills training may have its limits, it is still worthwhile to describe for all group members the nature of the enterprise in which they are involved and how it functions. Moreover, materials provided in training could serve as a continuing reference for the SDO members’ most frequently asked questions.

The biggest difference between standards committees and other professional committees is the variety of concerns and perspectives the individual members bring with them. It will be important to help participants understand that the "tunnel vision" so important to specification of the standard can also be a detriment if it prevents the participant from seeing the "big picture".

While a short orientation session might be run for new committee members, it is likely that the training will have to take the form of a video tape or paper materials.

5.0.3. Changes to the Process

Several suggestions were made for changes to the committee process to enhance the standards development process. Some of the more interesting suggestions include:

1. Use a formal decision log to keep track of all decisions made by the committee and use of this as a mechanism for orienting new participants.

2. Use PC based technology to display documents and decision logs to the group in real time to reduce disagreements and speed the process.
3. Encourage the use of e-mail to reduce the down time between meetings and to speed up the communications process, potentially relaxing the burden of 30 day balloting and meeting announcement times.
4. Make documents available online thus reducing publication costs and increasing access.
5. Provide an option in voting that addresses the issue of casual participants voting "yes" to avoid having to explain a "no" vote.
6. Allow the chairperson/editor to make minor editorial changes to the standards document after balloting without requiring a reballoting.
7. Provide for a reaffirmation vote that permits a brief explanation by the voter of what it would take to make it a "yes". This would help avoid the delays as the standard is recycled again through the lengthy process and reduce the chance of poor market acceptance that may occur by "ramming" it through the process.

6. Recommendations for Further Research

One of the difficulties in conducting research on standards is the lack of existing hard data related to operationally defined terms. How many different categories of standards are there? What constitutes an anticipatory standard, a reference standard, etc.? By what measures do we establish that a standard is "successful"? What is the optimal committee size? How long should it take to develop a standard? How much should it cost? How should the committee be composed? While several studies, e.g. (Weiss&Sirbu, 1990, Bonino&Spring, 1991, Weiss&Toyofuku, 1993, Lehr, 1992) have begun to address issues in this area, there is much work yet to be done -- see (Spring, 1991b, Spring, 1991a).

In beginning this study, we were aware of the lack of precisely defined terms. For example, the term "user" has many different meanings, even among the very knowledgeable group we interviewed. In some cases during our interviews, the term "user" referred to individual end-users. In other cases, "user" was applied generically, describing interests on a spectrum from single consumers to multinational corporations. The consequence of applying a term with such broad application to dissimilar groups creates the appearance that their interests coincide. Certainly, no one would argue that the individual user of a database program has the same interest in standardization as General Motors. Therefore, if the topic of the "user" involvement in standards development is to receive serious investigation, the term must have its definition established, and specified to the interviewees in the course of questioning.

Beyond the issue of more precise definition of terms, three suggestions can be made regards further research:

1. Revise the questionnaire for use with a larger group of participants involved over time in a single standards effort. In such an effort, it would be important to insure that a broad cross section is included and to track changes in the opinions expressed over time.

2. Revise the questionnaire in line with the techniques and strategies identified and survey a broader cross section of chairs to ascertain the relevance.

3. Structure a study to try to determine the impact of good and bad practices by the chair. This might be done by a retrospective study of successful and unsuccessful standardization efforts with an eye to determining what if any impact the role of the chair had along the dimensions identified in this study.

4. Work with selected chairs to incorporate the recommendations of this study and see if any difference in development time or participant satisfaction is noted in comparison to committees that continue to operate as before.

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A. Structured Interview Questions for Experts

As an active observer of information technology standards development projects, your assistance is being sought to further facilitate the overall standards development process. Here at the University of Pittsburgh's Information Science Department, our graduate student class in Information Technology Standards, has, under the aegis of Dr. Michael B. Spring, undertaken the assignment of researching the characteristics of human behavior and the related standards development process steps that contribute to the effective generation of quality standards. Our focus goes beyond the formal rules and procedures of standards development, to the human behavior, skills, and group dynamics of the process itself.

We would appreciate the opportunity to carry on a conversation with you at a pre-arranged time that accommodates your work and travel schedule. If you will grant us an hour of your time for a Q & A session, we believe you may benefit from it in the not too distant future. Pursuant to your initial contact with Michael Spring at Pitt, we would like to tentatively schedule the phone interview (approximately 1 hour) at your earliest convenience, preferably during the week of March 21, 1994, if amenable to your schedule. In the interest of time, we would appreciate your acknowledging receipt of this message and advising us by E-mail as to a tentative time that would be most convenient for you. If you are unable to pick a convenient time right now, please let us know when we may give you call or E-mail us to set-up a time that will fit your busy schedule.

E-Mail to: spring@lis.pitt.edu cc: xtal@lis.pitt.edu

In addition, we would appreciate it if you would print out the consent form which is included in this transmission, sign it if you agree to its terms, and provide us with a facsimile of the signed document at your earliest convenience. Our fax number is (412) 624-5231.

We offer an attached list of questions for your review. A copy of a survey conducted via the internet is also attached for your reference. We intend to use these questions in our telephone interview. However, we encourage you to supplement our list with topics for discussion that you consider pertinent. We would like to emphasize that the questions are meant as an outline, not a rigid script. Although we have provided suggestions for some open-ended questions, you should not feel restricted to respond only to these alternatives.

What is to become of the research? It is our intent to:

1. Identify some of the leading characteristics of human behavior and skills that contribute to quality/successful standards development.
2. Prioritize these skills.
3. Identify those skills that may be trainable and some of the resources available to facilitate such training.

As a participant in this process we would expect to share with you, later this Spring, some of our findings after talking with you and your colleagues.

We are utilizing a three-dimensional approach.

1. In-depth telephone interviews with you and your colleagues.
2. Internet surveys of recognized groups involved in standards development.
3. E-mail interviews/surveys of people who have served on standards development

committees/working groups. In addition, we are conducting a literature survey of materials relating to the standards process.

To lend credence to the study the report is targeted at high profile SDO participants and researchers like yourself who will be identified. However, we will incorporate a section that will provide complete anonymity, as to source, for any relevant insights that you would like to make "off-the-record". These insights could go a long way to help us understand some of the more sensitive issues extant within the standards community. In addition, we would like to tape record our conversations in the interest of research analysis. These recordings will be used only to facilitate transcription of the interview and will be destroyed immediately after use. We will naturally provide a copy to you if you so desire. If you prefer not to be recorded, we will accommodate you.

We look forward to hearing from you.

INTERVIEW QUESTIONS FOR EXPERTS

1) Composition
A) What do you think is the optimal size for an SDO?
B) Do you perceive a lack of balance or participation by interest groups affected by standards?
--industry
--users
--governments
C) Do you perceive a lack of balance or representation among the professional backgrounds of standards participants?
--engineers
--management
--academics

2) Individual Members
A) What do you think are ideal characteristics?
--speaking up
--finding compromise
--contributing work
--promptly responding to assignments
--having a vested interest
--social support
B) What are dangerous or undesirable characteristics?
--passivity
--failure to focus
--inability to compromise
--preoccupation with trivial details
--lack of sociability

3) Roles
A) What roles do you consider necessary in a standards making group?
--formal chair
--technology proponent
--observer
--user representative
--others
B) Do we need to ensure that certain roles are represented on every committee to guarantee success?
--formal chair
--technology proponent
--observer
--user representative
--others

C) How should work be distributed among participants? How would you establish responsibility and accountability for the work of the participants? What percentage of the work/responsibility should fall on the chair?

4) Processes

A) What events impede the standards development process? Are interpersonal conflicts more destructive than productive? Under what circumstances does a participant's withdrawal from a group derail the process? In terms of intra-group communication, which do you think is preferable, lengthy or abbreviated discussion?

B) What do you think are important techniques for disseminating information during meeting?

- **--overheads**
- **--handouts**

C) What do you think are important techniques for disseminating information outside a meeting?

- **--e-mail**
- **--teleconferencing**
- **--fax**

D) In what ways do you think administrative procedures affect the process?

- **-- adherence to deadlines,**
- **-- required document format**
- **-- following procedural rules for discussion**

E) Is there a need to determine objectively when a standard is done?

5) Training and preparation

A) What is the most important skill that chairs should have such that it should be a matter of required training?

- **--project management**
- **--negotiation skills**
- **--persuasive writing**

B) How important is it for chairs to:

- **--have self awareness of their personal style**
- **--have skill at conflict resolution**
- **--use formal methods for meetings**
- **--apply strict rules for documentation formatting**

C) What is the most important skill _members_ of a committee should have such that it should be a matter of required training?

- **--time management**
- **--skill in public-speaking**
- **--foreign language proficiency**

D) How important is it for members to:

- **--have self awareness of their personal style**
- **--know methods for conflict resolution**
- **--accept formal methods for meetings**

6) Reaching consensus

In coming to a decision, is it helpful to follow parliamentary rules, such as _Robert's Rules of Order_? In case the group becomes polarized, theory says that the group tends to polarize to one or another direction (cautious become MORE cautious, and the "risky" proposals become more extreme). How can this phenomenon be avoided? Do you think anonymity in voting would assist the process.

7) Conflicts

Consider three types of conflicts (schedule, technical, and interpersonal), which of the three most adversely affects the process? Can you propose solutions for each category?

B. Interview Questions for Technical Committee Chairs

As an active leader in information technology standards development projects, your assistance is being sought to further facilitate the overall standards development process. Here at the University of Pittsburgh's Information Science Department, our graduate student class in Information Technology Standards, has, under the aegis of Dr. Michael B. Spring, undertaken the assignment of researching the characteristics of human behavior and the related standards development process steps that contribute to the effective generation of quality standards. Our focus goes beyond the formal rules and procedures of standards development, to the human behavior, skills, and group dynamics of the process itself, as well as some of the techniques you use to facilitate this process.

We are asking for an opportunity to carry on a conversation with you at a pre- arranged time that accommodates your work and travel schedule. If you will afford us an hour of your time for a Q & A session, we believe you may benefit from it in the not too distant future. Pursuant to your initial contact with Don Loughry and/or Michael Spring at Pitt, we will schedule phone interviews at your convenience (approximately 1 hour long). In the interest of time, we would appreciate if you could acknowledge receipt of this message and advise by E-mail as to a tentative time that would be most convenient for you. If you are unable to pick a convenient time right now, please let us know when we may give you call or E-mail us to set-up a time that will fit your busy schedule.

E-Mail to: spring@icarus.lis.pitt.edu cc: tarr@icarus.lis.pitt.edu

We offer the attached list of questions for your review. These questions will form the basis of our telephone interview, however, please feel free to add additional items you feel we may not have included or make any changes you feel are relevant.

What is to become of the research? It is our intent to:

1. Identify some of the leading characteristics of human behavior and skills that contribute to quality/successful standards development.
2. Prioritize these skills.
3. Identify those skills that may be trainable and some of the resources available to facilitate such training.

As a participant in this process we would expect to share with you, later this spring, some of our findings after talking with you and your colleagues. We are utilizing a three-dimensional approach.

1. In-depth telephone interviews with you and your colleagues, whose names appear at the top of the questions list attached hereto.
2. Internet surveys of recognized groups involved in standards development.
3. E-mail interviews/surveys of people who have served on standards development committees/working groups. In addition, we are conducting a literature survey of materials relating to the standards process.

To lend credence to the study the report is targeted at high profile SDO participants like yourself who will be identified. However, we will incorporate a section that will provide complete anonymity, as to source, for any relevant insights that you would like to make "off-the-record". These insights could go a long way to help us understand some of the more sensitive issues extant within the standards community. Finally we would like to ask you to consider allowing us to tape record our conversations in the interest of research analysis. We cannot do this without your ex-

plicit permission, and would not want to do it if it were to make you uncomfortable in any way shape or form. We have all signed confidentiality statements and can assure you that the tape would only be used for our personal analysis and that the use of the tape would still be governed by any conditions of anonymity that are set up.

INTERVIEW QUESTIONS FOR CHAIRPERSONS

Toward the goal of looking for trainable aspects standard group participants and leaders, we hope the following questions will provide "food for thought" for the telephone interview. If you do not feel the questions are clear or that they do not relate, simply ignore them. With your broad perspective you might have other topics that you think should be added, we welcome any such addition.

1. Given the standardization process as it exists today, what do you consider the strong and weak points of the process?

2. If legality, politics and reality did not impose any constraints, what changes would you suggest to improve the process? (Seriously, we ask you to suggest improvements without having to address the full ramifications of such changes on issues such as due process or copyright.)

3. What kinds of training for TC Chairs and/or Members do you think would help the process? How much would it help?

4. What things do you feel are unique to standardization and specification teams as opposed to other development teams and committees?

5. Please characterize the stages of committee life cycle as you see them. Try to break down the stages into sub stages if possible in hierarchical manner.

6. What is the skill level of participants or chairs in the following areas:
- **a. Human Relations**
- **b. Group Dynamics**
- **c. Project Team Management**

How even are these skills across chairs? Do skills in these areas contribute to success? Do you think that those individuals you have known that don't have skills in these areas could or would learn them?

7. Please rank the following in terms of their importance as training issues:
- **a. Decision Making (e.g., choosing between alternatives).**
- **b. Conflict Resolution Techniques: Arriving at consensus.**
- **c. Human Relations and Motivating: Getting the best out of people.**
- **d. Group Dynamics: Understanding human relations and processes in the committee.**
- **e. Process Management: Techniques for moving a group from climate and goal setting to specification and evaluation.**

8. What formal or informal techniques do you personally use to motivate a group through the various stages and phases of developing standards?

9. What is your opinion about training standard committee participants in the following areas? How important are they are for most committee members?
- **a. Information gathering in their own source organization.**
- **b. Techniques of explaining the standard back at their organization.**
- **c. Group dynamics.**
- **d. Ways of listening and convincing (gaining consensus).**

10. How is documentation handled and how was it used in committees on

which you served. Do you see any way to improve it?

11. When do you consider a standard to be finished? Is there any evaluation process, within the committee itself that follows? Is there a need for such evaluation at all? if yes, what would you recommend?

12. Comment on the following idealized mechanisms for avoiding conflicts in a situation where the potential exists:

- **a. Setting climate.**
- **b. Analyze the image (how do you see others and how do they see you).**
- **c. Collecting information.**
- **d. Defining the problem.**
- **e. Sharing the information with all other participants (getting their support and thoughts).**
- **f. Setting priorities.**
- **g. Form problem solving teams (trying to get rid of personal factors).**
- **h. Solving the problem.**
- **i. Developing action plan.**
- **j. Implementing the work.**
- **k. Following up: obtaining feedback on implementation for the action plan.**

13. The following factors were identified as main sources of conflicts in project teams. We would like to know whether they also play a major role in standards committees disagreements. Please rank the following factors as sources of conflict (Most important = 1, Least important = 8):

- **a. Corporate financial interests**
- **b. Technical opinions**
- **c. Corporate policy**
- **d. Priorities**
- **e. Scheduling**
- **f. Personality**
- **g. Responsibilities**
- **h. Administrative procedures**

Are there any other factors that you have observed that could be added to this list? if so, where would they rank?

14. How is work distributed among the participants?. How do you establish responsibility and accountability for the work of participants? What percentage is usually done by the chair person? By the members?

15. According to your experience, How much of the committee's work is (give approximate percentage):

- **a. Information gathering.**
- **b. Design.**
- **c. Consensus seeking.**
- **d. Evaluating the standard that results.**

Do you expect to get very different answers across committees regarding this question?

16. In case of disagreement/dispute, how would you (if at all):

- **a. Build trust between conflicting parties.**
- **b. Keep the meeting under control.**
- **c. Convey your views.**
- **d. Maintain a give and take attitude.**
- **e. Make one side willing to say he was wrong.**

C. Internet and X3 Committee Member Survey

This questionnaire[23] has been developed as part of an ongoing research project on Information Technology Standards at the University of Pittsburgh. The goal of the research is to identify the characteristics of standards development processes that contribute to effective generation of quality standards. Please answer the questions as they appear and do not alter the question statements or choices. A section for additional comments is at the end of the survey.

Please complete and e-mail your completed survey to mbsclass@lis.pitt.edu as soon as possible, but not after April 7, 1994. All individual responses to the survey will be kept confidential and will be used by researchers exclusively for compiling and analyzing summary statistics. After the data has been analyzed, summarized findings will be available to you via Internet. If you prefer total anonymity, please send a copy of the questionnaire to: Andrew Snow Internet Survey Coordinator Suite 702, School of Library and Information Science University of Pittsburgh Pittsburgh PA 15213

In accord with University of Pittsburgh and Federal guidelines related to the conduct of research involving human subjects, we need to be clear that your participation in this study is voluntary. If you choose to return this survey it is an indication of your consent to be a part of the study described below and to publication of the data obtained from the study for scientific purposes. This study is being conducted under the supervision of Dr. Michael B.Spring, Department of Information Science, University of Pittsburgh, Room 705 LIS, Pittsburgh, PA 15213. The purpose of this study is to identify steps in the standard development process and characteristics human behavior that designate an effective standards development process. There is neither a cost nor a payment involved in this research project. Any information about you obtained from answers to questionnaires will be kept strictly confidential and your identity will not be revealed in any description or publication of this research. (Upon receipt of the returned questionnaire, your name will be stripped from the mail note and discarded.)

Any questions you have about this research will be answered by Dr. Spring who may be reached at 412-624-9429, or via e-mail at spring@lis.pitt.edu. A copy of the results of the study may be obtained by sending an e-mail request to spring@lis.pitt.edu. Any questions you have about your rights as a research subject will be answered by the Office of Senior Vice Chancellor for Health Sciences at 412-647-8475. Thank you for your participation.

QUESTIONNAIRE (X-36)

1. Please state the standard for which you actively participated in development:

2. Please state the standards organization and specific standards committee/subcommittee of which you were a member:

3. On average, how many times a year did your

[23]X3 Chairpersons had a note prepended to the questionnaire that indicated "You previously received a notice from Dan Arnold that a University of Pittsburgh questionnaire would be forwarded to you. It would be greatly appreciated if you could forward the attached questionnaire to all members of your committee with an encouragement to respond expeditiously. Thank you -- Dr. Michael Spring University of Pittsburgh.

committee/subcommittee meet (1,2,3,4,...)?

4. How many total meetings did you attend in the development of this standard?

5. What is the average size of the committees/subcommittees on which you participated?

6. Which of the following categories BEST describes your job function while engaged in the development of the identified standard? (Marketing/Sales, R&D, Product Development, Manufacturing, Operations, User Representative, Consortium Representative, Systems Integrator)

7. What percentage of your total work time was spent working on the development of the standard? (0 to 100 percent)

8. What one characteristic BEST DESCRIBES your personal contribution to this standards process (please select only one):

   ability to focus on objectives.....
   ability to forge consensus.....
   attention to technical detail.....
   ability to initiate proposals to get things moving.....
   ability to actively head-off bad ideas.....
   ability to listen attentively and monitor activities to ensure process is going in the right direction.....

   total 100

9. How many years had you worked on technical issues related to the standards activity?

10. How many years had you worked in information technology field at the time of your involvement?

11. Please allocate 100 points among the categories that best describe your MOTIVATION for participating in this standards process (more points to a particular category means better description of motivation):

   professional prestige.....
   intellectual curiosity.....
   desire to positively influence the future.....
   boredom back at the office.....
   like to travel.....
   supervisor sent me.....
   protect the interests of employer.....

   total 100

12. Please allocate 100 points among the skill areas you think are MOST IMPORTANT to individuals participating in the standards process (more points to an area means more importance):

   time management.....
   art of negotiation.....
   how to run and participate in a meeting.....
   technical expertise.....
   formal presentations.....
   competition and marketing.....
   international relations.....
   foreign language proficiency.....
   product management.....
   technology forecasting.....

---
total 100

13. On a scale of 1 to 10, rate the quality of the products (technical reports, drafts, annual reports, standards, etc.) produced by the committee/subcommittee (1 = poor and 10 = outstanding).

14. On a scale of 1 to 10, rate the efficiency of the process that produced these products.

15. On a scale of 1 to 10, rate the effectiveness of the chairperson in the management of the process that produced these products.

16. Please allocate 100 points among the following categories that best describes the characteristics of the chairperson who oversaw these activities:

able to focus on objectives.....
ability to forge consensus.....
attention to technical detail.....
ability to initiate proposals to get things moving.....
ability to actively head-off bad ideas.....
ability to listen attentively and monitor activities to ensure process is going in the right direction.....

---
total 100

17. Please allocate 100 points among the following characteristics that you believe are necessary for a chairperson to succeed:

able to focus on objectives.....
ability to forge consensus.....
attention to technical detail.....
ability to initiate proposals to get things moving.....
ability to actively head-off bad ideas.....
ability to listen attentively and monitor activities to ensure process is going in the right direction.....

---
total 100

18. Please identify characteristic(s), if any, of the member of the committee/group that you found particularly debilitating or harmful to the process.

19. Please identify characteristic(s), if any, of the chairperson of the committee/group that you found particularly debilitating or harmful to the process.

Please provide any comments you wish to make about the survey or the standards development process:

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