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ICT Standardisation in the New Global Context

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ICT STANDARISATION IN THE NEW GLOBAL CONTEXT
FINAL REPORT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1996

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FOREWORD

The new global information infrastructure will prove effective only if it can guarantee high-speed transmission throughout the network of all kinds of data -- text, images, sound or video -- in a secure manner while preserving its integrity. The challenge to technology is how to transfer large volumes of data between terminals (PCs, for example) which have different architectures and operating systems, across a network made up of an assortment which includes old copper wiring, fibre-optic cables and wireless communication media. **The ensuing problems in interfacing lie at the heart of the current debate on standardisation.**

To assess the implications the OECD sought the advice of a group of experts from the private sector, each responsible for the standardisation of information and communications technologies in their respective companies. The latter are major users of new technologies, manufacturers of Information and Communications Technology (ICT) products, and service providers. This Group of High Level Industrial Experts on Information Technology Standardisation was chaired by M. Jean Claude Dispaux, Senior Vice-President, Group I.T. and Logistics, Nestlé (Switzerland). A full list of the members of the Group will be found below, as an Annex to their Report.

The resulting report was discussed at a Workshop held at OECD on 26-27 October 1995 under the aegis of the Information, Computer and Communications Policy (ICCP) Committee, where participants included representatives of relevant government agencies, standardisation bodies, and experts from academia, and members of the expert Group as well as other industrial experts, and was subsequently made available for general distribution by the ICCP Committee.

The following document includes both the report produced by the Group of High Level Industrial Experts on Information Technology Standardisation and a report of the Workshop.

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Nestec Ltd.

Mr. Richard C. Beaird
Chairman of the ICCP Committee
Bureau of International Communications
and Information Policy
U.S. Department of State

USA - WASHINGTON DC

February 22, 1995

FCA-SIL/JCD/Mi

IT STANDARDISATION

Dear Mr. Beaird,

I have the great pleasure of transmitting to you the final report of the Group of Industrial Experts on IT Standardisation established by your Committee at the beginning of last year.

The report underlines the crucial importance of safeguarding the principle of voluntary industry-led participation that underpins today's standardisation system. It recognises, however, that the issues to be dealt with in information and communications technology (ICT) standardisation are increasingly complex due to many factors. Among these are the convergence of hitherto distinct areas of technology, the ubiquity of these technologies that have applications affecting all aspects of human life, the need to address issues globally, the rapidly growing political, economic and social stakes of compatibility and portability standards and the emergence of ICT-based new business and trading practices, etc. An emerging concern of great importance, the effective deployment of the new global information infrastructures, will in particular require the timely definition and provision of critical interfaces.

One of our early conclusions, in light of these developments, has been that special efforts may be required at international level, where the interplay of market forces, diverging regulations, unwarranted competition between standardisation bodies and duplication of efforts may hamper the development of fully compatible standards. While our recommendations have not been directed at the national scenes, the definition of common goals and practices may be required internationally to cope with new global needs.

For all these reasons, parties who have not been involved in standardisation efforts must now become increasingly active. Decisive steps are needed to facilitate the participation of private and public users, to improve the economy and effectiveness of the global ICT standardisation systems, and to set in motion or launch processes and discussions where and when they are required to respond to emerging techno-economic requirements. These requirements are especially important to extend the benefits of the new ICT technologies to all types of business activities and firms of all sizes in all countries.

The Group has formulated a number of recommendations dealing with these standardisation concerns and addressed to all stakeholders. Some of these recommendations may imply that your Committee, Mr. Chairman, take an active role, in particular to assist governments in further clarifying their responsibilities and the objectives they might pursue in this area, keeping in mind the voluntary nature of the processes in question.

I hope your Committee will be able to consider these proposals and react to them. Let me say, on behalf of the whole Group, that we are confident in the ability of the Organisation to meet these new and difficult challenges.

Yours sincerely,

Jean Claude Dispaux
Senior Vice-President Nestlé IT & Logistics
Chairman OECD High-Level Group of
Industrial Experts on IT Standardisation

EXECUTIVE SUMMARY

The standardisation process must adjust to the requirements of a new era which is being shaped by rapid technological advances in, and fusion of, the two hitherto separate areas of Information and Communications Technology (ICT). This technology will become ever more essential for all human activities. Taking account of the widening scope of users' demands and associated market needs has become a major challenge in designing the national and global information infrastructures that are expected to provide the backbone of the future world economy. In this light, the following four principles should govern the international standardisation process:

-- The standardisation process should be market-driven and voluntary, based on an open process in which all stakeholders can participate.

-- Formal standardisation efforts should focus on aspects relevant for interoperability of products and services.

-- The contributions of industry-led consortia, fora and other "informal" bodies in providing technical input into the formal standardisation process should be recognised and encouraged.

-- The importance of Intellectual Property Rights as a means to protect investment in the development of new technologies should be recognised, but fair competition among market players should also be maintained.

-- Government intervention should be limited to areas where regulation is essential, for example when safety considerations are at stake.

-- Users should be encouraged to organise themselves, so that they can play their appropriate role in the process.

-- Governments should promote the adoption of international standards in preference to national standards whenever possible. As users, governments should also act as role models in referencing internationally established standards in public procurement policies.

The deployment at global level of a seamless information and communication web may require innovative approaches, based on consensus with regard to the technical solutions required, priorities and methods of work. All market forces, e.g. suppliers, network operators, service providers and users, will need to work jointly in establishing this planning and prioritisation process.

The ICT standardisation process should thus continue to be driven by market forces, to be re-assessed and if necessary adjusted by them on a continuing basis for better market orientation, improved on-time delivery and reduced waste and duplication. The increasing demands for extending user participation, in particular, must be reconciled with the need for greater speed.

The ICT standardisation system has attempted, it is true, to adjust pragmatically to emerging requirements. These changes have remained limited. New mechanisms may often be required to better integrate the standardisation efforts of the diverse bodies involved, implement a more rational and effective distribution of the work taking account of the increasing role of consortia and fora in developing specifications, and to maintain competition between suppliers within an open system.

We have come to the conclusion that a number of efforts developed at national levels to facilitate integration and co-ordination of standardisation work should now be blended at global level by the standardisation stakeholders, into a single body with world-wide responsibilities.

In addition, the principles of the structural reforms proposed throughout the standards-making machinery at global, regional and national levels include:

A project management structure with a clear division of labour and explicit resource commitments at the various stages of the standardisation process, including accurate and readily available specification of the responsibilities of committees and working-groups.

Monitoring standardisation work to have readily available information on who does what and where.

Organisational structures needed for standards development to be kept at minimum levels while maintaining effective channels and procedures for world-wide consensus.

Overcoming rivalries, and achieving effective working relationships between standardisation bodies.

Easy entry for users to participate in the choice of areas where standards are needed, in the definition of priorities, and in the assessment of results.

General recognition that the diffusion and promotion of the results of standards development work are prime responsibilities of the developers and their sponsors.

Strong consideration to be given to the application of modern ICT methods in the development of standards, and the dissemination of specifications should be pursued for easy participation by all interested parties.

Adoption of a code of conduct for standardisers.

Provision of appropriate standards-related programmes in professional education.

The governments of OECD Member countries should develop guidelines on their role in the standardisation process according to the principles outlined above.

The deployment of global information infrastructures represents an emerging challenge which will require that immediate steps be taken by all economic players (suppliers, users, etc.), through the appropriate standards organisations, to provide essential technical solutions for the effective deployment of the new global information infrastructures. Rapid and decisive action -- preferably applying project management principles -- is to be considered if required to:

Identify the targets to be met in terms of critical interfaces that *must* be provided at an early stage.

Draw up a credible implementation scheme, including the specific targets to be met, the time-table to be observed, and the resulting distribution of tasks.

Take steps to ensure that appropriate collaboration and consultation of all interested parties is maintained throughout the development process.

Monitor the development work to alert the relevant bodies concerned to the progress achieved, possible delays, new standardisation challenges resulting from technological advances, or broader non-technical implications that have been brought to light.

The success of these efforts may require more than just the spontaneous joining of forces of the standardisation bodies concerned. Special initiatives might be required to set in motion and maintain the consensus-seeking efforts required to rapidly design the schedules and targets that will promote the necessary changes.

We urge the governments of the more advanced industrial countries, which have a special stake in the success of the outcome of these efforts, to:

Generally interact with standardisation efforts in a non-directive way that safeguards their open and voluntary nature.

Monitor the correct implementation of the standards, which must remain accessible on a fair and non-discriminatory basis, in order to avoid possible distortion of free competition in the market.

Take the steps required and assign responsibilities to further study the process, consult with all interested and concerned parties to bring to light the specific changes that might be needed, and to report on the progress achieved.

The governments of OECD Member countries should exercise every effort to work co-operatively together and with suppliers and users on the basis of the above recommendations. In this way, they will play a significant role in ensuring that standardisation processes be improved, and global information infrastructures be deployed to the satisfaction of all users.

INTRODUCTION

The objective of this report is to bring to light the demands and expectations to be placed in the information and communications technologies standardisation process stemming from current political, economic and industrial trends. These trends reflect the enormous world-wide interest in the deployment of new information infrastructures, as witnessed in 1994 by the G7 request that OECD address directly and urgently a host of issues related to the global information infrastructures, including the conditions required for their successful deployment and use, their potential impact on employment and growth, as well as the role governments should be expected to play in this connection.

In line with these new concerns, our aims have been to assess today's standardisation process in light of the rising expectations generated by ICT advances; to clarify the roles and responsibilities of the broad range of actors involved; and to outline the various policies they might consider.

This report has been prepared by a group of industrialists with responsibilities in the formulation of information and communications technologies standardisation strategies in their respective firms, and concerned as a result with the health and progress of their companies and the economy at large. They undertook this task at the invitation of the OECD: an Organisation without responsibilities in standardisation as such, but with broad concerns ranging from macro-economic to technology and innovation policies, whose membership has an enormous stake in the successful application and use of the new technologies: with 16 per cent of the world population, the OECD Member countries represent 60 per cent of the world Gross Domestic Product, 80 per cent of the world Research and Development effort and 92 per cent of the world information and communications expenditure.

In the course of its activities relating to information and communications technology, the Organisation has become more and more convinced that standards have acquired a key role in the development of national and international information systems -- leading to a growing debate on the likelihood of standards adjusting automatically to radical technological advances, and on the possible need for efforts to articulate technological policy and standardisation requirements.

Recent OECD work, has cautioned about the complexities of the day-to-day interplay of market forces and traditional approaches leading to the selection of the technological solutions to problems faced by the users of new technologies[1]. Longer-term perspectives (which should not be equated with arbitration and direction by public agencies) may be required to ensure greater coherence in ICT developments, based on solutions that will facilitate progressive adjustment to new opportunities and requirements and avoid technological "lock-ins" that will sooner or later entail enormous costs. The goal to be pursued is the provision of flexible overall frameworks accepted by the relevant players in order to promote, from the outset and when compatible with the principles of free market competition and innovation, the integration of ICT applications as they become available, rather than trusting in the ability of the system eventually to generate spontaneously cheap and reliable interfacing capabilities[2].

Our report will thus address a number of the features that shape the way ICT standards emerge or fail to emerge: the growing complexity of a system where the number of actors and institutions increases with the range of products; the magnitude of the economic implications; the nature of the priority goals to be sought; and the new relationships being established between the different types of actors. Finally, our report will conclude with a set of recommendations**.**

I. THE NEW COMPLEXITIES

If the challenge has become so pressing, it is to a large extent a result of the convergence -- or rather the fusion -- of two hitherto distinct technological markets, Computing and Communications, on which all types of business activities have become increasingly dependent. These have merged into intertwined industries whose development and application call for steady advances in establishing easier communication through common standards. In spite of this technological convergence, however, the political, institutional and social underpinnings of the two areas remain very distant from each other at national and international levels. There is a great deal of commercial rivalry that generates many obstacles still to be overcome in the quest fora more adequate standardisation process.

In spite of these differences, we take our mandate to cover the whole field of information and communications technology -- extending to all the mechanisms by which users receive, process and send all types of data. We shall therefore refer below to the whole scope of information, computer and communication technologies as “ICT”.

Efficient use of new technologies has always played a key role in productivity gains, employment patterns and economic growth. Many believe to-day that this impact is now more significant than it has been for decades, because the information and communication technologies potentially affect the very core of all economic activities.

Their adoption has been shown, for example, to entail extensive restructuring of industrial activities in many directions, ranging from “lean production” to “down-sizing” and “de-layering”.

This will often in fact lead to the re-engineering of the whole process chain -- including the establishment of new alliances and relations between firms of all sizes. Effective standards are required to facilitate these developments and take advantage of all the opportunities offered by the new technologies.

Standards have thus become a critical component within the more general context of ICT development, management and control -- the more so when all these developments take place world-wide: they are based on the availability of international capacities for information gathering, processing and transmission, and are inextricably linked to the expansion of world trade and the growing inter-dependence of national economies that are increasingly woven into a global system which has its own economic requirements. This phenomenon is generally referred to as “globalisation”.

ICT thus provides the basic infrastructure required by the globalisation process. In this light, it is all the more important to develop appropriate standards and to ensure that they are correctly applied so that information flows can proceed without barriers and unjustified complications.

The users’ dilemma

It is often suggested by observers of industry and the standardisation process in ICT, that users should play a more significant role. It is true that their market choices already affect directly the fate and trajectories of the various technologies being offered[3] and the tendency has been for some users (such as airlines or banks) to become more aware of this influence. These now tend to organise and join forces in order to express more forcefully their demands for easy to use ICT technologies that will allow them to concentrate on their core businesses.

We recognise the importance of stimulating more effective users' inputs into the standardisation process to complement the influence they already exert in the marketplace. The ICT industry could only benefit if priorities and associated time frames for standardisation were determined at an early stage taking account of users' needs, so that the scarce resources available are optimally applied. Users will also realise maximum value from the results.

In order to play a more significant role than they hitherto have been prepared for, users may need to become more organised and join forces to deliver a more representative and effective message. We believe that such groupings of users should remain informal and flexible, possibly with memberships fluctuating with the subjects tackled. These groupings would be especially effective to enter into various forms of partnership with suppliers and other stakeholders. Some such developments have already taken place, as illustrated by the activities of issue-specific fora such as Asynchronous Transfer Mode (ATM) and Network Management. However, while these pioneering efforts are indeed promising, the full benefit of users' involvement still remains elusive, at least from the perspective of users themselves.

This is due to a large extent to the dilemma that binds users and often discourages active involvement. On the one hand, any firm that makes extensive use, or intends to make extensive use, of ICT as part of its array of enabling technologies will have an acute interest in making sure that standards will match as closely as possible its immediate and longer-term needs. This should be a prime motive for active involvement in standardisation. However, users' needs are usually formulated in terms of functions, and most users have little interest in participating in narrow technical discussions.

The dilemma is difficult to resolve in fora which invite "all or nothing" participation: either users take the necessary (and highly expensive!) steps required to take part in *all* relevant discussions in the hope of having a chance to influence the outcome, or they stay out.

Another users-related dilemma confronts the official standardisation agencies, which shall be referred to below as "Standards Development Organisations", or "SDOs"[4] : while everyone agrees that strengthening users' participation would make the process more responsive to market demands, everyone also agrees that it should also be more rapid. The two preoccupations are incompatible to a large extent: the more actors there are, the slower the process will presumably turn out to be.

Solutions to these two sets of problems can only be found if the different stages of standardisation are more clearly delineated and users' participation facilitated when it matters -- which is not at all the case at all stages. This necessary effort to define the different stages of the standardisation process will be addressed below in this report, to illustrate the fact that users' involvement is mainly justified at certain stages of the standards production cycle. We are nevertheless convinced that the number and variety of user inputs to the standardisation process should and must be strengthened.

We do underline, therefore, the need to increase user input on a selective basis at certain key stages of the standardisation process, while minimising any resulting delays. The nature and extent of users' participation should be defined in reference to the fact that basic user needs do not address the elegance of the technology or of the standards *per se*, as much as they specify requirements and subsequent benefits, added value, and cost effectiveness of the expected products, processes and services.

If *when* to participate thus becomes an important question, equally important is to decide *who* would participate. We are, of course, aware of the fact that "users" represent a very heterogeneous group. A recent OECD Report[5] has in fact identified four categories:

-- individuals;

-- small units and organisations;

-- large concerns with specialised interests;

-- very large (usually international) entities whose activities call fora broad range of ICT capabilities.

Additional distinctions could be made according to the scope of standardisation demands, or to the extent of ICT use as a limited problem-solving instrument, as enabling technologies or as a core technology which conditions the very existence of a given business activity.

Obviously, all users are not, and will not be equally moved and able to be concerned with, and to participate in, standardisation processes.

The challenge is to find a common ground between the elements of consensus represented by users, suppliers and governments to the extent that they are stakeholders. This common ground includes responsiveness and matching to market opportunities, cost-effectiveness, interoperability for enhanced consumer choice and competitiveness due to more market access.

User input needs to be dynamic to reflect changing conditions in market needs, and insights gained during implementation, including practical constraints, opportunities and cost impact. However, it is generally unrealistic to expect users to sit through protracted standardisation meetings, as experience has frequently demonstrated. Rather, it is necessary to suggest periodic check-points or fora where the current status and decisions can be compared with user needs and expectations, in order to adjust related efforts accordingly.

Users will thus expect to influence ICT standards. But how? Special mechanisms, or the reinforcement of existing channels, might be required to facilitate this involvement of new actors without hampering the effectiveness of existing processes. The overriding goal will thus be to provide an environment where various systems modules become rapidly available to users in response to their broad variety of needs, while producers and service providers can ride the wave of a steadily expanding and increasingly explicit set of demands. What are the stakes? What needs to be done? What are the future requirements? What are the priorities and how will they be selected? These questions cannot be answered readily without reference to the different levels of standardisation infrastructure at national and international levels -- or to the different kinds of standardisation outputs that affect business processes and products.

What kind of institutional setting?

Institutional competition becomes harmful when various standardisation bodies compete in such a way that they duplicate each other’s work at great cost for participants. The subsequent co-ordination difficulties lead to additional delays and increased costs for participants.

The source(s) of difficulties is related here to the fact that any private or public body may decide to launch a standards project, without realising that the same work is done elsewhere and without public notice of the extent and purposes of its new initiative. This could only be prevented with procedures

providing information on who does what, and with mechanisms that would ensure a higher degree of co-ordination.

> **A basic rule to avoid waste of resources, accumulation of delays and a multiplication of incompatible standards should, in our view, be that *all* standardisation bodies involved in developing a standard fora particular application *always* collaborate in some fashion. Such new partnerships might be established either by formulating joint work programmes aimed at the production of a single standard or set of standards, or by co-ordinating efforts to avoid incompatibilities and make room for needed interfaces between various ICT standards.**

The focus should be on productive competition rather than sterile rivalry. Increasingly, however, the manner in which specialised requirements must be met is under question: the development of an integrated communications network will require that each user look beyond his/her own sphere to take account of other needs and adjust strategies to meet broader standardisation requirements. We assume that the challenges of global competition and the need to establish production and commercial activities on the basis of far-ranging alliances will provide a powerful incentive to thus extend the horizons of all actors.

In this light, it is critical that the formal standardisation bodies take the initiative to establish effective working relationships with the relevant informal bodies (consortia or fora[6]) created by suppliers and/or users to articulate their standardisation requirements and produce rapidly the specifications they need, which may or may not subsequently achieve recognition as full-fledged standards. Particularly successful examples include bodies such as the European User Group for Open Systems -- OSITOP, the European Workshop for Open Systems -- EWOS, or the Asynchronous Transfer Mode -- ATM -- Forum. Such relationships can be expected to play a growing role in facilitating the formulation of standardisation needs reflecting all types of interests. The overriding goal **for all** standardisation actors should be to produce standards in a timely fashion. Formal standardisation bodies will be increasingly expected to view themselves as partners or supporters of, rather than competitors with, the informal bodies created by industry.

All these questions are extremely difficult and challenge the very core of traditional standardisation processes that are complex, painstaking and time-consuming. We do recognise, of course, that this complexity is to a large extent the reflection of an intent to foster fully democratic approaches: in this area, decision-making mechanisms reflect the traditional consensus-seeking approaches rather than the need to develop rapid solutions in response to pressing demands. The existing process *will* facilitate the development of interoperable products in a competitive marketplace, *will* protect intellectual property rights (IPR), and *will* develop industry consensus via an open and voluntary system. However, it will do so at its own pace and not necessarily when and where most needed.

The pace of the innovation process in computing, the convergence of information and communication technologies, the complexity of issues, the growing number of institutions involved, and the sense of urgency due to the perceived need to speed up the standardisation process globally, have raised questions about the adequacy of the established processes. The challenge is now to safeguard the basic consensual philosophy while gaining in concentration, effectiveness and speed.

The speed with which a standard is completed is important, and has become even more important in the ICT area where optimal use of the technology relies on the effectiveness of interfaces -- and where the flow of computer-to-computer communications may be jeopardised for long periods of time if solutions have not been designed and implemented early enough. The life-expectancy and coherence of

standards are also crucial, in particular for end-users who cannot afford frequent migrations and expect any changes to be part of a planned process they can join as and when economically attractive or necessary.

To date, the major international standardisation organisations have succeeded in accelerating the work, so that the average production time of an internationally approved standard has decreased. International standards discussions in such fora, however, usually follow more or less extensive periods of preparations at national levels. Many national standards bodies still operate without clear time frame objectives.

For these reasons among others, private groupings of suppliers and users have proliferated in recent years and are often quoted as models for more rapid standardisation work. This greater speed, however, is sometimes made possible at the cost of not ensuring a fully open, representative, consensus-based process. A balance should be struck between the formal mechanisms of the public bodies, and the more rapid pace of private efforts. In this respect, new procedures need to be encouraged to ensure that SDOs are rapidly made aware of the results of the work of the more informal bodies, and deal with these results in an accelerated mode.

New forms of inter-institutional co-operation could thus usefully develop throughout the standardisation world, in particular to face up to the more urgent current challenges.

At the same time, one must recall that market-based competition is essential to promote innovation and stimulate the development of the broad scope of alternatives required to meet the highly diversified needs of various branches and sectors. The superimposition of an unrepresentative bureaucracy with the power to make arbitrary standardisation choices would have disastrous results. But the ultimate goal of standardisation -- simple, universally accessible standards -- may not be realised without co-ordination efforts and reference to an overall vision of the future[7].

What kind of standards?

From the standpoint of users, standards should be expected to guarantee certain functions where interoperability is essential but this must not be achieved at the expense of backward compatibility with previous generations of ICT. These functions should be incorporated into various products available from multiple sources in the marketplace but capable of being harnessed to a common task without discontinuity. They should not be subject to the fear that they may suddenly cease to be available. They should offer a credible promise of universality -- i.e. that they will be able to interact fully as components of the emerging global information infrastructure.

Any person with minimum background and skills should be able to make optimal use of the standardised product on the basis of the relevant documents. In other words, the basic requirements fora standard should be:

-- the documentation is complete;

-- the documents are readily and easily available;

-- it is simple, and even user-friendly;

-- no proprietary or otherwise exclusive technology is included, unless it is available in a non-discriminatory way[8].

In this light, the formal, public standardisation machinery should continue to be the most desirable way of establishing standards in the ICT field, since it is based on the broadest possible consensus among all parties concerned and, hence, assures a maximum of neutrality in a highly competitive market. But in order to meet market expectations and to cope with rapid technological developments, formal standardisation may need to adapt its working methods to today's needs, in particular in order to fully exploit valuable work done outside its own circles.

In the current context of on-going globalisation, global standardisation should always have preference to regional standardisation, in order to avoid the segmentation of markets. Regional standardisation should only be initiated where no global standards yet exist and where a need for such a global effort is not yet recognised world-wide.

While suppliers may have different views of an "ideal" standard, and the appropriation of IPRs, the past desire to dominate a market by exclusive technology is giving way to realism and the promise of larger global markets via agreed standards. Nevertheless, it is important to recognise the legitimate role of proprietary implementations where necessary to motivate suppliers and ensure that innovative solutions may be produced that can have the potential to earn reasonable return for the investor, before requiring them to relinquish IPR to effect open standards. It is also true, in our view, that the critical importance of certain interfaces requires that the related IPRs (if any), be available at reasonable cost on a non-discriminatory basis. As mentioned later in this report, the focus of open standards to realise interoperability should in fact be on key interfaces, leaving individual implementation of specific applications to the creativity of the supplier who will increasingly need to take into account a great variety of local and regional factors, such as culture, language or traditions...

The majority of ICT standards may reflect a large variety of situations and arrangements to cover diverse requirements and situations. It remains, however, that the smooth application and deployment of information technologies world-wide requires a minimum set of fundamental standards that, in our view, need to be timely, internationally agreed, voluntary and designed to guarantee interoperability of systems from multiple suppliers.

A special case occurs in areas which are subject to legal regulation, for example when safety considerations are involved. In such instances, the standardisation process should be all the more open while aiming at establishing international harmony, since a multiplication of different national or regional standards in these areas may constitute severe barriers to international trade.

Interoperability of systems designed by different suppliers is one of the key requirements and, fora standard to be complete, it must include (or be associated with) the necessary international standardised profile(s), conformance statements and test methods. The ultimate purpose is to reduce the costs of innovation by making the development, application, marketing and acquisition of new technologies easier and cheaper. In other words, to streamline the variety of products and processes to the minimum necessary in order to define trajectories for future development without constraining or limiting innovation.

Accordingly, the goals of standardisation are to:

-- arrive at commonly recognised specifications;

-- provide interoperability;

-- assure that products manufactured by different equipment suppliers can be easily interconnected;

-- minimise the variations of components and products in the manufacturing process;

-- safeguard the value of past investments through "vintage" (backward and forward) compatibility;

-- provide solutions that work, and continue to work as parts are exchanged or updated;

-- reduce costs in R&D, manufacturing, acquisition, installation, etc., for suppliers as well as end users.

II. THE INFRASTRUCTURE OF THE GLOBAL ECONOMY

If interoperability has currently acquired such vital importance, it is because of the networking nature of ICT. In particular, there is widespread appreciation that the economic impact of these technologies can be very large, since they can be used in such a variety of tasks involving collection, manipulation and transmission of information, and thus offer new functions that are relevant to all types of human activities to a greater or lesser degree. The urgency of these networking-related concerns should not, however, disguise the fact that the demands for "interoperability" are, in fact, much broader. While "networking" is obviously a fundamental requirement for the new information infrastructure, achieving interoperability is also essential to create a multi-vendor marketplace where the customer will not be locked into procurement from a single source, but has a choice, which in turn results in lower costs and a broader range of functions for users to choose from.

Applications range from automating and aiding office tasks, controlling industrial production, and providing new and improved functions for home and personal use (e.g. entertainment). ICT is an enabling technology that can be applied across all sectors, unlike other new technologies such as biotechnology or new materials, which are closer to final consumption technologies with functional boundaries on their applications. The blend of information and communications technologies holds the promise of a global infrastructure that will also allow interaction between applications regardless of distance, time differences, etc.

There has been rapid diffusion of new ICT-based goods and services through the economy, in particular because the real price of ICT products and services has dropped (and continues to drop) dramatically, while their capabilities are steadily extended. ICT systems have become faster, more powerful, cheaper, more user-friendly and -- last but not least -- ever more able to interact with each other. In principle, the outlook for the further diffusion and application of ICT goods and services thus remains one of continued growth, rapidly declining prices and ever-widening new applications [9].

These prospects have led many observers to compare the current impact of the penetration of ICT in our economies to that of previous technological revolutions resulting from the diffusion of, for example, railroads and electricity. In these two cases, the "diffusion bandwagon" of a core technology was contingent on, and also generated, a host (or "cluster") of technological, industrial and financial innovations[10]. It is often assumed that the impact of ICT will prove similar to these two cases, and will follow similar patterns.

This last assumption may be conservative. ICT has characteristics that played no significant role in previous cases:

-- ICT applications have the potential to affect *all* spheres of human activity, since all human activities make use of information;

-- the full potential of ICT can only be realised, however, through global and integrated implementation on a pervasive and commodity basis.

The first point underlines, among others, the enormous cultural implications of information technologies, and hence the fact that ICT standards, in particular at the dawn of the multimedia era, should be flexible enough to adapt to various local cultural environments, including languages and different uses in the same language, letter-writing customs, manner of expressing date and time, and so on. The last point is especially important: the new network technology requires a world-wide infrastructure to be used in an optimum way -- which entails effective blend of hardware and intangibles (such as protocols, data content and its availability in multiple languages) and standards, as in the case of "electronic highways". However, ICT itself has a strong "standardisation" effect on habits and customs...

Previous technologies, even the most influential ones, did not have such extensive requirements. Different countries have invested in railroads at different times from the 1820s (UK) to the present[11], with designs that have accommodated, for example, significant variations in rail gauges (sometimes even in the same country). And whatever its standards of use in a given location, electricity could easily be transported and converted into other forms of energy once Alternating Current (AC) was developed. Application, in these two cases, was local, which did not of course prevent the technologies in question from having universal economic impact. In such cases, the process of change could be characterised by qualitative and quantitative leaps in productivity levels that could not have been achieved with the previous technological modes.

The new technologies will certainly exercise similar effects on productivity gains and economic growth prospects when their optimal deployment is fully under way. However, the process that will allow for such successful deployment will be more complex and probably much longer in time than has been the case with previous technologies. Two conditions of universality must be realised: in geographic terms, to provide an infrastructure for the emerging global economy; and in operational terms, to integrate ICT to all forms of human activity. Such a process cannot but be a lengthy one. The capability will often be there well in advance of the users' financial and/or technical ability (or willingness, when the available systems are felt to lack "user-friendliness") to adopt it.

At present, the main benefits of the new technologies are often realised at "local" levels, defined in geographic terms (a single plant, or central administration in one location) or in terms of unity of processes and purposes within a given branch (without regard to the location of the various units, as in the case of a single corporation with offices world-wide). Benefits will tend to decrease significantly across geographic and/or sectoral and institutional boundaries because of the heterogeneity of equipment and applications. This heterogeneity is a natural reflection of the variety of demands that will not be spontaneously federated into unified standards. Thus, different systems coexist with limited or non-existent communications possibilities. These difficulties would, in fact, increase with time rather than diminish of themselves, because each insular ICT environment tends to generate its own applications that will diverge even more from the theoretical unique "norm" that could have provided the basis of a common standard[12]. This is why it is important to ascertain from the outset that the standardisation infrastructure will not foster a multiplicity of competing solutions and will minimise duplication of efforts, that would be all the more counter-productive in view of the limited supply of experts available to do the work.

The fabric of national societies, in any given country, is now increasingly affected by the ways in which ICT is used. It has become obvious that many large firms, for example, tend to focus on core business and transfer other activities to small and medium-size enterprises (SMEs). In order to retain a competitive edge these must in turn automate and streamline their operations. In the process, overall employment may be cut. New jobs might be created to fill specific manufacturing and service niches, but obviously not necessarily in the same branch and location. The world ICT infrastructure may not be coherent and advanced enough to promote new industries and services as much as it should, but it is more than adequate to handle remote operation within an existing structure (i.e. teleworking), and thus contribute to the re-distribution of employment world-wide. This illustrates the patchy nature of the present global information infrastructure, in the sense it is neither accessible and open to all potential users, nor ready to provide the complete range of services and opportunities inherent in the new technologies.

The social implications and economic consequences that result from the above define a specific cluster of problems that need to be addressed as such.

The new capabilities are supposed essentially to revolve around three central attributes of ICT technologies: speed, flexibility and networking. However:

-- *Speed* of computerised operations, transactions and communications has undeniably been considerably augmented when compared to the traditional practices that were based, a few years ago, on human abilities. However, the gains resulting from new ICT facilities in terms of speed appear more significant at local levels (as defined above) and often seem to decrease with distance, fora number of reasons which are not necessarily only technical ones (for example, established trading relationships play a major role in defining the scope of emerging networks), but which also relate to the complexity of electronic mail systems or the lack of correspondingly advanced communications networks. The extent to which incompatible standards influence these processes is unclear, but there are clearly cases where partial or total incompatibilities generate a host of barriers to information flows.

-- *Flexibility* in design, manufacturing, delivery, etc. also appears to decrease strongly in significance as the distance from central management and production facilities increases, for reasons similar to those mentioned above. The spectacular divergence of the various Manufacturing Automation Protocol/Technical and Office Protocol (MAP/TOP) related standards provides a well-known illustration of this type of development, in stark contrast with the initial hopes raised by the original General Motors initiative. The informal approaches of Internet have proven relatively more successful than more formal parallel efforts in developing effective networks.

-- *Networking* has also been greeted as a source of major change for industry and services world-wide, widely considered to provide the foundations of a global system of information processing, management and transmission. However, before users ensured the spectacular “take-off” of Internet at world scale, most successful networking initiatives were localised. The operation, growth and diversification of such a global network remain hampered by various limitations due to the lack of truly open multimedia standards, lack of “user-friendliness”, heterogeneity of applications, security of information, as well as potential overload. The relatively brief history of Electronic Data Interchange (EDI) already illustrates the potential of the new technologies for generating a number of applications of a given

standard, to the extent that progress towards a more unified system may be hampered by a rapidly growing -- but heterogeneous -- applications base[13].

Even the newest technological advances -- such as digitalisation -- might not suffice to overcome many obstacles: there are serious fears that the very existence of established local systems and practices -- and diverging standards -- may delay, or even prevent, the rapid deployment of the more mature technologies. What would be the costs? This is, of course, an area of considerable debate in view of the lack of comprehensive evidence that would conclusively bring to light the links between ICT diffusion patterns, economic growth and productivity trends. The empirical information that has been gathered on the subject does not lend itself easily to definite conclusions -- the more so in view of the complex interactions at stake that may vary with the different stages of diffusion of new technologies. For example, the relations between levels of accumulation of ICT hardware and software on the one hand, and employment patterns on the other, may well vary significantly over time.

Untapped sources of growth

We do not intend to take sides in this controversy on the employment impact of ICT, but it seems clear to us that different patterns of ICT diffusion will have different effects, and that a more balanced and coherent deployment of the new technological capacities cannot but foster more balanced growth. This consideration seems to us sufficient to justify considering whether special ICT standardisation efforts might be required in order to facilitate and accelerate the deployment of the basic infrastructure that will directly spur the expansion of international markets and of the activities of all firms, large and small, in order to promote global economic growth and employment.

> **We are convinced that there is a wealth of "virtual business" waiting to be born. An expanded global information infrastructure will multiply business opportunities and will provide, for example, the route for greater involvement of small and medium size firms in world trade. Such an infrastructure is one of the pre-requisites for the emergence and diversification of new industrial and service activities, with new capabilities to open the way for innovative activities and structures.**

On the side of ICT users, large trans-national firms can certainly survive and expand with only a small range of world standards, since they create their own -- but perhaps not as quickly as would be the case if an adequate global infrastructure was available. World standards are also crucial for the future growth of smaller units, which otherwise might neither be able to cope with increased competition at home, nor achieve the capability to penetrate foreign markets. In the absence of the more basic standards that are urgently required, the future markets for ICT companies are uncertain, and their growth might not be as pronounced, or as regular, as it could be.

The threat of a multiplication of barriers against a global networking effort may thus be far from theoretical. It is often argued that regionalisation of economic decisions entails the greater risk of fragmentation. The situation in this respect may still be different in the information and in the communications worlds -- with regional actors perhaps often less inclined to contribute to co-ordinated global standards efforts for communication technologies than for information technologies.

In our view, however, regional efforts -- such as the European Union or the North-American Free Trade Association (NAFTA) -- should play a beneficial role in achieving unity of purpose among groups of countries and facilitating the search for genuinely common and equitable solutions at world scale. Fragmentation threatens however, as outlined above, when the search for such solutions is pre-empted by the multiplication of incompatible applications stemming from the broad variety of special interests. When

standardisation efforts are too slow such special interests are most effective in generating their own approaches. And the resulting heterogeneity is difficult to overcome.

The challenge is thus to co-ordinate and overcome, or rather circumnavigate, these difficulties. One promising development has been the growing interest in "anticipatory" standards, which ideally should be developed at the end of an R&D project, before the marketing of the resulting product raises the competitive stakes and thus hampers standardisation efforts. Mobile telephony, with the case of the GSM standard for digital mobile telephony provides an illustration of the type of "anticipatory" strategy that might be deployed. The aim of GSM was to promote a new generation of technology by "leapfrogging" the various analogue standards that were already established. GSM, unfortunately, is not world-wide.

Anticipatory approaches to the formulation of standards will not always be easy. The adaptation of the standardisation process is a major challenge because of the fact that so many conflicting goals are at stake. A number of questions need to be addressed:

-- *With respect to objectives*. How should anticipatory standards be formulated without stifling innovation?

-- *With respect to mechanisms*. How can the process become more rapid while becoming more responsive? How can it hope to achieve greater unity in standards and also become more sensitive to demands from, for example, diverse suppliers, service providers and users?

-- *With respect to costs*. How will migration to new technologies be funded? But how wasteful would technology and innovation policies be, if they proceeded without taking account of the requirements of compatibility?

-- *With respect to users.* Are there stakes for users in general when the products are not yet developed? Can the standardisation process take into account the needs of future users as well as those whose past investments will be affected? To what extent should the positions of the various generations of users (those who might resist change because their current practices may become outdated, or those who will emerge as a result of the contemplated change) be taken into account at the different stages of standardisation?

And, in any case, who will represent users if one is to witness a multiplication of standards that anticipate for the forthcoming technical developments, or are so broad that, by definition, they cannot be related to specific groups of users?[14]

Standards should reflect the major "socio-economic demands" of the time. But how, and who, will define these? Many observers have complained of unchecked developments in the standardisation world, that generate new bureaucratic constraints and costs for suppliers and users which are often said to outrun the benefits[15]. Users' concerns may thus extend beyond the mere formulation of the standards as such, to encompass the costs of their implementation. And yet, with the best will in the world, *inviting* users does not seem to be sufficient over the long term, as the experience of many standardisation bodies has shown.

These preoccupations are major ones when attempting to define what minimum efforts would be required to establish foundations for future networks and lay down the infrastructure of the new global economy. This was a core preoccupation of our group. Although free markets and competition should continue to be the rule in the standardisation world, nothing should prevent the key players from reaching consensus on a framework for co-ordinated standards. This would make possible the more deliberate

priorities and strategies that are required in a few key areas to establish the overall setting -- the basic "technical rules of the game" of the future information infrastructure -- so that future ICT standards blend effectively, and as cheaply as possible.

III. THE PRIORITIES

Free and easy access to markets implies that innovations will take place in a competitive environment and will not necessarily from the outset embody compromises about functions and performance that will ensure easy integration into the overall pattern. Yet it should be clear that the cohesion of this pattern can be endangered by the multiplication of *de facto* standards -- with potentially huge social and economic costs for future adaptation. For this reason, priorities are needed which will be justified in well-defined cases by fundamental technical and economic criteria.

> **As a rule, a proprietary standard which controls a critical interface may be crucial for the future development of the ICT system. The difficulty will be, of course, to achieve a consensus on the appropriate balance between the requirements of an overall framework and those of free competition, and subsequently to implement the resulting policy in an open-market environment.**

One must also take account of the fact that urgent needs will evolve as a result of the complex interplay of various factors: in addition to the challenges and constraints generated by the evolving economic environment, the diffusion of technological advances will be influenced by the "active past", namely the enormous investment in previous generations of ICT. It is no doubt impractical at present to attempt to set up a system that will satisfactorily and comprehensively accomplish the standardisation of future technologies: information technologies have developed so quickly, based on loose collections of conventions, that enormous efforts would first be required to standardise the technological legacy of the recent past with respect to functions as basic as providing shipping documents, porting them between trading partners, etc.

Fortunately, such standardisation efforts are not always necessary or realistic. There are, however, important cases where they should not be spared. As noted above, the example of EDI illustrates both the consequences of the lack of a broad coherence in standardisation efforts, and the difficulty of overcoming existing barriers resulting from the proliferation of specialised proprietary solutions. Establishment of interoperability (communication between computers) may be currently more urgent than portability -- although, of course, users want both! However, it is clear that the two are related and that the practical requirements of interoperability will stimulate demands for improvements in portability. Interoperability covers a number of elements, ranging from emission and reception of data to connectivity with peripheral equipment, and including communicability of results obtained from software applications -- which in turn refers to portability.

This interaction of technological supply, standardisation and the diversification and evolution of demands hold the keys to the reconciliation of the market logic and the standardisation logic. On the one hand, competition is an essential element contributing to technological innovation and progress: any standardisation action that would hinder such progress should not be undertaken. The basic requirements of users must be met in a multi-vendor environment. Standardisation, however, need not be "full function", but is only required with respect to interfaces and basic functions considered mandatory for the users. The supplier should be able to produce freely what he feels are appropriate expanded additional functions -- in the knowledge that the passage of time may well lead this or that element to be eventually regarded as a basic function that will have to observe special standardisation requirements.

This underlines the fact that the required standardisation priorities should not focus on applications, where differentiation is essential. They should aim at defining boundaries and procedures, rather than products. In other words, they should be limited to aspects having a direct impact on all machine/machine and man/machine interfaces such as, for example:

-- operating systems that will affect programming and provide bases for future applications;

-- various conditions foraccess to data, communication and translation, extending beyond the technical level to include vocabulary, names, definitions, classification of data, etc.

One would of course prefer standards to be long-lived, but it must be recognised that their useful life is a direct function of their relevancy in the market place and the extent to which they are adopted, as well as of their ability to adapt to technological evolution. The consequence is that standards will need to be flexible, and designed to evolve without discontinuities, in tune with technology and the emergence of new needs. New approaches are increasingly needed, such as long-lasting “metastandards” that combine the definition of broad but flexible standardisation frameworks and architectures, with the development, when possible and needed, of more circumscribed modules.

The successful establishment of broad standardisation frameworks is highly dependent on their flexibility to cope with rapid technological change. It thus turns out to be very difficult to establish such frameworks in time to have the expected impact. However, we have already noted that a recent hopeful trend has been the emergence of “anticipatory standards” at an early stage of technological development, and when vested commercial interests are not yet entrenched. It may well be that such approaches hold the key to greater success in the formulation of “metastandards” that would, among other benefits, establish a link between advanced technological and market developments to the extent that technological development can be anticipated.

To summarise, standardisation priorities should focus on:

-- hardware/software interfaces rather than products;

-- critical interfaces by means of “formal, open standards” rather than by proprietary specifications;

-- inter-service interfaces;

-- broad standardisation frameworks that anticipate future technological advances and suggest desirable trajectories;

-- small/modular standards for interoperability;

-- inclusion of the necessary international standardised profile(s), conformance statements and test methods/test suites such that interoperability of multivendor products can be assured;

-- standards flexible enough to allow for maximum creativity in evolving technological areas.

IV. THE CURRENT INSTITUTIONAL SCENE

Existing organisations and mechanisms for the negotiation of voluntary consensual standards are currently under a great deal of pressure to redefine their roles. Nowhere is this more true than in the

dynamic, high-technology sectors that comprise the ICT industries. Over the past decade, primarily in response to pressures from industry and governments, accredited standards development organisations (SDO) throughout the developed world have made many organisational and procedural adjustments.

Nevertheless, the basic principles that underlie the process have not changed substantially, even though they too are now being questioned in some quarters. In brief, they are (1) open and broad representation of stakeholders; (2) 'due process' to all participants; (3) provision for public scrutiny and comment; and (4) decision-making by consensus.

There is no compelling reason to believe that these provisions have outlived their usefulness as principles. Indeed, it should rather be questioned under what conditions a potential stakeholder would agree to participate in the negotiation of a formal, open standard in the first place if these basic provisions could not be guaranteed. The propriety of these principles is not really at issue, but rather the particular context in which they are applied, and the degree to which their application might be dependent upon one form of organisation over another.

In the search for efficiency and responsiveness, can the mechanical structure of standards-making be altered while still preserving long-standing provisions to ensure equity in the process? We shall examine this question from two closely related perspectives. The first concerns institutional alignments. The second concerns the relationship between suppliers and users of products and services -- arguably the most basic relationship of relevance to ICT standards.

In spite of the convergence of the computing and communication sectors, each sector continues to operate in a substantially different institutional orbit. Telecommunications networks are still subject to various forms of domestic and international regulation, and public ownership remains a significant factor. The *loci* of international standards activities in the two sectors is likewise different, with telecommunication standards centred in the ITU structure and computing standards centred in ISO/IEC. When the orbits intersect, it is most frequently at the 'service' level. The functional service requirements of domestic and commercial customers are becoming increasingly incompatible with the institutional divides between the computing and communications sectors. This situation is changing (with closer co-operation and common targets in some areas), but will still deserve special attention in view of the fact that the international ICT standardisation system must cope with the rapid technological changes which are characteristic of both areas and which are often inter-related. New approaches are needed to overcome the existing lines of demarcation that generate useless duplication, if not conflicts, between standardisation bodies. The development of consortia and fora involving operators, suppliers, service providers and users may offer some solutions to these difficulties, but not without generating a new series of problems.

The term that most generally describes the overall momentum in network development as we approach the millennium is '*integration*' -- a term that covers three essential dimensions of current developments.

-- the technical advances that have opened the way for the convergence of information and communications technologies, thus creating new synergies and extending the variety of products and of their potential applications.

-- the dynamic pressure of the growing inter-dependence of industry and services world-wide.

-- the rising sophistication and expectations of users, underlining the fact that standards should not be merely driven by technology, but must also take account of the broader economic

implications, as well as of the specific market-oriented needs and strategies of the various actors.

A major challenge for the standardisation system is thus to develop an appropriate response to this integrated information and communication environment currently being described in such terms as the 'electronic marketplace', or the 'information super-highway'.

Integration thus defined brings to light the potential for new supplier/user co-operative arrangements in the production of standards. It also suggests a number of troublesome questions about existing arrangements, from the perspective of users as well as suppliers.

To what extent do industry and government strategies for developing the information and communication environment actually reflect socio-economic needs and wants? If future generations of network-based services are indeed to be market-oriented, ought the user be more actively involved in driving standards, in particular those that are directly related to services? Will users and producers continue to assume the costs of the imperfections of the standardisation system, in terms of excessive delays and lack of compatible solutions as a result of the absence of serious co-ordination between relevant agencies? Will 'user-driven' standards result in new conceptual and organisational frameworks for standards-making?

When going through the severe constraints of the structural adaptations encouraged by new global patterns of competition and trade, many firms have lowered their levels of competence in ICT in general, and more particularly in standards. Outsourcing of a fairly broad range of activities has often been put to good effect without discrimination and may have diminished control by the firms of their more strategic functions in the ICT area -- the more so when so many have not yet become fully aware of the strategic nature of standardisation activities. What new arrangements are required to ensure that these key interests are identified, articulated and taken into account in standardisation? Are new types of mediators actually needed, between the standardisation efforts and the "silent majority" of firms that cannot, or will not, actively participate? Or will the market-place suffice to express choices as translated into purchasing decisions?

All these questions represent direct challenges to the very core of the standards development mechanism and institutions.

The institutional variety

If applied only to the SDOs the term 'institution' is of limited value in assessing the standards environment. To paraphrase Neale, an 'institution' is a locus of human activity with patterns of behaviour established by rules, and precepts to justify and explain these patterns.[16] By this definition, each membership constituency of a standards organisation is also an 'institution', as is every external entity that influences the process in some way.

Furthermore, there are actually three categories of institution that interact in the standardisation process to determine its structure, operational philosophies, and outcomes:

-- *Official institutions* -- These are principally officially recognised standards development organisations, commercial firms and governments, although trade, professional and public service associations can also be included. Most of these institutions have legal and/or constitutional status.

-- *Informal* institutions -- We have already underlined the recent proliferation of private consortia or fora created by suppliers and/or users to explore jointly their standardisation requirements. A similar role might be most effectively played in the future, in our view, by various trade and branch organisations at national and international levels -- provided they develop the technical expertise required for standardisation work.

-- *Meta institutions* -- These are of the order of conceptual systems to which members of various 'formal' institutions display allegiance to greater or lesser degrees. Obvious examples are 'the market', the 'governance system', 'professional competencies', 'technology', 'science' and so forth.

When examining prospects for further evolution in the form and function of the global standardisation system, it is more useful to adopt this expanded conception of institutionalisation. The development of organised standards-making activities during this century, and particularly as they concern the ICT industries, can be analysed in terms of the rise in influence, or change in mode of influence, of an increasing number of institutional entities in both the public and private sectors. In other words, institutional evolution in standards-making should not be equated with, or limited to, the administrative and procedural adjustments as carried out in the SDOs, even though the SDOs may in fact come closest to the ideal process of open and consensual representation.

The interactions of institutions in the standards-making process should be set against the historical perspective that has shaped their development as well as the evolution of supplier/user relationships. It is only after considering this background that we shall discuss, in the next section, the emerging functions and structure of the standardisation system.

Historical evolution of the institutional setting

As an activity carried out in formal institutional structures, standards-making is a relatively recent phenomenon. Its earliest antecedents do not predate the middle of the last century, and the establishment of standards-making institutions dates back only to the early 20th century[17]. Although standards have been applied to technology from ancient times, standards-making as an activity does not merely reflect the requirements of technology as such, but responds to the configurations of commercial, industrial, social and political conditions in which technology is exploited. If these conditions change (as is probably the case to-day), the standardisation system may need to adapt.

The systematic practice of formally negotiating industry-wide voluntary consensus standards in expert committees started to emerge in the 1860s and did not fully assume its present form until after World War II.[18] The activity was begun first in trade and professional associations, and eventually became consolidated in formally constituted national standards organisations.[19] The initial drive to develop public domain standards was linked first to the development of 'professionalism' in the engineering industries, and, later, to the evolution of component-dependent mass-production processes. Many of the instigators were component manufacturers wishing to equalise their market relationships with the firms that purchased their components and assembled them into fully functional products.[20] The formalised standardisation system first emerged in response to the technological, professional, and commercial interests of producers and has continued to be predominantly producer-driven.

By the early 1950s, the international standardisation system, headed by the International Organisation for Standardisation (ISO) and the International Electrotechnical Commission (IEC) had assumed the basic hierarchical administrative and operational 'architecture' that, largely, it retains today. The system was based upon the assumption -- reasonable at the time -- that the vast majority of voluntary

consensus standards would continue to be set in national SDOs, with a comparatively small amount of harmonisation or initiation of standards occurring at the international level. On the telecommunication side, standards activities in the International Telecommunications Union (ITU) had been structured virtually from the beginning so as to fit with its treaty mandate for the general oversight of the global telecommunication and radio communication system. ITU 'Recommendations' were thus the result of agreements among national delegations.

This institutional 'divide' illustrates the importance of taking into account both the 'formal' and 'meta' levels of institutionalisation when examining standards issues. From very early on, ICT standards were caught in the cleft between the ISO/IEC system, an institutional entity primarily oriented towards technology and industry, and the ITU system which was primarily oriented towards an international governance function -- standards being but one aspect of this function.

Beginning in the 1960s, rapid technical and economic developments in ICT began to modify the founding principles of both the ISO/IEC and ITU standardisation systems.

-- ICT was a high-profile embodiment of the general phenomenon of rapidly increasing technical change. ICT standardisation requirements challenged the traditionally reactive mode of standards-making in the SDOs. Issues of speed and efficiency became highlighted, and the SDOs were forced into a re-examination of their working practices.

-- ICT highlighted the 'network effects' and 'complementarity effects' of technical systems, thus offering a challenge to the existing practice whereby the computer and telecommunication industries set technical standards in separate institutional orbits. ICT standards initiatives also raised the general profile of international standards, leading to questions about the relationship between national, regional and international levels of standardisation.

-- ICT carried with it an especially visible and complex public sector agenda. In addition to public procurement requirements (the public sector is the single largest ICT user constituency), governments and intergovernmental bodies pressed technical standards into service in support of R&D and trade objectives. Links between voluntary standards, 'regulation' and other publicly available specifications became more visible in much government policy, and voluntary standards were sometimes used as quasi-regulatory instruments. Particularly in the telecommunication field, there was a much increased emphasis on 'regional' standards structures which challenged established relationships between the national and international SDOs.

-- ICT was a prime factor in increasing the general awareness of standardisation as an economic and political issue. This resulted in a raised public profile for the SDO system in 'high-technology' areas, and, correspondingly, increases in the levels of resources forthcoming for ICT standards projects. On the other hand, this high profile also led to probing questions by industry and government about what exactly the benefits of standards were, and about the efficacy of the standardisation system.

Evolution of supplier/user relationships

'Suppliers' and 'users' are both institutional entities that exist at 'formal' and 'meta' levels. Consequently, there are many arguments about what the characteristics of each group are, and what their

respective roles in standards-making should be. The basic distinction proposed here is the simplest one possible -- that between the production and use of ICT goods and services as primary activities.

Over time, a certain general shift in momentum is discernible in the supplier/user relationship with respect to standards and standards-making. Basically, there has been a progression from a kind of *unilateral* approach to standards, in which the primary focus was upon the technical and commercial requirements of specific supplier communities, to a kind of *multilateralism* involving ever more sophisticated forms of brokerage among the interests of suppliers, users, and the public sector.

In the ICT sector, this shift has been due to some extent to increased sophistication and technical expertise in the user community, but it has also been the result of regulatory pressures and restructured commercial relationships within the supply industries themselves. It may be premature to predict how this momentum will express itself in institutional terms. However, there are two clear frameworks within which the options can be evaluated.

-- *The* '*symbiotic*' *framework* -- Most of the debates on user involvement in standards-making are undertaken from the perspective of the SDOs. The 'user problem' is typically framed in terms of how to get the user involved in developing standards *alongside* the supplier, as if the two sets of institutional interests were basically congruent. From this perspective, standards are regarded primarily as tools for the supplier to employ in order to increase his market-share through gains in production and distribution efficiencies. This overlooks, to a large extent, the market-oriented logic that will initially tie a supplier's interest to the ownership of proprietary systems rather than to standards. More standards-oriented approaches and the shift of the supplier-client relationships in favour of portability and interoperability result from a re-assessment of market opportunities resulting from the demands of users and of other actors such as software producers or service suppliers

The traditional assumption is that the user will thus eventually stand to obtain benefits in the form of lower cost, higher quality, and interoperable and interchangeable products that will provide insurance against, for example, the disappearance of a supplier or lock-in to a single or limited set of suppliers due to product incompatibilities. The rationale for user involvement in the standardisation process is that these perceived benefits could be delivered more efficiently and more quickly, and possibly be even increased, if an effective user dialogue could be introduced at the standards development stage.

Additional requirements have emerged in recent years, so that the business community increasingly expects the standardisation process also to open the way for new opportunities for co-operation with contractors and suppliers (in particular with or between smaller firms) and to provide remote added value service opportunities, especially relating to closer customer relations.

-- *The* '*reflexive*' *framework* - Several observers have shown that the perspectives of the user and the supplier are quite different. The supplier perspective is primarily one of design, fabrication, and marketing, whereas the user perspective is primarily one of functionality, application and business opportunity. This leads to two fundamentally different perspectives on standards. The supplier sees standards in terms of providing a wide scope of functionalities to a universe of users. In contrast, and although broader concerns and higher expectations have emerged among some sophisticated users, many still view standards merely in terms of

selecting from a universe of potential offerings in order to facilitate an often very limited set of specific functionalities.[21]

Once this observation is taken as a starting point, the relationship between suppliers and users is cast more in terms of a '*reflexive*' *tension* than of a symbiosis. It is clear that the producer interest in standards is not simply 'efficiency' but also 'advantage'. Where there are competitors in a market, a producer firm must be convinced either that the presence of a standard will not bias the market unfavourably against its product, or, perhaps more importantly, that the product concerned *will not achieve its market potential without some level of standardisation*.

Seen from this perspective, the user assumes a potentially more commanding position if the institutional orbits of 'supplier' and 'user' maintain a respectful distance. Conceivably, groups of users could drive the process by coming first to an 'institutional' consensus that a selected product must conform to certain specifications *as a condition of purchase*. Perhaps the ubiquitous 'user problem' with respect to ICT standards is not one of integration into the SDO structure at all, but of users learning to focus their institutional power on ICT standards issues. If so, this could entail developing a user consensus independently of the standardisation process in the supplier sectors.

This reflexive framework probably comes closer to describing the actual nature of the relationship between users and standards. However, its actualisation in operational terms would also create serious problems for the standardisation structure as it currently stands, not least with the financial aspects of standards-making.

The direct costs of standards development have always been structured so as to be absorbed directly by producers to be subsequently indirectly charged to users. The assumption in many cases was that the benefits of standardisation to the producer would be such that the costs would be transitory, and that there would be minimal if any need to pass these costs on to users. The difficulties with this arrangement are (1) that it is a non-trivial problem for producers to determine what standards activities actually cost in real terms; (2) that there are as yet no commonly agreed objective measures to determine the actual financial gains to producers from standardising, or, the actual costs to producers of failing to standardise; and (3) that the increasing involvement of users in standards-making will generate new direct costs for all participants[22] .

It is not surprising that standards resulting from such mechanisms are often felt to be biased to satisfy suppliers' rather than users' requirements. Current indications are that users are therefore not inclined to take on strong responsibilities for standardisation in structures -- like SDOs -- which appear to them to be monolithic and supplier oriented. It would appear more likely that they will direct their resources at *ad hoc* user interest groups and consortia centred around specific problems and aimed at specific products and services. Furthermore, ICT users typically do not want to concern themselves with technical details, preferring to outline the general functionalities and service characteristics for which standards are required: they will be essentially concerned with *what* "it" does, rather than *why* or *how*.

As noted above (and although they are by no means a recent phenomenon, as witnessed by the bar-code developed in the 1960s at the initiative of a group of large groceries), such consortia and fora have multiplied in recent years, often in the wake of the "open systems" movement, typically for the sole purpose of establishing and promoting a set of specifications in a particular technical area. Individual ICT companies and agencies (equipment suppliers as well as service providers and users) subscribe to participate in their activities that often focus on specific issues to be clarified more rapidly than the formal

standardisation procedures would allow. Membership is sometimes restricted, geographically, or in terms of specific areas of concern. Each consortium may or may not make its specifications publicly available. Whether these specifications can be termed 'standards" depends on the degree of openness of the membership and of the consensus process, and on the degree of public availability of the specifications.

Noteworthy developments resulting from such new types of activities have taken place in areas as diverse -- and as essential -- as UNIX operating systems, ATM, EDI and aspects of Wireless technology. The result of these activities then proceeds through the formal standardisation channels, but are often implemented on a consensual basis even before the official procedure is completed. The very high value of such fora is due to the fact that they provide producers and users with opportunities to reach agreement on how a technology can be applied, which of the various options within it should be selected and how the resulting system should be configured. Without open standards fora for the exchange of ideas and crystallising of market requirements, producers would be less willing and more cautious about incurring the huge R&D investments required to develop new products, and users would be less willing to procure products which might be single source and not interoperable.

Informal fora can provide new and often effective ways of dealing with urgent requirements. However, reliance on these fora can encourage piecemeal approaches to broader issues that may hamper the subsequent implementation of more comprehensive standards. Furthermore, the coexistence of formal and informal standardisation circuits also generates duplication of efforts for lack of effective co-ordination. There is already some evidence of growing co-operation between SDOs and informal bodies, but additional efforts are needed, as already indicated above, to generalise more constructive approaches in this respect on the part of SDOs. We shall recommend below the development of structures and mechanisms at global level to facilitate these improvements.

This would be all the more useful when acknowledging that suppliers, particularly in selected service-oriented areas, have also shown an inclination either to pursue standards initiatives outside of the SDO structure altogether, or, to supplement their standards-making activities in SDOs with participation in informal standards consortia or fora. In some cases -- Integrated Services Digital Network (ISDN), EDI user groups, Network Management Forum and ATM are prominent examples -- the independent consortia are a mixture of supplier and user interests.

V. THE REDISTRIBUTION OF ROLES

In spite of the explosive proliferation of international standardisation bodies in ICT, and while industries are themselves more and more structured internationally, the standardisation process as such remains in principle under national management. Furthermore, ISO remains constitutionally under the control of its national member bodies. This "national approach" has traditionally been even stronger in telecommunications, in spite of recent increases in participation by new private sector entrants in the telecommunications market place, most of which operate on a multinational basis. As a result, many industrial leaders with global horizons resent what they experience as a needlessly costly[23], short-sighted and irrelevant management style. Despite these problems and the feeling that many obstacles prevent effective and efficient contributions to the international standardisation scene, the participation of multinational firms has been increasing, and this has helped to add focus and responsiveness to global standardisation priorities, offsetting some of the more national and bureaucratic interests. However, the participation of multinationals has also become more diversified as many of them are desperately seeking greater speed in producing needed specifications, and now elect to re-direct some of the resources they allocate to standards away from official standards bodies and towards consortia.

Beyond this first circle of participants, other large players, and in particular firms that have, or aspire to have, international scope, may need to be convinced that taking a more active role will bring them short-term benefits. The problem for users is that they are a heterogeneous group confronted by an opaque and heterogeneous system. As we have seen, there is no ready-made answer to decide where, how and when, they could get involved. But the radical critique of the standardisation process is not confined to users. In recent years, an increasing number of computer companies have reduced their participation in, or even altogether pulled out of, the formal ICT standardisation process to work informally and produce specifications quicker.

The recent economic recession has reinforced this trend. The more so in view of the lay-offs in industry and services that have depleted the ranks of experienced engineers with long-standing experience of industrial standardisation questions: the voluntary work of many standardisation bodies has thus been jeopardised by reductions in funding and personnel on the part of corporate participants.

Standards have always functioned with reference to (1) technology development, and (2) technology application. Changes in supplier/user relationships result in ebbs and flows of emphasis between these two 'poles', although the historical momentum in standardisation has been in the direction of a steadily increased accommodation for the circumstances in which technology will be applied. A number of currently observable factors have implications for the new structures required of the standardisation system:

-- the development of 'fundamental standards' -- basic references, procedures, principles and frameworks upon which ICT technology is based -- still tends to favour centralised organisational structures ;

-- the development of 'application standards' -- pertaining to the specific services that technologies deliver -- tends increasingly to favour decentralised organisational structures, in particular to cope with the short delays required to satisfy the special needs of quickly developing (even experimental) technologies ;

-- suppliers and users hold stakes in the development of both 'fundamental' and 'application' standards.

Most of the different types of structures that could be envisaged in future are already represented within the existing, increasingly diversified, ICT standardisation system. Ranging from the most centralised to the most decentralised, these are for example:

-- Established national, regional and international SDOs, and, in some cases, their supporting bodies (EWOS, for example), plus the ITU standardisation sector.

-- Established non-SDO agencies involved in setting ICT standards. A prominent current example is the United Nations Economic Commission for Europe (UN/ECE) and its EDIFACT initiative.

-- SDO collaborations with each other and with outside bodies. ISO and IEC collaborated formally to form the Joint Technical Committee (ISO/IEC/JTC1), which in turn has established collaboration with the ITU standardisation section, ITU-T. ITU, ISO, IEC and the UN/ECE collaborate specifically on EDI through an 'Inter Agency edi Group' (IAeG). At national level, an example of such an arrangement is provided by the computer standards department of the Institute of Electrical and Electronics Engineers (IEEE) in the USA.

-- Independent ICT standards organisations, such as the European Computer Manufacturing Association -- ECMA that are perceived to operate independently of SDO control over the subjects they elect to pursue even when they have established some kind of formal affiliation with an SDO structure.

-- Industry, user, and professional consortia and interest groups concerned with the development and/or application of standards. OSITOP, the Corporation for Open Systems (COS), the ATM Forum, the Frame Relay Forum, and the Internet Society are but a few examples of the diversity of these groups, in terms of geographical and technological coverage, as well as in the degree of independence from suppliers.

-- Ephemeral groupings. Informally constituted ad hoc and often temporary bodies based around selected technological and/or commercial and regulatory issues.

As we approach the decentralised end of the scale, the range of subject areas becomes more curtailed and the characteristics of the institutional actors becomes more focused. In some cases, there are also efficiency gains as we move to the decentralised end of the scale -- at least as measured in time consumed and success in deployment of the standards. The Internet Society, for example, has an enviable record for *de facto* standards production and application under quite informal conditions.

Relationships between the Public and Private Sectors

Although most national SDOs have some kind of formal association with government, the SDO system world-wide has developed no consistent pattern of relationships between the public and private sectors. Relationships between ISO member bodies and their respective governments range from no official association (as with ANSI in the US) to the status of official by recognised and supported organs of government (as with JISC in Japan). The average amount of direct government support for the activities of the national accrediting authorities in OECD countries is about 30 per cent.[24]

Perhaps the largest single challenge to established public/private sector relationships in standardisation has come from the 'single European market' initiative of the European Communities. Through the across-the-board interpolation of a regional level of standardisation, established relationships between national SDOs and their members, and between national and international standards organisations have been modified. Moreover, the regionalisation of standards has involved increased amounts of direct public sector involvement through specific standards policies and the establishment of specific linkages between standardisation and general economic and industrial policies. It has also involved public sector 'encouragement' of selected standardisation initiatives through the provision of public funds.

The European 'experiment' has increased the profile of standards internationally, and placed national governments and intergovernmental agencies in the position of having to react. In some cases, this has resulted in parallel regional initiatives and perhaps an excessive proliferation of competing standardisation bodies.

The evolution of the public sector role in standardisation can also be viewed in terms of the four principle factors of the 'continuum' as presented above. Generally speaking, and irrespective of the nature of the particular relationships between governments and national SDOs, public sector priorities for standardisation during the roughly 150 years of what could be called the 'modern industrial age' fall into three somewhat overlapping historical eras.

The *first era* (from ca 1860 to ca 1960) was characterised by three main concerns:

-- efficiency in public procurement;

-- protection of the public interest, mainly in the areas of health and safety;

-- international trade -- but leaning toward 'protectionism'.

During the *second era* (from ca 1960 to ca 1990) all of the above concerns remained to some degree, but were expanded and modified:

-- Voluntary standards became increasingly incorporated into the industrial policy and regulatory structures.

-- The public sector profile in the voluntary standards-making system was raised. Governments gave material and 'moral' support for leading international initiatives -- OSI, ISDN etc.

-- 'Official' positions on standards and international trade began to lean towards 'liberalisation'.

-- The concept of 'regional' standards systems gained in currency, particularly in the telecommunication sector.

The *present era* (from ca 1990 onwards) is witnessing an increased concentration on pragmatic objectives:

-- The concentration of both the private and public sectors is moving away from specific sectorial standardisation concerns and towards infrastructural concepts like electronic 'markets' and 'highways'.

-- Governments are re-examining the 'faith' that was placed in standards as agents of technical, industrial and trade development during the 'second era'. After two decades of supporting OSI, for example, the US and the UK public procurement regimes now seem to favour the adoption of 'hybrid' computer networking solutions that incorporate both publicly available specifications and proprietary standards.

-- Both the public and private sectors are searching for new frameworks for the assessment of standardisation as an economic factor -- for practical indicators of standards performance and effects.

The danger inherent in such approaches is that they may favour the selection of solutions based on purely national -- if not intra-agency -- considerations. Thus the government sectors of individual Member-countries might be tempted to seek alternatives to international OSI standards and to elevate such sets of specifications to a status equivalent to agreed international standards, so as not to consider them "proprietary". Such action at national level has serious implications for the development of ICT infrastructures world-wide and the likely prospect of achieving truly interoperable and seamless global networking capability.

While the development of standards should be both led and implemented by industry, governments still have an important role -- or important roles -- to play.

Governments of course cannot ignore their special responsibilities with respect to the ICT standardisation process, because of its economic implications and of the fact that public authorities can mobilise resources for long-term goals to serve the public good. Governments may be called to play a

catalytic role in some areas, for example to give impetus to priority-setting efforts to be pursued by all economic players, or to promote the steps required to safeguard the fairness of standardisation processes. They will also be expected to continue to play a key role in representing national interests in standards-related international discussions.

Problems arise when governments view standardisation as part of industrial or other policies and therefore as a technical infrastructure to be "set right" without regard for its specific constraints, logic and requirements. The participation of governments should thus not imply that they have a predominant position in these areas, or at least that their legitimate role extends to standards development and the adoption of standards. Such public policies could lead, and have already led in many cases, to the adoption of ineffective, inadequate or inappropriate standards that can delay developments and applications in new technologies.

Governments can, however, participate today as major users of ICT products and services, and should support the various stages of standardisation. In particular, public agencies should be expected to contribute their fair share of the costs of standards development, and to support it by selecting products and services based on existing standards, in particular on available international standards, in order to avoid the multiplication of incompatible national applications.

A great deal of responsibility falls upon public agencies in this respect, since governments assume regulatory functions with respect to security, connectivity, etc. that will often refer to accepted standards. Government bodies often need to take an active role in the diffusion of these standards: there are public needs and specifications to be defined for the procurement process, demonstrations to be made by public users, consultations with the private sector, etc., as well as work needed to articulate standardisation developments and the legal frameworks at national and international levels.

When major technological investments are envisaged (as is currently the case with respect to information infrastructures at national and global levels), governments should be especially active in encouraging the relevant private actors to participate in international discussions to determine standardisation requirements. A key dimension in this respect is due to the fact that governments have the ultimate responsibility for ensuring that standardisation, at national and international levels, remains as transparent and challengeable as possible. As in all decision-making processes, there should be minimum safeguards to ensure that the process is fair and well understood by all concerned.

A crucial aspect will be therefore to foster (in particular through education programmes) better public understanding of the implications of standardisation.

The future

The ICT standardisation environment of the future appears certain to incorporate a *spectrum* of organisations and administrative paradigms. The basic problem will change from one of how to ensure equitable participation of a cross-section of interests, to how to co-ordinate the spectrum of initiatives and venues through which suppliers, users and governments alike might become involved in various aspects of standardisation at various times in the standard's life cycle.

To address the standards needs of initiatives like the 'electronic marketplace' or the 'information super-highway', the standardisation process will presumably need to become even more responsive to market demands that cannot be readily anticipated. For this reason in particular, SDOs will have to let the characteristics of the service environment, rather than the particular technologies or individual sectors, lead the process. For the confidence of all institutional constituencies to be obtained and maintained,

identification of the requirements for standards would have to encompass some mechanism for also evaluating the extent to which a proposed new service environment is demand or supply driven.

Such gains in effectiveness would require that many of the artificially maintained distinctions between technical and political agenda in standards development would have to be reformulated. Consultation with governments and co-ordination with intergovernmental initiatives would become a virtual necessity at some point in the standards development cycle.

If a sense of 'system' is to be maintained at all, however, four centralised functions must be preserved and expanded.

(i) Direction-setting

It is not always obvious that a mechanism can be put in place and continuously reviewed to articulate the extremities of the standardisation environment -- 'fundamental' standards on the one hand, and 'application' standards on the other -- to broad conceptual frameworks for network technology and service development. Such a mechanism should also be expected to help align the economic and social interests of businesses, administrations and the general public. In the context of increasingly multilateral institutional relationships, a significant part of 'direction-setting' in future will thus involve bringing together an expanding range of players to plan, mediate and arbitrate with respect to diverse and perhaps divergent objectives

(ii) Project linkage

If, as seems likely, the standardisation system assumes a very diversified and 'fluid' state in at least the short to medium term, some form of centralised information exchange will be useful, as will some mechanism to exchange information on projects and eliminate needless duplication of work.

(iii) Compliance

The problem of certifying compliance to standards is moving out of the national arena and into the international one. Although the trade implications of standardisation are more often presented from the perspective of international standards development and/or harmonisation, the practical issues, including the real costs in many cases, concern conformance testing, certification, and multilateral recognition of compliance. It is critical that the SDOs undertake to complete in a timely fashion all aspects of standardisation necessary to assure interoperability; that is, base standards, international standardised profile(s), conformance statements and test methods.

(iv) General governance

For industry (suppliers and users), government, and the general public alike, there is a continuing need to assure openness and equity in the standardisation process, and to exercise quality control over the standards produced. Moreover, there is now a particular need for the standards community to establish a more formal and direct interface with the international trade structures that are now emerging at global levels, and at regional levels under such initiatives as the European 'single market', and NAFTA.

In a rapidly diversifying standards environment, there might be a danger that the existing SDO structure fails to respond with measures that would ensure the preservation of an appropriate level of centralised oversight over the process as a whole. Thus, for the existing SDO structure, there are three

main relationships to re-evaluate: (1) between national, regional and international levels of standardisation; (2) between suppliers, users, and government; and (3) between the established SDOs and the diversifying milieu of industrial consortia.

National and international SDOs may in future be faced with developing product lines that are not "standards" as such. A decreased or less universal profile of "in-house" standards development, and an increased information, co-ordination and dissemination profile may mean that the future growth area for national and international SDOs is in the production and sale of expository and promotional materials rather than standards *per se*. The future will almost certainly involve the development and application of objective measures for assessing standardisation initiatives in order to provide expert guidance to all of the institutions with a stake in standards where responses to new service environments must be planned.

New structural requirements

In order to meet these needs the standardisation structure should reflect recognition of seven basic factors:

-- *Responsiveness* and capacity to anticipate market requirements of all kinds become essential features for the standardisation process at a time of rapid technological change. On occasion, the standardisation system has been known to act somewhat autonomously and produce more standards or different standards than the market requires. Emerging demands and needs require a much more definite focus in the SDOs.

-- *New relationships* will gradually need to be established between users and suppliers in the ICT sector, in areas and to an extent that is not yet fully clear. There is already evidence of a general increase of ICT expertise among some types of users and a corresponding increased "in-house" ability to identify and specify ICT requirements. In future, the advantage of the producer (a term used here to cover a large variety of actors ranging from ICT manufacturers to service suppliers, and including telecommunications operators as well as network services) is likely to be centred upon the capability to design and produce components and whole systems as well as engineering individual customer ICT solutions. Given the increasing awareness of the economic stakes of ICT investments, initiatives by users to effectively organise themselves institutionally (for example through trade associations and groupings, or under the aegis of ad hoc informal fora) in order to gain more direct influence on the production and commercial practices of supplier firms, including the standardisation process, are bound to increase. This will significantly complement the influence they already exercise as customers who select the products they prefer.

-- *Technological* "*convergence*" has implications that extend beyond crossovers in technical acumen to challenge business philosophies and institutional lines of demarcation between the computing and telecommunication sectors.

-- *Standardisation has become a critical condition* for the maturing of new technologies and their application. The standardisation process facilitates industry convergence and, in effect, "de-risks" the significant R&D investment required by producers to deploy competitive, cost-effective products. It provides users with the knowledge that their investments will not be dead-end or result in lock-in to a single producer. Standardisation of existing technology and designs which was prevalent in the past is a rapidly declining portion of the total information

technology and telecommunications standards activity, and is also of lesser importance than the initiatives addressing new technologies and the related applications.

-- *The role of governments* in the development of voluntary standards is basically problematical. On the one hand, governments are large and often expert users of ICT. They may seek to influence the standardisation process for political reasons. There is also, in many countries, a tendency to seek rapid immediate solutions based on national standards, rather than seeking to establish the basis of the future international information infrastructures.

   The role of governments in standardatory is so complex that government action should always be undertaken with maximum transparency. Public procurement procedures should, for example, clearly spell out standardisation requirements developed coherently at an inter-departmental level. Most importantly, and even when they support certain voluntary standards in response to more general economic and industrial policy goals, governments should not try to force adoption of certain standards single-handedly, but seek a broad consensus of government, producers and users. Finally, special arrangements must be made at international level to overcome the threat of diverging national standards.

-- *Reaping the full economic benefits* of emerging multimedia technologies requires the deployment of new information infrastructures at a global scale, based on fully interoperable systems. The implementation of local solutions which ignore these requirements, at national and regional levels, will be counter-productive for the industries and services concerned. However, the development of universal solutions that will be politically and economically acceptable by all concerned will require detailed preparation and consensus-building efforts jointly conducted by government and industry.

   These efforts, however, need to be deployed urgently. In the absence of overall standardisation concepts, users will adjust and develop solutions according to their immediate practical needs, thus running the risk of creating unnecessary technical barriers to the smooth flow of multimedia communication between nations, sectors, organisations and firms.

-- *Official and informal standardisation bodies* have emerged or have adapted over the last decade to attempt to meet the challenge of extremely rapid technological advances in ICT. As a result, the traditionally slow mechanics of standardisation have been accelerated somewhat in most SDOs. This may not be sufficient, however, to meet the needs of the global information infrastructure where open and universal standards solutions should be developed in anticipation, rather than as a result of the deployment of the new global systems. The magnitude, the stakes and the urgency of the current challenges to ICT standardisation are without precedent**.**

Any proposed changes in the standardisation machinery must take account of these factors at each of the eight basic phases in the standardisation process:

identification of standards requirements;

allocation of work and resources to appropriate committees;

development of technical specifications and the associated profile(s), conformance statements and test methods/test suites;

enquiry into the acceptability of draft specifications;

promulgation of completed and approved standards;

promotion and application of approved standards;

testing for conformance and compliance;

feedback of standards performance and revision requirements.

These phases are not necessarily consecutive. The "feedback" function should occur at all times. Likewise, the "enquiry" phase may occur at anytime during the process. And, once again, these various steps of standardisation need to be well-articulated in line with market demands and developments.

When the relative degrees of administrative control, committee participation, and decision-making power of the four main institutional communities -- producers, users, governments and SDOs -- are compared over time, some significant shifts in the degree and quality of these influences may be observed[25].

The traditional pattern -- roughly prior to 1980 -- was for the process to be led primarily by producers and SDOs. There were, of course, notable exceptions involving significant government initiatives (such as the development of ASCII under the leadership of the US Department of Defence). Since 1980, however, considerably more effort was made to incorporate a broader range of participants -- primarily users. The distribution of roles has changed with the emergence and increasing variety of independent industry consortia which have gained influence in determining where the work will be done and under what terms. At the same time, there has been increasing government pressures to standardise in particular areas and governments have allocated administrative, technical and even financial support to the direct priming of the standards process. The SDOs have thus lost some of their influence, although they still play a key role in promulgation and promotion activities.

Users have been expected to take a prominent role at the identification and promotion phases. On the other hand, and because they will always be closest to the technology and the standardisation machinery, suppliers will probably continue to be in the best position to lead the allocation and development phases. In addition, the increasing importance of services in world trade, as a result of the new information infrastructures, will compel service providers to become more active in order to achieve recognition of their own ICT standardisation needs, and to ensure appropriate development of the corresponding applications. However, depending on the subject under consideration, service provider input could be aligned on some occasions with manufacturer interests, and on other occasions with user interests.

Government areas of involvement also tend to become more specific, with concentration (in decreasing order) at the feedback, identification, enquiry and allocation levels. These developments imply more straightforward mechanisms for government intervention -- promotion of "public good" concerns, ensuring equity of representation, addressing market failure situations, and the like. Governments thus should be expected to exert influence in the public interest while not becoming bogged down in the minutiae of standards-making or complicating unnecessarily the relationships between suppliers and users.

These trends imply that, in order to encourage rationality and transparency, promulgation should be left entirely in the hands of SDOs. These institutions would then enhance their roles in managing and strengthening the "marketing" of standards, feedback and enquiry processes. They would also adjust to the

need to serve producers and users equally and therefore may need to concentrate more on the organisational and promotional sides of standardisation as industrial projects rather than upon the development and execution of specific projects within specific organisational boundaries.

CONCLUSION AND RECOMMENDATIONS

The standardisation system has evolved to respond to a set of specific requirements. In the past, the slower pace of technical change and the more circumscribed patterns of trade gave birth to a system where truly world-wide standards needs were limited, where a few key actors could slowly confront their views until the time was ripe for consensus, and where national or regional efforts could proceed independently with little interaction: the nuisance value of the international variety of electrical plugs, for example, was of very limited concern.

This is the inheritance: a system that answered admirably the needs of the past, but which now must adapt to unprecedented challenges resulting from the tremendous acceleration of technological advances or with the new requirements of international economic inter-dependence.

The standardisation system, as it now operates, is thus not yet fully adequate to cope with the enormous needs generated by ICT developments, and still less well prepared to confront the enormous challenges that will result from the deployment of new global information infrastructures. Continued operation of the standardisation process in the current mode *may* undercut the returns to be gathered from the enormous investments that will be required in this area. The lack of a minimum set of interface standards from the start *is likely to* fashion what should be the future planetary backbone of business and trade, into an ineffective patchwork based on the proliferation of differing standardisation solutions, that will not make it possible to take full advantage of the opportunities offered by the new technologies.

These missed opportunities would represent fewer jobs, lower levels of growth, and probably added international frictions as a result of uneven distribution of competitive advantages. However, we are confident that these threats can and will be overcome. We observe that many voices (such as those of the authors of the Bangemann Report[26]) are being heard in national and international fora to recommend that governments and other actors take decisive steps towards the goal of deploying a seamless and effective global information infrastructure.

The following recommendations are presented in this spirit and as a result of these considerations:

New mechanisms at global level

(1) Global co-ordination

In view of the overall analysis presented above, there are important aspects of standards development that should be carefully evaluated and acted upon, but the central tasks in this respect should be generated and allocated from within the voluntary process. Although governments do have an appropriate role, as we shall discuss below, we are convinced that they should not attempt to override the voluntary process based on balanced participation of all private and public actors: this process has demonstrated again and again over time that it is best geared to provide market-oriented solutions.

The standardisation community should therefore itself generate the innovative mechanisms required to further refine and implement our recommendations. We have noted with interest that such efforts have already been undertaken in some Member countries. One example among others already

established or being developed is the Information Infrastructure Standards Panel (IISP) recently created under the aegis of ANSI in the United States.

The functions of these bodies typically range from the identification of requirements to the harmonisation of efforts, and include various tasks such as monitoring, assignment of tasks, co-ordination, funding, etc.

We welcome such initiatives that should blend into internationally concerted efforts rather than be limited to a multiplication of national initiatives.

We suggest that such a co-ordinating structure should be created at world-wide level.

The solutions retained should in particular provide for adequate resources to undertake the tasks required, which are outlined below.

Although the primary tasks of such bodies in present circumstances will be to deal with requirements related to the deployment of regional and global information infrastructures, we believe that -- if they demonstrate their value -- they can address other important standardisation issues that will emerge.

Co-ordination of standardisation initiatives at an international level is only one aspect of the continuous effort of structural adaptation required from the standardisation actors.

Initiating structural reforms

(2) The question of "project-management"

Given the close interrelatedness of ICT developments, there may be a need in some cases for rapid migration from the current committee management approach in individual standardisation bodies and related organisations, to a project management approach oriented toward broad final objectives.

We are fully aware of the fact that the record of recent efforts leading to the introduction of "project management" methods in standardisation is not unanimously assessed in a positive light, although it is being advocated by many standardisation actors as a decisive step in improving the process. These new methods should therefore be applied with caution and it is especially important to maintain the appropriate balance between the effectiveness of administrative needs and the voluntary nature of the standardisation process.

We suggest that the record of "project management" in standardisation would need to be assessed by a neutral source as objectively as possible. The introduction of project management in new organisations and areas would need to be treated as experimental, and thus subject to continuing monitoring and assessment.

Project management implies that responsibility for each project should be clearly allocated to a lead organisation assisted by a project committee representing all participants; should be based on a clear distribution of tasks between the various bodies involved; and should be able to involve, when needed, full-time research staff. These decisions need to be made on a consensual basis.

A clear definition of the scope and objectives, including time scales, deliverables and resource requirements will be necessary. Time scales would need to be defined to meet market needs, as already noted above.

The active use of electronic communications should be considered to reduce travel costs and proliferation of meetings. Such on-line possibilities have already been developed, and are offered by various organisations.

Project management could be centred at various levels -- global, regional or national -- as appropriate and depending upon where the expertise and interest are the greatest. For all future initiatives, joint technical committees, directed at specific practical objectives, should become the rule rather than the exception.

Special arrangements should also be made by SDOs to assign responsibility for the formal validation of ICT standards before their publication, in order to reduce the risk of diffusion of defective reports and the subsequent avalanche of technical corrigenda that need to be publicised and disseminated.

(3) Monitoring the standardisation process

A formal registration procedure is proposed through which standards projects can be tracked as they proceed from relatively informal settings to more formal ones -- i.e. from ad hoc initiatives in an ephemeral grouping to project status in an international SDO.

Elevation to the status of national, regional or international standards could continue to be by votes of SDO memberships as at present.

Adequate monitoring, however, would need to account for various levels of standardisation, such as:

-- the levels at which a standard is initiated and developed -- national, regional, and international;

-- the forum or fora in which it is being negotiated;

-- the migration of initiatives between fora and levels;

-- the implementation, revision and replacement of individual standards.

We acknowledge the fact that many standardisation bodies -- in particular consortia and fora with commercial interests -- are very often reluctant to take any step that would lead to premature publication of their work. There will in any case occur many instances where the initiators of standardisation projects will consider that their efforts are not yet ripe enough to justify reporting. Still, the principle should be that information flows be initiated at the earliest possible stage.

Every effort should be made to encourage consortia/fora to make their specifications publicly available at an early stage.

(4) Implementing a more effective distribution of tasks

Standards projects might be individualised in such a way that they can be pursued on the basis of agreements involving, as appropriate, producers as well as users and organisations, to co-ordinate their

mutual objectives related to ICT standards production and application. This might be in particular the key contribution of the new Information Infrastructure Panel we have recommended above.

The allocation of tasks might be designed so that individual SDOs establish a planning and prioritisation function involving all affected market forces, and assign standardisation projects to the organisation deemed most suitable in each particular case. This may be an SDO, a consortium or forum, a commercial laboratory, etc.

All organisations involved in undertaking such standardisation projects should be encouraged to establish more explicit time frames for their proposed work. This would maintain a market-oriented pace without sacrificing due process.

(5) Defining the tasks of committees

Once a standard has been developed, there is often the desire or necessity to maintain a committee so that there will be a collective focus for monitoring future developments to adjust the standard accordingly. Other committees are often created to engage in "discovery" activities related to new (but not necessarily unrelated) areas of standardisation. The multi-functional nature of standards committees can lead to confusion as to the active or passive status of their standards projects.

SDOs should categorise committee activities publicly so that distinctions are drawn between "active development" projects and those which have primarily a "discovery" or "maintenance and monitoring" function. The explication of these distinctions will assist different institutional groupings to identify better the kinds of activities in which they choose to become involved. The role assigned to each committee should be clearly spelled out from the start, and sunset clauses included to ensure that the relevance of the committee's mandate will be re-assessed at later stages.

Categorisation could also help encourage efficiency in the committee process by concentrating often quite legitimate *negative* participatory rationales (i.e. those directed at preventing or controlling the pace of standardisation) and investigative rationales (i.e. utilising the standards process collectively to monitor aspects of technological development) in committees specifically formed to accommodate these rationales. Categorisation could also be helpful in determining the most appropriate circumstances, and in selecting the proper channels, for the application of electronic communication media to standards-making.

Finally, categorisation should also be viewed as an important step towards the implementation of ongoing monitoring, audit and evaluation of the standardisation work of each organisation, based on sound methodological approaches and assigned to independent teams. Such evaluations would serve, in particular, to terminate, create or re-channel committees as required within each SDO.

(6) Creation of opportunities for users' participation

Efficiency during a process is dependent upon efficiency gains in each phase of the process. A division of labour and resource commitments in standardisation according to areas of interest, knowledge, expertise, and business priorities is therefore in order.

Different types of actors and organisations do not necessarily need to be involved in the standardisation process to the same extent at each phase, as long as the system is equitable and makes it

possible for each type of interest to make itself heard and influence the outcome according to its specific needs and concerns. Clearly, users should be more involved at the 'identification' and 'allocation' phases of the standardisation work, but they will probably always be less inclined or able to become involved in the development phase.

Whatever the form or forms of user representation that will emerge, however, the user voice should be heard and heeded.

Users may not wish to enhance their participatory profile in standards-making until they have confidence that they will be able to exert more influence over the process. But mechanisms will be needed to increase opportunities for users' participation in strategic requirement assessment and priority setting.

Obtaining a balance of user representation should follow the same criteria as obtaining a balance of producer representation -- i.e. as not all affected producers can be expected to participate, neither can all affected users. Added to the involvement of individual users, particularly 'key' users and/or sector leaders, user associations may be able to focus user positions effectively in selected sectors.

The important thing is to better balance the decision-making process, which, for example, could be accomplished in either or both of two ways:

-- **A parallel structure of user committees, consortia and fora to address standardisation issues of particular relevance to users.**

-- **The reconstruction of the 'identification', 'allocation', and 'enquiry' processes to ensure that a broad sample of the various interest groups are consulted actively by means of workshops and seminars in which both users and producers participate.**

Such reconstruction of the standardisation process unavoidably raises a number of new issues. Two at least would need to be explicitly addressed and resolved in view of their relevance for the successful outcome of the changes we suggest.

The first set of arrangements to be considered would aim at mobilising an adequate level of resources, while providing appropriate incentives for more effective priorities and management of efforts:

New channels must be found for the funding of standardisation activities. These channels, with a mix of public and private sources, might usefully be diversified to foster diverse management approaches and encourage more explicit distribution of tasks between committees, as will be outlined below.

Another set of procedures and mechanisms are needed to establish maximum transparency of the standardisation process, which is a necessary condition to facilitate the participation of relevant groups at the appropriate stages:

Ready market recognition of the resulting standards will require special efforts to publicise the conditions under which consensus has been reached, the nature of the partners involved, the economic and commercial implications, and the rationale for the solution that has been selected.

(7) The re-definition of funding principles

Regional structures have upset the traditional financial structure of national SDOs, which in most OECD countries is considerably dependent upon the sale of national standards. The British Standards Institution, for example, has recently reported that it earns less revenue now that it is compelled to sell more international and regional standards -- products from which its earnings are comparatively less than for national standards.[27]

The future of the current approach to the publication and sale of standards as an important revenue stream for many standardisation bodies is thus under question. All the more so in view of the criticism that this approach is counter-productive to the desire to maximise access and encourages marketing of publications rather than the development of longer-term strategies based on a coherent set of priorities. When paramount importance is attached to the production of standards that will sell, standardisation work can be deflected away from the questions which are fundamental for the future but have not achieved popular recognition. In some cases (for example, according to critics, in relation to the recent wave of quality standards) these marketing approaches may have major negative effects if insufficient attention is paid to the conditions required for sensible application.

Innovative approaches should be found to replace this revenue stream so that standards -- in both approved and final form as well as in draft/ working document form -- can be freely and easily made available to all who wish to use them. The latest electronic document handling techniques (e.g. CD ROM and remote data access) should be adopted to facilitate and speed up such access.

In many Member countries, there are already well-established traditional funding mechanisms that lead governments to provide substantial institutional finance for standardisation activities, while other governments only play a minor role in this respect.

In any case, we consider that the fact that governments subsidise standardisation activities should not imply that they control them.

(8) Establishing a "standardisation" ethic

Any reconstruction of the standards-making machinery must also include a detailed examination of the evolving role of the "standardiser". In a real sense, standardisers are also an institutionalised community. They can come from the public or private sectors (user and producer firms) and they are the only grouping with direct affinities to both the participant entities in standards-making, and to the SDO structure. This has a positive feature in that standardisers can efficiently transfer information from one forum or initiative to another simply by participating in more than one group. The disadvantages are that this information exchange is not co-ordinated, and that it may or may not reflect accurately the positions of the entities sponsoring the standardisers.

All standardisers should be expected to operate in reference to a code of professional conduct that would define more clearly their role and the responsibilities of the sponsoring firm or organisation. The practicality and method of developing such a code need to be decided by SDOs in partnership with industry and government.

(9) Training for the future

We realise that some of the above suggestions may be interpreted as bound to lead to the development of bureaucratic structures. We have struggled with these objections and come to the conclusion that the standardisation system in ICT would on balance greatly benefit from improved

professional approaches to the whole scope of standards-related activities, from the identification of needs and management of projects, to the assessment of the conditions for successful implementation and the implications of new standards for the economy and society.

> **In connection with these aspects, and in view of the growing importance of standardisation in all spheres, we suggest in fact that special efforts should be made by governments and educational institutions (possibly in collaboration with SDOs) to ensure that standards-related questions (including their impacts on global markets and economies) are more fully dealt with in the training of future engineers, managers and leaders of industry and government.**

(10) Increasing awareness of the role of standards

Such programmes will not only assist in producing new generations of standardisers, but will stimulate needed research in this area and will raise the general awareness of standards-related questions in business and government.

> **Employers' awareness levels need to be raised to ensure that there are attractive career paths for those who actively participate in standards development.**

Increased awareness of the value of such work will also benefit both the private and public sectors' resource support for standardisation work. There have been many failed attempts to develop such awareness. We recommend that the OECD apply its economic expertise to undertake a substantive study to measure and demonstrate the business value in efficient participation in standardisation.

The Role of governments

(11) Guiding the reform process

We obviously do not believe that we have designed all the details and foreseen all the difficulties of the reforms we suggest. Their implementation would necessarily require overall guidance, monitoring, and regular reporting to industry, governments and the general public on progress and further actions that may be required. In view of the fact that the OECD includes the major industrial countries which have a special stake in leading the efforts, it seems to us that the Organisation, which initiated the work of our Group, would be most appropriate -- as a "neutral" body with respect to standardisation, and in view of its economic analysis capabilities and its proximity to governments -- to take stock of the situation in light of our recommendations.

> **It would be especially useful, in this context, to seek consensus among the governments of the OECD Member countries, as users, regulators and keepers of the "public good", with regard to the roles of the various actors and the measures that might usefully be taken, at national and international levels, to facilitate balanced and timely standardisation efforts. Special attention would need to be paid to fully taking into account the emerging standardisation needs of non-Member countries in view of the globalisation process under way and the requirements of the new global information infrastructures.**
>
> **This new initiative might take the form of "Guidelines" issued by the Organisation.**

(12) Bridging the gap between voluntary standardisation and public policy

We naturally recognise the fact that voluntary standards developed at national and/or regional levels will often need to reflect the specific national legal and policy structures of the countries involved. The interest and responsibility of governments as guardians of the "public good" is of course legitimate. However, it should neither generate increased obscurity of the standardisation process, nor overload it as a result of increased delays or drain on resources.

Where standards initiatives are clearly in the public interest, the resulting government intervention in standardisation should be carefully limited to areas where regulation is essential.

In principle, government interventions in standardisation should be non-directive to safeguard the voluntary and open nature of the process. Governments, however, should play an important role as users at national and/or international levels, where equitable formulae and mechanisms for government participation and payment of participation fees need to be carefully designed. As users, governments should also set an example in referencing internationally established standards in public procurement policies.

Standardisation-related issues increasingly spillover the limits of the technology area to affect other spheres -- for example, in the regulated area, mutual recognition of conformance certificates deserves to be considered as an international trade issue. Another important case is the legal acceptance of electronic documents. The current controversy on IPR also underlines the existence of issues that cannot be effectively resolved from a purely technical perspective but which require the definition of different consensual approaches. These examples illustrate the increasingly multi-dimensional nature (political, economic, commercial, cultural, legal, etc.) of the standardisation process.

For these reasons, the work of standards bodies may require some co-ordination with that of other organisations concerned with these various dimensions. This might involve increased consultation with organisations which are "neutral" in the sense that they neither develop or rule on the use of standards. However, the specific organisation and direction of such forms of co-ordination and direction will need to be discussed in greater detail in the appropriate fora.

(13) Other key issues to be evaluated.

Appropriate action would also need to be taken to monitor the progress being made in structural reform, assess the economic implications of major standardisation questions under consideration, and assist in bringing to light alternative courses of action to be considered by the relevant key players in the international sphere.

This task needs to be assigned to a "lead organisation", selected or created with the agreement of all concerned.

Emerging important issues will need to be carefully assessed throughout the current phase of deployment of new technologies to detect new trends, new problems and new needs.

We support the continuing study of the evolution and global implications of standards development by the OECD, in order to permit the Organisation to continue to determine the best interests of its constituents in the current environment of exploding technology in computers, telecommunications and information resources.

Standards-related issues of special import include:

-- the political, economic, social, etc. implications of the convergence generated by technology in the computer and telecommunications domains, with the emergence of a global information infrastructure that will demand more and more seamless interoperability of all its elements;

-- the evaluation of economic benefits to all ICT industry related stakeholders (manufacturers, operators, service providers, users) of effective participation in global standards development in a global market economy;

-- the evaluation of the implications of advances resulting from an evolving global economy in terms of timely global standards required to satisfy the needs of global markets;

-- monitor the development and adequacy of standards-related programmes in the education of engineers and managers, as well as the extent to which attractive career paths are available for those who actively participate in standards development.

Standards and the Global Information Infrastructure

We refer again to our previous recommendation for the standardisation community to create a world-wide Information Infrastructure Standards Panel to facilitate the co-ordination of the work needed for the new information infrastructures. The following questions could be meaningfully addressed under the aegis of such a body.

(14) Improving the ICT standardisation framework

There is no need, in our view, to search **fora** new ICT standardisation framework. Work should continue within the existing framework, in a market-driven perspective, to focus on the "critical interfaces" for which standardisation work is lacking although it may be urgently required.

We expect the new world-wide Information Infrastructure Standards Panel whose creation is recommended above to play a key role in helping identify the needs to be met and in co-ordinating the prioritisation efforts of SDOs.

In particular, in the current context which is characterised by a host of political and industrial demands for the rapid deployment of a global information infrastructure, it seems to us that it would be most useful for the major SDOs to focus on establishing priorities for the work on critical interfaces needed, define the more urgent overall standardisation goals and concrete targets to be met.

We fully recognise the efforts already initiated in this direction by the global level SDOs and encourage them to further expand these activities, which will be essential to ensure that the strategies being developed for the new multimedia networks are based on common and sound technical, economic and commercial premises.

This work thus needs, in particular, to identify the basic standardisation targets to be met, the work that they imply and the mechanisms to do it, including allocation of responsibilities. The resulting standardisation effort should be conducted by those parties

with commercial interests in the establishment of the new information infrastructures at global or regional levels.

(15) Who should be involved, and how?

This broad effort, however, should not limit itself to the established standardisation bodies and the leading edge actors that are better able and prepared to participate in such efforts. Attempts must be made to *eventually* involve also the "second circle" of potential actors, who will not yet have taken active interest but will play a crucial role in the diffusion and adoption phase of the new standardisation targets.

In order to promote interest and involvement on the industrial side, the new standardisation framework, and in particular the implications of the critical interfaces identified and proposed for priority action, must be explored in close collaboration with equipment producers, service providers and users, in a way that will be meaningful in business management and organisational terms rather than merely in a technical sense.

Although SDOs will have to assume leadership in bringing to light the many dimensions of these emerging standards issues, this awareness-raising effort at national and international levels should be a shared responsibility of all stakeholders -- users, suppliers and government -- to evaluate and communicate the costs and benefits of the new standards investment required.

In light of the many non-technical dimensions of the problems to be attacked, consideration should be given at some stage to the need to consult with national and international organisations that are not traditional standardisation actors, including industrial branch organisations, or other professional associations. The roles of all actors would need to be clearly defined so as not to politicise unduly the standardisation process.

(16) Are immediate standardisation measures needed with respect to GII?

The above suggestions tend to strengthen and expand ongoing efforts towards the identification of the critical interfaces required for the new global information infrastructures and should make it possible to clarify which standards are needed by when and whether additional efforts are required. Once again, we underline that such a task needs to involve all market players, with the assistance of the government agencies concerned.

Governments should not direct the process, but facilitate it when required. This might require better understanding at the highest levels of government of the strategic nature of the standardisation process and of its mode of operation, based on the voluntary participation of all economic players. Such recognition and caution would be especially useful at international level, where world standards are expected to play a major role in ensuring the effectiveness of new information infrastructures.

In particular, and in view of its role in encouraging the deployment of global information infrastructures, we urge the G7 to express its full support for the standardisation work under way in this area, and to encourage the formation at global level of the Information Infrastructure Standards Panel recommended above.

The development of this overall plan and its subsequent implementation will require in particular the full co-operation of SDOs and other standardisation bodies, including experimentation with, and adoption of, new procedures for the organisation of the work as well as new methods for working jointly on urgent questions. In light of the progress already achieved in past years in this respect, we are confident

that the required adjustments will be designed and implemented in all organisations as the needs become clear. This is in fact a necessary condition for the safeguard of a voluntary and open standardisation system.

ANNEX I

Ad hoc group of industrial experts on IT standardisation: List of members

The Group held three meetings at OECD Headquarters, on 27-28 January 1994, 18-19 October 1994 and 10 February 1995.

M. Jean Claude DISPAUX (Chairman)
Senior Vice-President
Nestlé I.T. and Logistics
SWITZERLAND

Mr. David ALEXANDER
Technical Director,
OSITOP
UNITED KINGDOM

Mr. Attilio GNETTI
Director of Standards
STET
ITALY

M. Louis-Noël JOLY
Directeur Général Adjoint
Société Générale
FRANCE

Mr. Roland LINDEROTH
President
Verimation AB
SWEDEN

Mr. Phil SAUNDERS
Director
Commercial Relations
Northern Telecom
CANADA

M. Philippe TASSIN
Directeur
IS Télécoms
Michelin
FRANCE

Mr. Dieter GANN
Manager Technical Relations
Hewlett Packard Europe
GERMANY

Dr. Etienne GOROG
Vice-President
IBM Consulting Group
FRANCE

Mr. Ellwood R. KERKESLAGER
Vice-President
Technology and Infrastructure
AT&T
UNITED STATES

Mr. Horst NASKO
Vice-Chairman
Siemens Nixdorf Informationssystem AG
GERMANY

Mr. Taihei SUZUKI
Vice Chairman
Technical Assembly
Telecommunications Division
TTC
JAPAN

EXPERTS

Mr. Richard HAWKINS
Deputy Head
Centre for Information & Communication Technologies
SPRU
University of Sussex
UNITED KINGDOM

Mr. John RANKINE
Consultant to IEEE Standards Board
UNITED STATES

Mr. Denis HILL
Special Consultant
ISO
SWITZERLAND

SECRETARIAT

M. Georges FERNÉ
Economics of Information Technology Standardization
Information, Computer and Communications Policy Division
Directorate for Science, Technology and Industry
OECD

ANNEX II

Summary Record of the Workshop

Held on 26 and 27 October 1995 at OECD

The Workshop was organised under the aegis of the Committee for Information, Computer and Communications Policy (ICCP[28]) in order to provide an opportunity for discussion of the Report ("Dispaux Report") drafted at its request by the High-Level Group of Industrial Experts on Information and Communications Technology (ICT) Standardisation. The Workshop was chaired by Mr. Richard C. Beaird (U.S. Department of State), the Chairman of the ICCP Committee.

The objective was to discuss the analyses and conclusions of the Report, in order to provide guidance to the Committee in assessing the recommendations of the Group in light of the views of major actors concerned with ICT standardisation issues.

For this reason, broad representation of key actors involved in the ICT standardisation process, including suppliers and service providers, public and private users, as well as national and international standardisation bodies, had been sought for the Workshop[29]. Following two introductory Keynote Presentations, the agenda was structured with four main themes:

-- The Future of Standardisation at Global Level;

-- Who should be involved in Standardisation Work, and When;

-- The adequacy of existing mechanisms;

-- Need for Change.

Introductory Keynote Speeches

The first Keynote Speaker was Mr. Henry J.F. Ryan (JTC1), who spoke on behalf of JTC1 -- the Joint Technical Committee established in 1987 by ISO and IEC to oversee ICT standardisation efforts at the global level.

His intervention on "Perspectives on Delivering International ICT Standards" set the discussion of the " Dispaux Report" in light of the major goals pursued by JTC1, which had three major thrusts:

-- the Business Objectives, which included the promotion of world-wide economies and efficiencies in expanding global trade through the creation of an international standards

environment that enables ICT suppliers to provide users with the means to manage information efficiently, economically, accurately and securely;

-- the Pursuit of Process Improvements designed to meet market needs in a continuous and timely fashion, based on business analysis and planning, co-operative agreements with other actors, and systematic transposition and referencing of Publicly Available Specifications (PAS);

-- the Promotion of Global Information Infrastructure (GII) Standardisation, through the recent creation of an Ad Hoc Working Group and a Special Working Group.

In this light, the speaker felt that JTC1 was indeed already moving in the broad direction suggested by the Report under discussion in particular with respect to the emphasis placed on the standardisation environment. The strategic objectives, for example, included a focus on user needs and demands for increasing interoperability. Standardisation processes were being streamlined and reviewed on a continuous basis. Efforts were made to accelerate them while providing mechanisms (such as ballot processes, broader accessibility of agendas, on-line information systems, etc.) to facilitate participation by all interested parties. The Report's recommendations with regard to the need to ensure greater convergence of efforts conducted by different types of organisations were met through a broad range of co-operation efforts launched with organisations as diverse as CEN/CENELEC, ITU, ETSI, the Internet Society, and many fora and consortia. New procedures developed to identify, review and assess PAS went in the same direction. At the same time, the importance attached by JTC1 to the emerging GII standardisation needs reflected a scale of priorities that met the concerns expressed in the Report.

There remained a set of major challenges expressed by the Report that needed to be addressed. In particular, additional efforts were certainly needed to better structure the discussion of future standardisation needs taking account of the broad range of relevant factors such as the role of users, emerging technology trends, the economic requirements, and the new values of knowledge and information.

The OECD could well continue to contribute to these efforts. In particular, it could bring its expertise to bear on the critically important economic aspects of standardisation, that needed to be clarified in order to set more effective hierarchies of priorities, and facilitate strategic decisions as well as financial planning. At the same time, the Organisation was also especially well-geared to assist in improving the effectiveness and relevance of standardisation processes, promote greater awareness of the role of standardisation among government spheres, participation of users at the relevant stages of standardisation, and encourage standards-related training efforts.

The second Keynote Speaker, Mr. Walter de Bakker (EC) addressed the question of “Standards for the Information Infrastructure”.

He first recalled that the concept of the GII was based on three expected developments: the availability of all-digital technology to open the way for easy and effective multimedia applications; the simultaneous involvement of public services and private sector actors engaged in free competition; and open access for users and providers. This was not, however, the reality at present, with networks that were often still analogue and unable to perform adequately in many instances; with markets where competition was still limited and segmented; and with structures that seemed to delay the broad convergence that had been predicted in the information-related sector as a structural feature of the new knowledge-based economy.

A number of actors thus still failed to become involved and the existing processes thus did not necessarily reflect the broad diversity of needs to be taken into account, such as all types of users, service providers, and operators, component vendors, systems integrators, network operators, information producers, etc. Public procurements could play a crucial role in this respect, and promote the integration of systems that emerge somewhat chaotically from the mass production economy.

In this light, standardisation requirements extend beyond the concerns for interoperability and "openness". Each market segment should be able to move at its own optimum speed, without disturbance for other areas and without requiring the re-definition of other applications, in order to facilitate the smooth deployment of the largest possible variety of services, founded on basic systems that steadily mature in order to diminish the costs incurred by users. The basic rule should thus be to develop the right standard at the right place and at the right time.

The ways in which the Internet has developed through broad consultation of all interested parties and market acceptance provides a model of the kind of overall standardisation environment that would best respond to these needs but that could only be effective, however, if supported by an effective intermediate structure. The key question is thus focused on the ways in which the market chooses standards, and how to ensure that the resulting choices best serve the open economy and the public interest. This in turn, as underlined by the Report under discussion, raises a host of questions about the "roles" to be played by the various actors concerned and the nature of the consensus to be sought with respect to each major standardisation question, as it emerges.

Session 1: The Future of Standardisation at Global Level

Participants in ICT standardisation activities usually agree that the quality and relevance of this work is a direct function of the extent to which it is market-driven and industry-led. On the other hand, many observers acknowledge that the voluntary nature of standardisation work may foster long delays, excessive costs and inefficiencies. Efforts have been made by most organisations involved to overcome these deficiencies, but additional steps may still be required in view of the broad scope and possible urgency of emerging demands generated by ICT developments .

The questions addressed in this Session revolved around the need for new approaches and priorities as a result of the deployment of the GII, such as the solutions advocated by the Report to improve the flow of information between formal and informal standardisation bodies and promote greater transparency in the distribution of tasks between them. A specific suggestion that needed specific discussion was the proposal to create an Information Infrastructure Standards Panel at global level.

The first speaker, Mr. Akifumi Kambara (NEC, Japan), presented “A View on What Future for ICT Standardisation at Global Level”.

He underlined the importance of standardisation efforts whose results ultimately benefit everyone. Current challenges include the need to proceed rapidly, to reflect shorter product life-cycles while responding to a growing need for more open networks and systems. Interoperability hinges on the availability of open standardised interfaces and the key technologies required to implement them. At the same time, other considerations lead to export control measures, or encryption-related regulations, that prevent the attainment of these goals. Intellectual Property Rights (IPRs) may also turn into obstacles to interoperability if the various interests at stake are not well-balanced in implementing them, in particular

in the case of *de facto* standards whose adoption and maintenance will be affected by the IPRs rules applied and the degree of transparency governing their future evolution.

This being said, and while stronger standards are certainly needed, they should be less numerous and should relate to the lower layers of ICT, where competition essentially relates to performance and effectiveness while higher levels set the stage for competition between a variety of services.

The need is thus to define policies that will encourage the best standardisation processes, experiments in standardisation, and elaboration based on *de facto* standards. The time has come to foster closer collaboration between formal and informal bodies in recognition of the growing contributions of the latter, and to seek greater timeliness of efforts through more advanced use of ICT for standardisation work, and global sharing of the work.

Mr. Kambara recalled that various efforts were already being initiated along these lines. In Japan, for example, an Open Interface Inventory System had been established to ensure greater transparency and information. National Pilot Projects had been launched in areas such as Electronic Commerce and Open Network Systems. At global level, Working Groups and Pilot Projects were also under way under the aegis of organisations such as ISO, IEC and ITU, often to bring to light the requirements for critical interfaces.

These efforts could only benefit from OECD support in exploring the social, legal, economic and policy aspects of standardisation efforts. The objective to be sought should be to ensure that all relevant intelligence on the implications of standards under consideration be readily available at any time and anywhere.

The next intervention, by Mr. Vishnu Mohan Calindi (ITU), was entitled: "An International Telecommunications Perspective on ICT Standardisation".

According to Mr. Calindi, the emergence of GII requirements represents the major challenge of the day for the global standardisation system in ICT. The Report under discussion provides a sound basis to address the resulting problems, from a good vantage point and with a stress on the policy decisions that must be sought to remove obstacles and prevent negative impacts. The report thus presents a framework that is entirely relevant to current preoccupations at the International Telecommunications Union (ITU) as well as other Standards Development Organisations (SDOs) organised around geographical, economic or functional interests, and ranging from internationally recognised bodies endowed with official responsibilities to informal fora and consortia that play an increasing role.

The recent changes implemented within ITU, for example, reflect these concerns. New structures have been put in place to bring closer together standardisation work in hitherto separate areas such as radio and telecommunications. Procedures have been changed to accelerate the work so that the adoption of a new standard might take less than twenty-four months against four years in the previous set-up. Strategic thinking and planning have been encouraged within the new organisation scheme, as well as participation by new bodies -- which is considered to be crucial to enhance overall responsiveness to new demands. In this line, co-operation with consortia and fora is now actively sought, as witnessed by the progress achieved recently through the ATM Forum.

The GII-related concerns reflect the importance and scale of emerging needs. Concerted action is now more than ever required by global bodies such as ITU, ISO and IEC, and JTC1. A joint working group has in fact been set up to identify GII-related standards that are available, are being developed or need to be sought more actively.

The Report under discussion recommends a strengthening of such co-ordinated initiatives towards better global blending of the relevant SDOs. The conditions under which such an evolution might take place would need to be clarified, in particular with respect to the distribution and hierarchy of responsibilities. Structures already exist to provide a platform for such efforts. It must be kept in mind, however, that any attempt at reorganisation of standardisation processes at global level will need to take account of the variety of needs of non-OECD Member countries.

General discussion

While there seemed to be broad agreement on other recommendations formulated by the report with respect to the adaptation of ICT standardisation to new requirements, the focus of the discussion was on the question of co-ordination at global level, particularly in light of the Report's recommendation to establish an International Standardisation Panel as a focal point for all the GII-related initiatives undertaken by various organisations. Mr. Ray O'Connor (Consultant, Switzerland), for example, saw a contradiction between the overall market-orientation of the Report, and its advocacy of certain planning efforts. He cautioned not to set up hierarchies, but let the pluralistic system produce standards that would naturally emerge when required. On behalf of the Expert Group that had produced the report, Mr. Dieter Gann (Hewlett Packard, Germany) recalled, however, that his colleagues had been impressed by evidence of the need to attain higher levels of coherence to overcome the current state of confusion and overlapping of the activities initiated by both ICT suppliers and users. There was, however, as underlined also by another member of the Group Mr. David Alexander (OSITOP), no suggestion as to the allocation of responsibility for such a new structure, which probably needed to be determined in consultation between governments and the standardisation community. The key question was to clarify the functions to be assumed by such a body and then let the major stakeholders draw out the structural implications. The system did not need to be re-engineered, but new circumstances called for a better balance between suppliers who now were in control to a large extent, and users who were called to play an expanded role. These new requirements, however, could be met by SDOs that had to face up to a broader constituency and new communications challenges in the emerging GII context.

As a member of the Group of Industrial Experts, Mr. Attilio Gnetti (STET, Italy) recalled that the suggestion to create the international panel under discussion had been prompted by the example of similar structures that had emerged on national scenes, as in the United States -- not to create another layer of decision-making but to define more harmonised requirements under the leadership of the main industrial actors.

Several speakers considered that the creation of the international Panel was premature. Mr. John Rankine (Consultant, US) thought its charter was not precise enough with respect to membership and tasks, while there were already too many standardisation bodies. This view was shared by Mr. Jun Okayama (MPT, Japan), Mr. Brian E. Carpenter (Internet, Switzerland) and Mr. Henry Ryan (Digital Equipment International, Ireland) who all felt that bureaucracy should be abolished and not strengthened and that the envisaged body would add another level of complexity to the existing system.

Mr. John Ketchell (ETSI, EU) referred to efforts currently being deployed to establish a common European ICT standards Board. The aim was not to create a new layer of decision-making, but to facilitate co-ordination and involvement of a broader range of stakeholders, including informal fora and producers of PAS, etc. Similar concerns were legitimate at global level, where there was already a plethora of initiatives. The question was not so much to create a new body, but to construct effective bridges.

Other speakers (Mr. Norman Lamb, Consultant, United Kingdom), Mr. Phil Saunders (Northern Telecom, Canada), Mr. O'Connor and Mr. Liv Slolhjell (Norway), felt that SDOs had a strategic role to play in this context to ensure that the full range of key actors were fully informed and able to become involved, to maintain balance between the various interests and to foster early recognition of market needs. This implied ever stronger lines of communication between the various organisations, to facilitate joint and early recognition of the lines of action to be considered and the relative priorities to be set among them.

Mr. Michel Audoux (EC) pointed out, for his part, that the central question was to determine whether the emergence of GII-related requirements called for major re-engineering of the standardisation system. There were a number of inter-related factors to be taken into account. For example, the establishment of GII as a priority implied that the track to be followed needed to be defined. Although there was already, in many regions of the world, agreement on the need to define the critical interfaces, it was not clear how efforts would converge to meet this goal and develop the road maps needed to attain them. Such broad strategic choices were needed, however, in order to set a course for the adequate development of inventories, methodologies and technical specifications, meeting the requirements of interoperability and establishing the appropriate regulatory environment to govern diverse questions such as encryption, radio links, etc.

Session 2: Who should be involved, and When?

The “Dispaux Report” stresses the fact that there are different phases in standardisation processes, and that different categories of actors and organisations -- from equipment suppliers and service providers to end-users -- do not necessarily need to be involved to the same extent at each phase. Each category, however, should have an opportunity to make itself heard and influence the outcome according to its specific needs and concerns. The themes suggested for discussion included the usefulness of increasing the involvement of users at various stages of standardisation work; how best to encourage such participation; the precise steps that could be taken to ensure equitable representation of all categories of stakeholders; and the extent to which government agencies have a special role and/or assume special responsibilities as users of standards.

The first speaker, Mr. Claude Hamon (CEN convenor of Ad Hoc Group on GII, France), addressed the major question of "Users and ICT Standardisation" that had become a constant preoccupation within the standardisation community for the past decade and had brought to light many questions:

-- What type of users should be primarily concerned? How to involve them and where? One needs to distinguish, in this respect between standards users and end-users. The latter express their requirements in terms of functionalities, and the former in terms of technical specifications. Taking the example of the Information Highway, an effort of clarification of functional objectives is needed -- in other words a definition of what the highway is supposed to carry. Various situations might thus call for different types of representation or mixes of representation at different levels in different arenas. One approach might well be to have "users councils" where the various users might be able to agree on their requirements and the way to formulate them.

-- Does the emergence of GII create a new situation? The GII, which is the infrastructure to be installed in order to move into the Global Information Society, will effectively impact a completely new category of users who are less concerned with the technical specifications than with the functions available at the end of the line. There is thus a suddenly enormous range of potential contributors to the definition of standardisation goals, with correspondingly enormous problems of communication (language, terminology, etc.) between them. There is a great deal of confusion with regard to the legitimacy of the claims of various bodies that present themselves as representatives of users. Some sorting out would obviously be needed. At the same time, actors who have long been active participants in ICT standardisation (such as government procurement agencies) are slowly drifting away from their traditional stance concerned with the elaboration of technical specifications, to focus on the definitions of users' requirements.

-- Do informal standardisation approaches provide a model? Are existing bodies appropriate? How to trigger users' motivation to become involved? Informal responses such as the PAS have emerged to overcome problems resulting from the fact that the market is still dominated by products that do not comply with standards. It reflects a failure of the formal standardisation process. The adjustments implemented by JTC1 represent a first step in attacking the problem.

-- How to move ahead? A number of initiatives provide interesting reference points or models for the new strategies to be developed. OSITOP, for example, represents an important precedent in the setting up of "users only" bodies. Other fora have multiplied expert groups to facilitate selected users' involvement at various steps of the standardisation process. Can these two approaches play complementary roles, or are they mutually exclusive? Will there be enough resources and manpower to cover all the essential requirements?

In his contribution on “The Changing World of Standardisation”, Mr. John Rankine (Consultant, US) suggested that a major point to be kept in mind was the fact that compromises on standards at all levels were necessarily unsatisfactory and tended to tilt towards halfway, if not impractical, solutions. Many standards tended to be produced for the sake of producing standards -- which was sufficient explanation of the fact that they would be largely ignored by the producers of leading edge equipment and services. Furthermore the average time required to produce a standard (two to five years for national standards and five to ten years for international standards) was not commensurate with user needs. The case of the Open Systems Interconnection (OSI) set of increasingly complex standards developed over decades was, in his view, a striking example of the consequences of these structural deficiencies: the marketplace does not stand still waiting for a final product and vendors will fill the vacuum, as happened with NOVELL and TCP/IP.

At the present stage, it had become necessary to question the continued usefulness of the existing standardisation structure that he considered to be less and less relevant in areas where issues of public safety, measurement, security or common languages did not arise. The established standardisation structure should focus on less time-dependent standards such as vocabulary, symbols, measurement, testing methods, etc., thus drawing the implications of the general move to on-line standardisation processes, based on global communication capabilities that enable users to easily bypass established standardisation procedures, as evidenced by the work of consortia.

The continued failure of traditional standards-making bodies to adjust to the realities of today's marketplace might lead to obsolescence of the institutions concerned. Efforts to find new directions for the work and generate new revenues by shifting standardisation priorities to non-technical areas such as management would, in Mr. Rankine's views, further weaken the institutions concerned.

New standardisation procedures were being launched for critically time-dependent standards, with on-line facilities and start-date immediately open to all affected interests, under procedures that sought completion in less than one year. The tendency was, however, for each major body to go on-line separately. The need was for an overall framework, some kind of consensus on a basic common on-line system. There were, of course, many candidates for such a platform that needed to be selected by all partners -- including governments -- as a key element of an emerging standardisation world that needed to be able to use all the new tools available.

General discussion

The number of initiatives currently under way, in connection with GII or other areas, was, in the view of many speakers, a major source of confusion. Mr. Milliam McCrum (Industry Canada) pointed out that this evolution was also accompanied by rising demands from users who, however, could not easily determine where and when it was important to become involved. Mr. Ketchell noted that while ETSI had established user groups in key areas, it seemed to be difficult for user representatives to obtain resources required for effective participation: the problem was thus also one of priority-setting within user organisations. However, Mr. Hamon underlined the fact that a diversity of groups was often necessary for effective work, because of the diversity of interests and standpoints. This was a reality the system needed to take into account.

Others felt the issue of users' participation was over stressed. According to Mr. Rankine, for example, user power is best expressed on the marketplace and in the media. Also, suppliers themselves include and represent communities of users. Users could also take initiatives when they felt the requirement, as in the case of the development of bar codes by groceries. Mr. Carpenter thought that, in any case, effective standardisation work did not require a grand plan but a good climate that made it possible to move in small pragmatic steps with fluctuating participating groups.

Governments also had to cope with the need to assume their responsibilities as users of ICT standards. In the case of Norway, recalled Mr. Eivind Jahren (Ministry of Government Administration, Norway), the public sector had been re-organised accordingly to foster more horizontal approaches, greater consistency and efficiency. Guidelines were needed, in particular, to encourage sectoral agencies to look ahead in this respect, develop the functional specifications needed and interact more actively with other sectors.

In line with the emergence of the global information society, noted Mr. Helmut Willke (University of Bielefeld, Germany), the products of standardisation efforts had to change -- perhaps to shift to more qualitative aspects. There was also increasing pressure for standardisation efforts to reflect overall societal visions relating to culture, quality of life, quality of society, etc. Thus, stressed Mr. Hamon, attitudes and values had to change. The new context implied, noted Mr. Rankine, more intensive interaction between the policy and the technical levels, as in the case of privacy protection and encryption.

The Chairman noted that the discussion reflected a great deal of uncertainty in this area, about the mechanisms, the goals to be sought and the factors to be taken into account. In the current situation it was clear that social visions had growing influence on standards -- but there was little feedback.

Session 3: Are existing mechanisms appropriate?

The mechanics of standardisation -- from the funding of efforts to the co-ordination of activities that cut across organisational lines, including the modes of discussion of standards under consideration, as well as the diffusion of the final products of these discussions -- may involve a number of host organisations and participants, and will often be fairly difficult to comprehend by outside observers. Yet these processes need to be as transparent as possible to facilitate the involvement of all stakeholders, or at least provide the assurances they expect with regard to equity and fairness.

The questions for discussions revolved around the adequacy of existing mechanisms and processes to determine standardisation priorities; the need for improvement of funding methods, channels and levels; the ways in which information on on-going standardisation work could be made more readily and broadly accessible; and the usefulness and means of more systematic monitoring of projects advocated by the Report.

The first introductory speaker was Mr. Brian Carpenter (Internet Architecture Board, Switzerland), with “Internet Standards and the Global Context”. In his presentation, he first provided an overview of the Internet standards process, before submitting his comments on the Report under discussion.

The Internet structure he described includes:

-- The "Internet Society" (ISOC), which is an international organisation for global co-operation and co-ordination of Internet and its technologies. It includes more than 100 organisational members and more than 5 000 individual members, altogether representing more than 100 nationalities. It provides the legal umbrella for the IETF described below.

-- The "Internet Engineering Steering Group" (IESG) co-ordinates the "Internet Engineering Task-Force" (IETF), which is at present the sum of about 70 working groups. The meetings and Electronic mail discussion of subjects treated by these working groups are open to all. More than 700 people currently take part in the three meetings that take place every year.

-- The "Internet Architecture Board" (IAB) has oversight over the Internet Architecture.

Both the IESG and the IAB are nominated from the IETF, but the ISOC approves IAB membership.

The standardisation process is launched when a suggestion leads to the call of a scheduled “birds-of-a-feather” (BOF) session open to all who are interested, that may result in an initial proposal. The new Working Group charter and chair is then approved by IESG and IAB. The Group then launches discussion (at meetings and by E-mail) of Internet Drafts. The Chair must seek to establish rough consensus on a proposed standard, but there is no voting. The Group is also allowed to fail or to produce "informational outputs".

The fully open nature of the process means that debates leading to consensus are rough. The "rules of the game" require that complete running software is obligatory to advance on a standards track, with emphasis on technical clarity and simplicity at all stages. Approvals as "Internet Standards" are by formal IESG vote with appeals to the IAB. Originators of text waive copyright, all documents are available free of charge via Internet, with dependencies of standards on patents explicitly declared and non-discriminatory licences available. Software copyright are unaffected.

The success of this approach, according to Mr. Carpenter, is due to the fact the process is driven by engineers, and is pragmatic and truly international -- national bodies are neither needed nor wanted. In his view, this experience sets the requirements to be met in the new global context: discourage regional and national bodies, discourage bureaucracy, open access to all standards groups and free access to all documents, standardise only finite, pragmatic, proven steps in the technology, and make full use of what already exists as a result of the work of ITU, Internet, JTC-1, etc. There is no need to standardise the upper layers in advance since engineers will do it when needed. One should also abstain from mandating technology that excludes the developing countries (for example, ATM, that cannot be used everywhere). Another important point is to liberalise international cryptography while forbidding mandatory key escrow. A basic target should be to reduce content regulation to an absolute minimum. In particular, international bandwidth provision should be deregulated.

Mr. Carpenter's comments on the Report were in line with these conclusions. He fully supported the suggestions that would lead to higher degrees of decentralisation and flexibility, that would foster broad availability of standards free-of-charge, or that would promote the use of electronic communication in standardisation work.

On the other hand, he was against any expanded role for formal standardisation bodies and the creation of a world-wide co-ordinating panel. He thought the solution was to abolish national and regional structures so that the work could be done once, and only once, in global working groups.

Mr. Daniel Lecomte (Alcatel, France) then discussed "The Economic Dimension of Multimedia Standardisation". His experience showed that delays in producing standards were very harmful. A market-driven process is at work, so that firms need to launch their products and cannot wait until the contemplated standard is finalised. The result often is a multiplication of standards, which in turn will not allow the market to take off for lack of a coherent set of references that will inspire full confidence among users.

New technologies of compression and digitalisation, coupled with hypertext tools, represent essential steps forward in reducing memory requirements for multimedia applications. The challenge is now to provide imaginative channels for their distribution and use and it might even be suggested that new standards in such areas include the instruments required to assess their relevance to various forms of utilisation.

General Discussion

The following discussion was opened by Mr. Georges Ferné (OECD), who thought that some of the comments addressed at the Report of the Industrial Group were excessive in taking its recommendations as reflecting a "planning" orientation, rather than a "pragmatic" approach. He thought the Report essentially reflected concern for economy of resources, concentration of efforts, more effective management and priorities, as a result of a central preoccupation of the members of the Group of Industrial Experts, namely the excessive costs of participation in standardisation -- a concern that was prevalent throughout the manufacturing industry, among users as well as suppliers.

Another aspect was, of course, the need to strengthen the links between standardisation and policy. Although the complexity of the issues and the diversity of interests were such that it would always be easier to leave everything to the specialists, it had become difficult to ignore social and economic impacts at a time when there was increasing evidence of the disruption and suffering that often accompanied the diffusion of ICT applications.

Mr. Ferné concluded with the observation that, although all speakers had broadly agreed with the major goals suggested by the Report he had outlined above, the failure to suggest credible mechanisms to implement the changes required led to some doubts as to their short-term implementation.

As a member of the Group of Industrial Experts, Mr. Phil Saunders recalled that these issues had generated a great deal of discussions that reflected the difficulty of formulating clear-cut solutions in such a complex area. The suggestion for an overseeing body was essentially aiming at providing a focal point for assessment of process improvements and identification of possible gaps.

National bodies were certainly needed for a number of reasons, including -- importantly -- to encourage the implementation of international standards.

Also a former member of the Group of Industrial Experts, Mr. Alexander pointed out that the case of the Internet brought to light the crucial importance of the existing market for pre-standards in a number of areas. The intent of the Group, in recommending the creation of an international panel, had been to strengthen the linkage with the global market at a time when the prevailing trend is to standardise bits and pieces of equipment and services while users are increasingly concerned about effective usage of systems. This prompts the concern for better monitoring of the process. Another major need, and an important gap in current efforts, is for quality standards meeting the functional requirements of end users.

According to Mr. Michael Smith (ISO, Switzerland), the Internet standardisation process presented by Mr. Carpenter provided good inspiration for all. However, he doubted that there could be a single model in the ICT area. For example, one of the current problems with on-line participation was a linguistic one. The formal procedures of bodies such as ISO provided the possibility to refer to original languages. Also, the breadth required for discussions varied according to the issues, ranging from narrowly based fora to much broader institutional settings such as the IEEE, that functioned more or less in the same pattern as Internet standardisation.

There would thus continue to be a need, in his view, for international bodies such as ISO, IEC and JTC1, with fully open processes and formal decision-making procedures. National bodies also had an important function, to represent local interests, specific economic structures, language, culture, etc.

The example of Europe, concurred Mr. Lamb, showed that standardisation bodies tended to be more and more open, at least at strategic stages of the discussions. The actual work of developing standards had become more decentralised and thus relatively easy to access at local and regional levels. Mr. McCrum, for his part, cautioned that the success of the Internet as a service may have been more directly related to its peculiar funding and tariff structure than to the standardisation process. The procedures for the development of the technical specifications required was very sound in this light. In comparison, more formal standardisation bodies seemed to have a more monolithic approach. They were progressing as fast as they could to streamline their organisations and take greater account of the work of fora and consortia.

The financial future of the Internet process was indeed a factor to take into account, acknowledged Mr. Carpenter. At present, Internet standards were freely available, but this was due to a large extent to the availability of funding from a U.S. Government source. This was a temporary arrangement, and alternate sources needed to be created. Mr. Rankine underlined the importance of the funding issue for all standardisation bodies. Sales of standards was definitely not an adequate yardstick of the quality of standards and the related commercial considerations should not influence standardisation decisions. Alternate sources of funding were needed.

Solutions needed to be found in this respect and might call for some re-structuration of existing bodies. He could, for example, readily acknowledge the important role of ISO, IEC, etc. However, these were not inter-governmental organisations, and about 150 countries were represented by national committees that did not necessarily reflect the interplay of the various agencies and actors on the national scenes. The ITU, on the other hand, is an inter-governmental body. These differing statutes had financial implications and were a source of co-ordination difficulties and complexity.

Mr. Ryan returned to the example of the Internet standardisation process that had made such good use of new technologies, thus opening the way for similar practices everywhere. In this light, the creation of a global panel such as the one recommended in the Report could be seen as a source of difficulty in experimenting with speedier and more flexible market-driven approaches. In his view, the current stage required further thought on, and studies of, the economic, financial, statistical and other dimensions of the standardisation process, in order to bring to light longer term strategic options. Also, there was ample evidence that important steps were being taken internationally to accelerate processes but similar efforts were still required at national levels. Finally, the growing stakes of standardisation needed to be better understood, and taken into account in educational programmes delivered by a broad range of institutions. Mr. O'Connor supported these comments and suggested that the OECD would be a suitable forum for exploration of the economic and social aspects of standardisation.

Mr. Rankine noted that the Workshop had indeed provided an opportunity for very interesting and useful discussions, a feeling he was sure was shared by all participants and illustrated the value of the OECD setting to tackle these complex issues. In light of the magnitude of standards-related questions of concern to all sectors of the economy as a result of the emergence of the Global Information Society, he wondered whether the OECD might not usefully provide an institutional umbrella for a periodic "forum" to discuss new issues of concern to industry and governments in this area.

It is in this spirit of open confrontation of points of view that he wanted, at this stage, and on behalf of the Business and Industry Advisory Committee (BIAC) of the OECD, to present the following statement on IT Standardisation, as transmitted by the Group Chairman, M. Dispaux about the Report under discussion:

-- “BIAC welcomes the final report of the Group of Industrial Experts Jean Claude Dispaux, Senior Vice-President of Nestlé, to Mr. Richard C. Beaird, Chairman of the OECD ICCP Committee.

-- BIAC endorses many of the recommendations of the Report. Among these are the recommendation that the standardisation process be market-driven, voluntary and open to all stakeholders. Also, that Intellectual Property Rights should be recognised and that governments should participate in and contribute to the standardisation process principally as users and not as regulators.

-- An area of concern to BIAC, however, is that those areas of the Report dealing with the need to monitor the standards process might be misinterpreted by some as a recommendation for government control which would clearly be contrary to the underlying thrust of the recommendations as referenced above.

-- BIAC also questions the usefulness of the Report's reference to a code of professional conduct, and would suggest that this notion be removed.

-- BIAC appreciates this opportunity to comment on the report”.

Session 4: What should be done, where and how?

Like all political, economic and social institutions at this time of profound change, standardisation bodies have entered a phase of adaptation whose scope and directions are far from clear. True to its industry-led and market-driven nature, the standardisation process, and the organisations responsible for standardisation efforts, will undoubtedly assume their full share of the work required to identify and implement solutions. It has been suggested, however, that the magnitude of the longer-term issues at stake may justify special efforts to define more explicitly the longer term implications of standards under consideration.

Questions to be addressed included the development of methods to identify standards under consideration that might deserve special analysis from an economic and/or social perspective; the availability of more detailed information on on-going standardisation efforts, in particular their location, volume and nature, including the possible need for indicators that would make it easier to assess new approaches and compare the performance of various agencies and bodies; the degree of agreement on the respective roles of industry and governments with respect to ICT standardisation; and the extent to which OECD might further contribute to progress in clarifying these questions.

The first speaker was Mr. Richard Hawkins (University of Sussex, United Kingdom), on "Efficiency and Responsiveness in Standardisation Organisations: Determining a Realistic Basis for Evaluation".

His presentation focused on three central questions: How to measure performance in standardisation? How to evaluate standardisation in a context of technological change? How to evaluate standardisation systems?

Measurement of standardisation performances, he argued, was especially important in view of the massive changes under way in most organisations. These changes, however, were often incremental and did not affect basic structures. Hence the relevance of assessing progress in efficiency and reviewing changes whose accumulation might finally compromise the continued viability of existing structures.

Assuming -- as did the speaker -- that the positive features of the existing standardisation process deserved to be preserved, there would still be a role for the institutional structure: problems could not be solved by abolishing institutions. However, some agreement had to be found to determine the best locus for the conduct of assessments that would be as unbiased, timely and well-informed as possible.

The next difficulty would be the current lack of reliable criteria and data. New sets of indicators were needed, but had to take into account the deficiencies of linear measures: quantity, consensus or speed, for example, might well turn out to be achieved at the expense of quality. Basic theoretical questions arose with respect to the relation between standards and technical change. How to define a standard -- as a state or as a process? What is the output of the process -- a milestone of an evolving document? What is the nature of standardisation bodies -- publisher or provider of information?

The implication of these questions from an assessment perspective needed to be explored, and new indicators had to be defined to bring to light the influence of standards on technical change and the corollary links between standards, productivity, incentives to address the global market, the scope for international standardisation, etc. Preliminary work was necessary to shed light on the appropriate steps to be taken to gather information for the evaluation of performance in different social, economic and institutional contexts.

Mr. Hawkins outlined a number of fields where highly relevant -- but hitherto unexploited -- data could be easily provided by standardisation organisations, in particular in five areas that were of direct interest for the definition of performance criteria:

-- rates of standards production, revision and replacement;

-- status of operations of technical committees;

-- affiliations and status of technical committee participants;

-- origin, nature and content of standards initiatives;

-- progress and outcomes of work programmes.

Preliminary studies showed that the exploitation of these sources of information could be extremely fruitful for the subject under discussion as well as, more generally, to provide a new dimension for the production of indicators of technological change and for international comparisons in this area.

The presentation by the next speaker, Mr. Phil Saunders (Northern Telecom, Canada), focused on “Economic Justification for Standard Investment by the Private Sector”.

He first recalled the magnitude of the changes that had taken place recently in standardisation, ranging from the streamlining of procedures to the implementation of cross-industry co-ordination, and including the strengthening of collaboration between standards bodies and the growing use of electronic document handling techniques.

While these changes have been well-publicised and studied, the ways in which large multinationals invest in standardisation have not drawn as much attention. Yet these commitments can be very large in terms of money and skills, and have major impacts on business. This cost-benefit ratio is still poorly understood, which may lead to under-investment or late-investment by the private sector, if not -- as in the case of firms that expect to reap benefits from the efforts of others -- to insufficient investment. Although suggestions have occasionally been made that governments might pick up the resulting slack, the speaker believed that -- as recommended by the Report -- the standardisation process should remain under the lead of private industry.

The current situation, however, had many new features resulting from the deployment of GII and the emergence of global markets that fostered increasing demands for international standards.

All these factors will affect the competitiveness and profitability of companies in a way that often is not understood by senior executives and CEOs of large corporations, or by SME owners. Even when commitments to standardisation have been made in the past, these misapprehensions may generate highly damaging cutbacks at a time of more severe resources constraints.

Mr. Saunders thought the OECD, with its established track record in economic analysis, could contribute to countering these dangers and deficiencies, and foster better understanding of the economic benefits to private enterprises of investing in the development of timely, high quality strategic standards. Examples of themes suggested for OECD study included:

-- the bottom-line implications of delays in new market developments due to delays in standardisation;

-- the competitive and financial implications of leaving strategic standardisation to other industry players;

-- the costs of redesigning products due to misalignment with accepted standards;

-- the impact of a lack of appropriate standards to support the effective implementation of free-trade agreements;

-- the typical cycle time on payback from standardisation investment;

-- the ways in which the costs and benefits of standards development could be reflected, on an amortised basis, in the corporate bottom-line.

General Discussion

The following discussion focused on the question of indicators. The importance of shedding more light on the costs of standardisation, and of providing mutual information on efforts under way was highlighted by several speakers

Raising a more general point, and while acknowledging as a general principle the notion that industry had to play the leading role in the standardisation process, Mr. Michel Audoux cautioned that major areas of public concern and the pressure of unexpected events might lead to more active involvement of governments than was initially assumed. At a time of rapid technological and social changes, the scope of these interventions could not be mapped out and legislated in advance but would be determined by events (such as questions of national security) that might challenge hitherto accepted rules in all spheres.

General Conclusions

In his concluding remarks, the Chairman underlined the breadth and high interest of the issues covered during the Workshop. At this final stage, he thought it appropriate to share three main impressions:

The first was related to the importance of the emergence of GII, that set a goal of global harmonisation to foster more effective communication at an unprecedented scale. The resulting interoperability requirements brought closer together two hitherto distinct worlds, thus blurring the frontier between the public telecommunications world of ITU and the world of information technology.

The second impression was that the reconfiguration of these demarcation lines generated tensions: those on the telecommunications side were more comfortable with government involvement than the others.

The third was that reconciliation of the two worlds had great importance and that the Internet phenomenon was taking place at the intersection. This was an unexpected and momentous development, that had many of the qualities usually displayed by the tradition of individual entrepreneurship.

These trends were as many indications of the features of the emerging society based on new communications tools. The ITU community thus needed to assess and take more fully into account the resulting need for accommodation.

ANNEX III

Acronyms

ATM	Asynchronous Transfer Mode
BIAC	Business and Industry Advisory Committee
BOF	Birds-of-a-feather
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation
EC	European Commission
ETSI	European Telecommunications Standards Institute
EU	European Union
GII	Global Information Infrastructure
IAB	Internet Architecture Board
ICCP	Information, Computer and Communications Policy
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IESG	Internet Engineering Steering Group
IETF	Internet Engineering Task-Force
IPRs	Intellectual Property Rights
ISO	International Organisation for Standardisation
ISOC	Internet Society
ITU	International Telecommunications Union
JTC1	ISO/IEC/Joint Technical Committee 1
OSI	Open Systems Interconnection
OSITOP	European Workshop for Open Systems
PAS	Publicly Available Specifications
SDOs	Standards Development Organisations
SMEs	Small and Medium Size enterprises

ANNEX IV

List of Participants of the Workshop

Held on 26-27 October 1995

CHAIRMAN

Mr. R.C. BEAIRD

Tel.: (1) 202 647 5832
Fax: (1) 202 647 5957

Deputy U.S. Coordinator
and Deputy Director
Bureau of International Communications
and Information Policy
U.S. Department of State
Washington D.C.
United States

PARTICIPANTS

Dr. David ALEXANDER

Tel.: (44) 1606 77170
Fax: (44) 1606 77173
E-mail: alexander@aict.demon.co.uk

Technical Director of OSITOP
Managing Director of ALEXANDER ICT
17 Chantry Avenue
Hartford
Cheshire CW8 1LZ
United Kingdom

Dr. Shoichiro ASANO

Tel.: (81) 3 3942 2351
Fax: (81) 3 5395 7064
E-mail: asanojp@sinet.ad.jp

Professor
National Center for Science Information Systems
3-29-1, Otsuka
Bunkyo-ku
Tokyo 112
Japan

Mr. Michel AUDOUX

Tel.: (32) 2 2969 539
Fax: (32) 2 2968 998

Head of Division
Standardization DGIII-B/2
European Commission
200 rue de la Loi
1049 Bruxelles
Belgium

Mr. Malcolm S. BERMANGE

Tel.: (44) 1707 352 200
Fax.: (44) 1707 353 305
E-mail: malcolm_bermange.rxl@eur.xerox.com

European Standards Manager
Rank Xerox
Bessemer Road
Welwyn Garden City
Herts AL7 1HE
United Kingdom

Mr. BLAIZOT

Tel.: (33) 73 30 23 07
Fax: (33) 73 31 66 73

Michelin
Place des Carmes
63040 Clermont-Ferrand Cedex 1
France

Ms. Janie BLANCHARD

Tel.: (33) 1 46 96 17 60/17 83
Fax: (33) 1 46 96 15 11

Government Relations (Director)
Northern Telecom Europe
12bis rue Jean Jaurés
92807 Puteaux
France

Mlle. Françoise BOUSQUET

Tel.: (33) 1 69 87 10 01
Fax: (33) 1 69 87 27 00
E-mail: bousquet@pao.mts.dec.com

Manager Corporate Standards and Consortia France
Digital Equipment France
43 Boulevard Diderot
75012 Paris
France

Mr. Keith BRANNON

Tel.: (41) 22 749 0111
Fax: (41) 22 733 3430
E-mail: brannon@isocs.iso.ch

Group Manager IT
ISO
1 rue de Varembé
1211 Geneva
Switzerland

Mr. Vishnumohan CALINDI

Tel.: (41) 22 730 6073
Fax: (41) 22 730 5881

Planning Officer
Strategic Planning Unit
International Telecommunication Union
Place des Nations
1211 Geneva 20
Switzerland

Mr. Brian E. CARPENTER

Tel.: (41) 22 767 4967
Fax: (41) 22 767 7155
E-mail: brian@dxcoms.cern.ch

Chair, Internet
Architecture Board
Computing and Networks Division
CERN
1211 Geneva 23
Switzerland

Mr. Yurdakul CEYHUN

Tel.: (90) 312 210 1000/2351
Fax: (90) 312 210 1315
E-mail: yceyhun@rorgual.cc.metu.edu.tr

Advisor
Tübitak
Ankara
Turkey

Mr. CHAZERAND

Tel.: (33) 1 47 67 47 04
Fax: (33) 1 47 67 47 97

Director, Public Affairs
AT&T France
Tour Horizon
52 quai de Dion-Bouton
92806 Puteaux Cedex
France

Mr. In-Uk CHUNG

Tel.: (82) 2 570 4060
Fax: (82) 2 570 4249
E-mail: chungi@sunnet.kisdi.re.kr

Research Fellow
Korea Information Society Development Institute
1-33 Tuom-Dong
Kwachun
Kyunggi-Do 427-070
Korea

Mr. Walter DE BACKER

Tel: (32) 2 296 8192
Fax: (32) 2 296 8359
E-mail: wdeb@dg13.cec.be

Conseiller Principal, DG XIII
European Commission
200 rue de la Loi
1049 Bruxelles
Belgium

Mr. Jaime ECHEVARRIA

Tel.: (34) 4 416 6978
Fax: (34) 4 416 2174
E-mail: jaime.echevarria@iberdrola.es

OSITOP President
Director Corporative of IBERDROLA
Gardoqui, 8
48008 Bilbao
Spain

Mr. Dieter GANN

Tel.: (49) 7031 14 2497
Fax: (49) 7031 14 3147
E-mail: dieter.gann@hpgrmy.desk.hp.com

Manager External Technical Relations Europe
Hewlett Packard Gmbh
Herrenbergerstr. 130
71004 Böblingen
Postfach 1430
Germany

M. Antoine GILLABERT

Tel.: (41) 31 338 5058
Fax: (41) 31 338 7605
E-mail: gil@gd2.telecom.swiss.ptt.ch
X400: ch; arcom; swissptt2; ptt; ti; gi

Counsellor
Swiss Telecom PTT
Telecom International
International Relations
Victoriastr. 21
3030 Berne
Switzerland

M. Attilio GNETTI

Tel.: (39) 6 8589 463
Fax: (39) 6 8543 958

Director of Standards
STET
Corso d'Italia, 41
00198 Roma
Italy

M. Claude HAMON

Chargé de Mission
CIIBA
56 rue de Varenne
75700 Paris
France

Mr. Richard HAWKINS

Tel.: (44) 1273 678 165
Fax: (44) 1273 685 865
E-mail: r.w.hawkins@sussex.ac.uk

Consultant
SPRU
Mantell Building
University of Sussex
Falmer, Brighton
East Sussex BN1 9RF
United Kingdom

Mr. Denis HILL

Tel.: (41) 22 749 0233
Fax: (41) 22 733 3430
E-mail: hill@isocs.iso.ch

Basic Semantic Repository Project
ISO
1 rue de Varembé
1211 Geneva 20
Switzerland

Mr. Eivind JAHREN

Tel.:(47) 2234 4980
Fax: (47) 2234 9517
E-mail: eivind.jahren@ad.dep.telemax.no

Deputy Director General
Ministry of Government Administration
Box 8004, Dep
0030 Oslo
Norway

Mr. Akifumi KAMBARA

Tel.: (81) 3 3798 6823
Fax: (81) 3 3798 9133
E-mail: kambara@ppd.ho.nec.co.jp

Chief Manager, Computers Group
Planning Division
NEC Corporation
7-1 Shiba
5-Chome
Minato-Ku
Tokyo 108-01
Japan

Mr. John KETCHELL

Tel.: (33) 92 94 42 57
Fax: (33) 93 65 47 16
E-mail: ketchell@etsi.fr
X-400: C=fr; a=atlas; o=etsi; s=ketchell

European Co-ordination Officer
ETSI Secretariat
Route des Lucioles 650
06921 Sophia Antipolis Cedex
France

Mr. Akira KUBOTA

Tel.: (33) 1 53 76 61 91
Fax: (33) 1 45 63 05 44

Counsellor
Delegation of Japan to the OECD
11 ave Hoche
75008 Paris
France

Mr. Norman LAMB

Tel/Fax: (44) 1277 624246

Consultant
46 The Rising
Billericay
Essex CM11 2HN
United Kingdom

M. Daniel LECOMTE

Tel.: (33) 1 47 85 54 47
Fax: (33) 1 47 85 55 60
E-mail: lecomte@col.bsf.alcatel.fr

Division Manager
Alcatel
54 Ave Jean Jaurès
92707 Colombes Cedex
France

Mr. W. A. McCRUM

Tel.: (613) 990 4493
Fax: (613) 957 8845
E-mail: mccrum.william@ic.gc.ca

Director
Standards and Interconnection
Industry Canada
300 Slater Street
Ottawa
Ontario K1A OC8
Canada

M. Giovanni NAPOLITANO

Tel.: (39) 6 481 62430
Fax: (39) 6 481 62456

"Autorita" Garante della Concorrenza e del Mercato
Via Calabria
48-00187 Roma
Italy

Mr. Ray O'CONNOR

Tel.: (41) 41 397 2138
Fax: (41) 41 397 1050

Technology Management Consultant
Unterstegli
6354 Vitznau
Switzerland

Mr. Jun OKAYAMA

Tel.: (81) 3 3504 4835
Fax: (81) 3 3509 4553
E-mail: j-okayam@mpt.go.jp

Senior Advisor, Telecommunications Bureau
Ministry of Posts and Telecommunications
3-2 Kasumigaseki 1-Chome
Chiyoda-Ku
Tokyo 100-90
Japan

Mr. Samuel RAMOS

Tel.: (33) 1 53 67 86 00
Fax: (33) 1 39 76 64 93

Delegation of Mexico to the OECD
4 rue Gacliera
75116 Paris
France

Mr. John RANKINE

Tel.: (1) 203 226 0657
Fax: (1) 203 222 7978
E-mail: j.rankine@ieee.org

Consultant to IEEE Standards Board
Rankine Associates
231 Bayberry Lane
Westport CT 06880
United States

Mr. Henry RYAN

Tel.: (353) 91 - 754813 / 757651
Fax: (353) 91 - 753946 / 754444
E-mail: hryan@essb.enet.dec.com

IT Standards Consultant
Corporate Standards and Consortia
Digital Equipment Corporation
European Software Centre
Ballybrit, Co. Galway
Ireland

Mr. Phil SAUNDERS

Tel.: (1) 905 238 7271
Fax: (1) 905 238 7203
E-mail: phil.saunders@nt.com

Account Vice President, Commercial Relations
Northern Telecom (Nortel)
2920 Matheson Boulevard E.
Mississauga,
Ontario L4M 4W7
Canada

Mr. Michael A. SMITH

Tel.: (41) 22 749 0280
Fax: (41) 22 733 3430
E-mail: smith@isocs.iso.ch

Director, Standards
ISO Central Secretariat
1, rue de Varembé
1211 Geneva 20
Switzerland

Mr. Liv SOLHJELL

Tel.: (47) 2246 6094
Fax: (47) 2246 4457
X.400; G=liv; S=solhjell; O=norsk standard;
P=msmail; A=telemax; C=no

Technical Director
P.O. Box 7020 HO
0306 Oslo
Norway

Ms. J. TALLARICO

Tel.: (1) 202 482 5820
Fax: (1) 202 482 2669
E-mail: jennifer-tallarico@ita.doc.gov

International Trade Specialist
US Department of Commerce
Room 1120
14th and Constitution Ave NW
Washington DC 20230
United States

Mr. Yasuhiro TANAKA

Tel.: (81) 3 3504 4792
Fax: (81) 3 3504 0884
E-mail: y.tanaka@mpt.go.jp

Assistant Director, International Organisation Div.
International Affairs Department
Minister's Secretariat
Ministry of Posts and Telecommunications
1-3-2 Kasumigaseki
Chiyoda-Ku
Tokyo 100-90
Japan

Mr. M. TIGER

Tel.: (1) 613 990 4242
Fax: (1) 613 998 4530
E-mail: Tiger.Michael@ic.gc.ca

Senior Policy Advisor
International Telecommunications Division
Telecommunications Policy Branch
Industry Canada
300 Slater Street
Ottawa
Ontario K1A OC8
Canada

Mr. Stefaan VAN DER VEKENS

Tel.: (33) 92 94 42 24
Fax: (33) 93 65 47 16
E-mail: stefaan.van-der-vekens@etsi.fr
X.400: c=fr; a=atlas; p=etsi; s=van-der-verkens; g=stefaan

ETSI
Route des Lucioles 650
06921 Sophia Antipolis Cedex
France

Mr. Helmut WILLKE

Tel.: (49) 521 106 3869
Fax: (49) 521 106 6019
E-mail: hillke@soz01.uni.bielefeld.de

Professor
Postfach 100 131
33501 Bielefeld
Germany

Mr. M. YOSHIDA
Tel.: (33) 1 53 76 61 43
Fax: (33) 1 45 63 05 44

First Secretary
Permanent Delegation to Japan

SECRETARIAT
Directorate for Science, Technology and Industry
Information, Computer and Communications Policy Division

Mr. John DRYDEN

Tel.: (33) 1 45 24 93 73
Fax: (33) 1 45 24 93 32
E-mail: john.dryden@oecd.org

Head of Division

Mr. Georges FERNE

Tel.: (33) 1 45 24 93 46
Fax: (33) 1 45 24 93 32
E-mail: georges.ferne@oecd.org

Principal Administrator

NOTES

[1] "In a competition between standards, it is not necessarily the best solution which triumphs, but rather that which has made a better start and managed to build up quickly a critical mass of users which will attract ever more new users", in: OECD, *Information Technology Standards: The Economic Dimension*, Paris 1992, pp. 8

[2] "Problems arise, when technologies are changing rapidly, since the process of standardisation is slow and will fall farther and farther behind. The challenge, then, is to encourage the development of standardised interfaces earlier than might be 'natural' but to do it in such a way that future development paths are not cut off... If policy-makers foresee the survival of several standards, and believe that communication among hose standards will be an important goal, then encouraging flexibility of design in the sense of non-idiosyncratic interfaces and data structure (to name but two examples) will lower the costs of making it possible for different systems to communicate in the future", in: OECD, *Information Technology Standards: The Economic Dimension, op. cit.*, pp. 47-48.

[3] See: OECD, The Role of Users in the IT Standardisation Process, forthcoming publication.

[4] Given the wide variety of national institutional arrangements for standardisation, it would be difficult to produce a comprehensive definition (for example, SDOs may or may not be part of the government structure). We refer here loosely to recognised national standardisation agencies that have as a primary responsibility participation in international discussion on behalf of their national standardisation community. Other bodies, such as consortia or fora, will be referred to below as "informal" to differentiate them from official SDOs.

[5] Ibid.

[6] See Note 4 above.

[7] This tension between the quest for universality and the need to take account of the various stages of technological and commercial development underpins to a large extent the diversity of standardisation patterns, from non-proprietary to proprietary standards, or from *de jure* standards (formal public standards developed by a publicly recognised standardisation organisation such as ISO, IEC and ITU) to *de facto* standards (standards established through market acceptance, such as IBM's Systems Network Architecture (SNA) and Microsoft Windows). Standards can also be defined in accordance to their use: from mandatory by law for every product concerned (for example when safety considerations have prompted regulations), to requested by a vendor or system integrator, and including numerous instances where the application of a standard is mandatory for public procurement (as in the case of the European Handbook for Open Systems -- EPHOS -- according to a decision of the European Council). A consequence of this complexity is that there is no fully satisfactory typology of standards, and we do not intend to enter a debate on definitions that have been addressed in a previous OECD report. See: *Information Technology Standards*: The Economic Dimension, *op. cit.*, pp. 11-12.

[8] This reflects, for example, European legislation (Council Directive 83/189), according to which: "Standard shall mean a technical specification approved by a recognised standardising body for repeated and continuous applications, compliance with which is in principle not compulsory".

[9] See: Freeman, C., Technical Change and Unemployment: The Links between Macro-economic Policy and Innovation Policy, paper prepared for the OECD Conference on Technology, Innovation Policy and Employment, Helsinki, October 1993.

[10] See: Grübler, A. The Rise and Fall of Infrastructures: Dynamics of Evolution and Technical Change in Transport, Vienna/Heidelberg, Technical University of Vienna/Physica Verlag, 1988; and: ICSPS, Science and Technology in Developing Countries -- Strategies for the 1990s, Unesco, 1992.

[11] Ibid.

[12] See The Economic Dimension of Standards, op. cit.; also: The Role of Users in the IT Standardisation Process op. cit..

[13] See: OECD, The Economic Dimension of EDI, publication pending.

[14] These two types of standards are usually referred to as "anticipatory" or "meta" standard.

[15] The case of "quality standards" such as ISO 9000 (whose coverage obviously extends far beyond the ICT area we are concerned with in this report) is often mentioned in this respect, because of the uncertainties and confusion that have plagued the implementation of commonly accepted conformance testing procedure world wide.

[16] Walter C. Neale, 'Institutions', in: *Journal of Economic Issues*, Vol. XXI, No. 3, September 1987, pp. 1181.

[17] E.R. Weidlein & V. Reck, "A Million Years of Standards"; H. Coonley, "The International Standards Movement"; C. A. Adams, "The National Standards Movement: Its Evolution and Future"; in: D. Reck, ed., *National Standards in a Modern Economy* , New York: Harper Bros., 1956. See also: ISO, Geneva: ISO, September 1986.

[18] The International Telegraphic Union (the forerunner of the present ITU) was founded in 1965. It was the first major organisation to concern itself with public domain 'standards' in the modern understanding of the term. See: G.A. Codding, "Evolution of the ITU", in: *Telecommunications Policy*, August 1991, pp. 271-285.

[19] B. Sinclair, "At the Turn of a Screw: William Sellers, the Franklin Institute, and a Standard American Thread", in: *Technology and Culture*, Vol. 10, No. 1, January 1969, pp. 20-34.

[20] G. V. Thompson, "Intercompany Technical Standardisation in the Early American Automobile Industry", in: *Journal of Economic History*, Vol. XIV, No. 1, Winter 1954, pp. 1-20; D. Hemenway, *Industrywide Voluntary Product Standards*, Cambridge: Ballinger, 1975.

[21] C. Cargill, Information Technology Standardisation: Theory, Process, and Organizations, n.p.: Digital Press, 1989, pp. 47-56; B. Dankbaar, and R. van Tulder, *The Influence of Users in Standardisation: The Case of MAP', Maastricht Economic Research Institute on Innovation and Technology*, MERIT, Working Paper, 91-013, 1991; T. F. Bresnahan and A. Chopra, "The Development of the Local Area Network Market as Determined by User Needs", in: *Economics of Innovation and New Technology*, Vol. 1, pp. 97-110.

[22] There are of course a number of suggested theoretical models of how such a determination might be made (see: P. A. David and S. Greenstein 'The Economics of Compatibility Standards: An Introduction to Recent Research', in: *Economics of Innovation and New Technology*, Vol. 1, 1990, pp. 3-41). These are primarily related to situations of *de facto* standardisation in the marketplace.

[23] To give an idea of the costs for a single firm, we may quote the example of Siemens where, when this report was being drafted, 329 people were active in standardisation work, with 25 having chairmanships of various standardisation groups. Siemens Nixdorf is also a founding member of bodies such as the Open Systems Foundation (OSF) (subscription fee: 5 million $/year).

[24] ISO, Member Bodies, seventh edition, ISO, Geneva, 1991.

[25] The following account is drawn from an assessment of standardisation power shifts undertaken by Richard Hawkins, SPRU, University of Sussex (United Kingdom) -- unpublished.

[26] Europe and the global information society, Recommendations to the European Council, Brussels, 26 May 1994.

[27] British Standards Institution, *Annual Review 1992-93*. BSI reports a decline in sales revenue of 11 per cent.

[28] A list of the main acronyms will be found in Annex 1 attached to this Summary.

[29] The list of participants will be found in Annex 2 attached to this Summary