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ABSTRACT

This document presents the findings of a joint study on telecommunications in support of the education, science, culture, communication, and information sectors, particularly from the point of view of developing countries. The topics include: (1) an overview of the present situation from the user's perspective, with a focus on present practices and trends in telematics use and user difficulties and examples of solutions; (2) practices from the point of view of the International Telecommunications Union (ITU) and telecommunication operators, focusing on general tariff principles as seen by the ITU, tariff policies at the national level, and variations in tariff practice; (3) the options of public authorities in terms of services and policies, and strategies for the future; and (4) recommendations for the definition and organization of demand, standards, tariff policy, and developmental assistance. A list of acronyms and a list of experts who participated in the study are provided. (Contains 60 references.) (AEF)

The right to communicate: at what price?

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May 1995

International Telecommunication Union
and
United Nations Educational, Scientific and Cultural Organization

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UNIÓN INTERNACIONAL DE TELECOMUNICACIONES

INTERNATIONAL TELECOMMUNICATION UNION

organisation des nations unies pour l'éducation, la science et la culture

organización de las naciones unidas para la educación, la ciencia y la cultura

united nations educational, scientific and cultural organization

10 May 1995

To the designated authorities of Member States of the ITU and of UNESCO

Dear Sir/Madam.

It gives us great pleasure to transmit herewith a copy of a study entitled "The Right to Communicate - At What Price? Economic Constraints to the Effective Use of Telecommunications in Education, Science, Culture and in the Circulation of Information" which was prepared jointly by the ITU and UNESCO and presented to the World Telecommunication Development Conference (WTDC/94) convened by the ITU in Buenos Aires from 21 to 29 March 1994. The background and goals of this joint study are explained in the Preamble.

We believe that the study defines a new and promising approach to ensuring access to good telematics facilities at affordable cost for educational, cultural, scientific, media and information, and social and administrative applications, particularly for users in the developing countries (presented in the strategies and recommendations in chapters 5 and 6). In brief, this approach involves three elements: i) cooperation among the users in order to understand, consolidate and promote demand for telematics services, ii) partnership between telecommunication operators and users to develop and expand services based on market opportunities and principles, and iii) enlightened public policies to promote telematics infrastructure building and use by development-related sectors, including appropriate tariff reform measures emphasizing cost-oriented access.

The international community, and particularly the ITU and UNESCO, has an opportunity and responsibility to catalyze this process. After affirmative consideration by the WTDC/94, the joint study is being taken into account by the two ITU-D Study Groups set up by the Conference, and is already generating joint ITU-UNESCO activities in the framework of the Buenos Aires Action Plan adopted by WTDC/94 and UNESCO's Programme for 1994-95.

.../...

In order to develop cohesive and fruitful action in improving access to telematics for development, we would welcome your comments on the relevance of this study and on ways in which appropriate elements could be tested or implemented in your country.

We remain at your disposal for any assistance you may require.

Yours faithfully,

Pekka Tarjanne
Secretary-General of the ITU

Federico Mayor
Director-General of UNESCO

EXECUTIVE SUMMARY

1. INTRODUCTION

- This Executive Summary presents the main findings of a joint study carried out by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Telecommunication Union (ITU). It considers - particularly from the point of view of the developing countries - telecommunications in support of the education, science, culture, communication and information sectors.

- These sectors have in common an orientation towards service to the public, often receive support from public funds, and represent a dispersed, but potentially vast, demand for telecommunication services which is largely unsatisfied. In addition, technological changes, particularly the growing convergence of telecommunications, informatics and audio-visual technologies, are steadily breaking down the institutional barriers and bringing these sectors together into a common market for telecommunications.

- The study broadly covers the availability of telecommunication services - particularly the transmission of data or images in digital or analogue form - and focuses on economic barriers to access (especially tariffs of such services). It traces recent developments in telecommunications and in particular the impact of trends in tariffs on universal service.

- It addresses the effect that tariffs can have on the use of telecommunications. The implication of high tariffs is that existing services would be under-used and the development of potential future services would be delayed.

- Overall it is clear that the recent trend in tariffs has been downwards, particularly at the international level, under the influence of the technological revolution and commercial competition, but the situation varies greatly among countries.

- The major communities of users and user institutions of concern to UNESCO are researchers, teachers in educational establishments and their students, information specialists, the cultural information community, journalists and the radio-television community. These "UNESCO communities of interest" need telecommunication services of all kinds. They are at the heart of the evolving information and communication world where access to knowledge will be the driving force in shaping the future of society.

2. OBJECTIVE

The study is intended to bring together representatives of the UNESCO communities of interest and the telecommunication sector. Its objective is to clarify user requirements, and to identify opportunities. It does not attempt to cover all aspects of the problem of information access, but aims to provide a balanced analysis for an evolving debate between users and service providers. It concludes with a number of ideas for further action.

3. THE USER VIEWPOINT

This section in the Report provides an overview of the present situation concerning the use of telematics and data transmission services - including audio-visual signals - by the different groups of users under study. It describes the constraints, such as connection procedures, tariff structures or terminal equipment restrictions, which may be dissuasive to attaining optimal, cost-effective service. The Report offers information on user needs, problems and solutions. The following are some examples:

Researchers employ two types of networks which have developed in parallel - public data networks (PDNs) available to all users and private "research" networks which are in principle restricted to specific user groups. The latter, linking co-operating institutions through private channels, have developed widely in the industrialized world thanks to strong user communities and telecommunication facilities and support from both government and industry. The most impressive development in this field is undoubtedly the Internet which is said to be the world's largest computer network with more than 1.3 million connected computers and about 8 million users.

- Research networks represent both a challenge and an opportunity for telecommunication operators: a challenge because such networks may represent revenue diversion or dilution, and an opportunity because of the new markets which are created.

Educators are interested in telecommunications for distance education. The more advanced needs in this field require economies of scale to be able to afford state-of-the-art technologies. One example is in the Pacific region where The Commonwealth of Learning is proposing a satellite-based network with several levels of service. These range from interactive video-conferencing at major institutions, to interactive audio-conferencing and e-mail at key population centres, to semi-interactive audio-conferencing at outer island sites. The success of this scheme will depend on the cooperation of the education systems of the region in the procurement of telecommunication facilities and services on a common basis, and in administration and management of the resultant network on a cooperative basis.

Library networks see a growing need for telecommunications for access to and sharing of information. Access to telematics applications in and between countries in different geographic and development situations is becoming an increasingly important requirement. Specifically, the

- Demand for information retrieval is expanding rapidly, due to the growth and increasing decentralization of automated library systems and large information centres;

- Demand for electronic interlibrary loan services is expected to increase as the international standard protocol for this application is implemented on a wide scale, as will the use of telecommunications for electronic document delivery;

- Developing countries require efficient and affordable telecommunication services to provide speedy access to local, regional and international information sources.

Inadequate data communication facilities, and drastically reduced financial support for library and information services, severely limit these possibilities in many developing countries.

Organizations responsible for access to cultural and heritage materials have wide-ranging potential uses for telecommunications. Those concerned with works of art use data communications, throughout the world, to access catalogues and databases. This use has expanded from narrow band data requirements to sophisticated image retrieval. Communication among cultural institutions is receiving initial emphasis, with a view to future development of telecommunication applications open to specialized researchers and eventually the public at large.

Journalists use messaging services to submit stories and photographs and also access databases, including press archives, for background information. They rely to a large extent on the public switched telephone network for data transfer. The press, in turn, makes heavy use of specialized channels, particularly for remote printing, and is increasingly using telecommunications in electronic publishing applications.

Radio and television organizations use telecommunication channels to exchange news and programmes among themselves and also to reach consumers via direct broadcasting and cable. Television differs from radio mainly in the much larger bandwidth that is required, although new digital compression techniques are continually improving the throughput of data.

The problems faced by users are multiple and can require diverse approaches depending on the specific needs and situation:

In some countries and regions, disparities in tariff practices at the national and international levels are seen by users as contributing to high costs or ineffective telecommunications use. In other countries and regions, the users may feel real or perceived structural or development problems, which can only be resolved by consultation among all of the concerned parties and, where necessary, by appropriate political decisions. A major problem for researchers and other professionals using data communication services has been that public data networks and research networks have not in general been compatible. In Africa, unavailability and poor quality of lines have been cited as a serious problem restricting the development of data communication, as well as lack of awareness of, and cultural barriers towards, such communication.

A user in Jamaica, noted that: "A vigorous programme of expansion [of telecommunication services] is taking place, but there is, and will be for some time, considerable delay in the provision of certain advanced services available to industrialized countries".

A number of successful approaches to reducing the costs of telematics services have been identified with the following examples being typical:

- In Colombia, discounts of 15-35% for national calls and 15-25% for international calls are offered to the higher education sector by the national public data network, COLDAPAQ and fees for connection to national and international research networks are reduced 62.5 and 25% respectively for institutions in this sector.

- In the Dominican Republic, a promotional agreement with the national PTO provides for free connection of the research community to the national public data network and to the international research network system.

- The telecommunication authorities in four East African countries have already licensed HealthNet ground stations, apparently free of charge; the rationale used was that the network is an emergency service analogous to emergency numbers in the industrialized countries which are not tariffed.

- Several developing countries, such as Indonesia and Oman, offer substantial telecommunication discounts for press use.

- In France, as part of a general system for assistance to the press, the national PTO grants news agencies and the daily newspapers 50% reduction for leased telegraph lines; the same reduction is offered through state budget subsidies for national switched telephone network use, leased telephone lines and ISDN.

- In Central America, the Comisión Técnica Regional de Telecomunicaciones (COMTELCA) oversees an agreement on transmission of non-profit cultural and governmental television programmes free-of-charge over the subregional microwave network.

- In the Arab States a major Regional Telecommunication Development Conference sponsored by ITU/BDT requested the national telecommunication operators: "to exempt Arab TV organizations from payment of ground sector charges (commercial charges) for news and programmes transmitted on ARABSAT TV channels leased by Arab States Broadcasting Union" (including sound co-ordination channels); any charges for the ground sector "should only be promotional and reduced to the minimum possible".

4. THE ITU AND THE TELECOMMUNICATIONS OPERATOR VIEWPOINTS

This section of the Report clarifies the basic economic and regulatory principles behind telecommunication pricing, with respect to the different categories of public telecommunication operators (PTOs). It describes the influence of the changing telecommunication environment situation (technology and liberalization) on telecommunications pricing and analyzes to what extent the awarding of reduced prices by PTOs may be possible. (Readers unfamiliar with tariff issues are strongly advised to read the original text in its entirety).

The evolution of telecommunication tariff principles has closely followed technical, economic and political developments since 1865. The latest set of general tariff principles are contained in ITU (CCITT) Recommendation D.5. These are:

1) the principle of overall cost compensation (including capital interest);

2) recognition of cross-subsidization among services;

3) consideration of the value of the service rendered to the user;

4) avoidance of harmful competition among different types of services;

5) respect for the principle that the surplus income should not be greater than the amount required for the efficient running of services.

Recommendation D.10, governing the general tariff principles for the international public data transmission service over public data networks, enumerates a number of factors in addition to the provision of Recommendation D.5:

1) tariff relationships with other services provided by the Administrations;

2) flexibility, enabling new needs to be accommodated as the service develops;

3) maximum simplicity from the administrative viewpoint;

4) the geographical configuration of countries:

5) not to impart undue advantage or disadvantage to any category of user;

6) encouragement of customer choice, depending upon needs, concerning the use of circuit or packet-switched services where the alternative exists;

7) encouragement of the use of the public data network, meeting the needs of as many users as possible, and promoting optimum growth and utilization of the network;

8) the need to be easily understood by subscribers;

9) sustainability of the service on a long-term basis.

Another important Recommendation is D.140 covering accounting rate principles, which establishes the principle that accounting rates underlying international telephone charges should be cost-oriented. This Recommendation will, *in time*, positively affect user charges given the underlying cost trend, taking into account the situation of the countries concerned.

It is worth remembering that ITU Study Group 3 deals only with general tariff principles and cannot consider the possibility of awarding a reduced charge for a specific group of users since the level of charge is, in principle, a national matter.

Having established the principles on which tariffs are based, the Report describes how tariffs are used by PTOs, using two extreme cases: monopoly and oligopoly/competitive operators. It then discusses the role of the regulator noting that the objectives of regulators differ according to whether they are dealing with a monopoly or oligopoly/competitive situation. The Report states that:

- From the charging point of view the fundamental duty of the regulating entity is to ensure the best possible deal for the end-user in terms of quality, choice and value for money.

The Report addresses, as a central issue, whether or not telecommunication tariffs are too high and deals with three subsidiary questions:

- Why do telecommunication tariffs vary so widely between countries?
- Is the level of profitability achieved by PTOs unjustifiably high?
- Are telecommunication tariffs too high as a percentage of *per capita* income as a measure of clients' resources?

Conclusions are elusive for a number of reasons including the fact that it is hard to distinguish voice services from data services in any economic analysis, because telecommunication network infrastructures have always been designed and equipped to transmit speech. Most tariff studies have been restricted to telephone services of the public switched network. Existing studies on charging in data services are fragmentary and cover only a number of developed countries.

- A specific tariff and traffic study on data services would thus require much additional effort and would be rendered difficult by the fact that many developing countries are not yet fully equipped with data transmission services.

Various examples of improvements in tariffs are presented and the Report notes that, even in the developing countries, telecommunication charges have fallen noticeably in recent years. As an illustration a study carried out by the Tariff Group for Asia and Oceania in 1992 shows that international telecommunication charges decreased every year by an average of 3.5% within the region. But this tendency has been masked for the users by an extraordinary growth in data communication volumes and budgets, and it is also true that commercial competition has exacerbated the complexity and diversity of tariff practices and thus increased demand for tariff transparency.

In this context, the report offers a number of positive suggestions to help the UNESCO communities to benefit from these new trends. One way that PTOs can attract more appropriate types and higher volumes of traffic is to adopt a commercial approach aimed at specific user groups. Although such practice is now common for the business sector and its various specialized branches, this has not often been the case for public service and professional sectors such as the press, broadcasters, education and research.

5. OPTIONS AND STRATEGIES

Telecommunication tariffs have become the preoccupation of service providers, the user community and governments but must be considered in a larger context of the *availability* of, and constraints on *access* to telecommunication facilities and services.

Tariff principles have evolved and the trend is now toward cost-oriented, non-discriminatory mechanisms. The major burden for addressing the problems rests with government authorities who are being given two challenges. They are being called upon to:

- take steps, in the public interest, to extend the availability of services, particularly to meet the growing needs of the public sector;

- remove, through policy and regulatory actions, barriers of access to telecommunication services including excessively high tariffs.

Concerning the latter, there are a number of tariff reducing mechanisms already in place (e.g. off-peak discounts, high-volume discounts, experimental tariffs) which fall within the practical definition of "non-discriminatory". These mechanisms. when applied judiciously and in conjunction with other policies, can help reduce the cost of access to services.

In elaborating such an overall approach, it may be useful to consider that the sectors of public concern, such as education, are in some ways in a situation concerning access which is analogous to that of the neglected rural sector in the industrialized countries of the 1930s. Special efforts were needed then to extend services, an investment which has been returned many times in profits to the telephone companies and to the countries concerned in terms of contribution to the national economy.

The right conditions for the growth of telecommunications have been well documented in ITU studies.

The formula for success includes:

- investment, regulatory reform, service development and regional cooperation.

There are well documented "models" where national policies, properly applied, have resulted in dramatic growth of the telecommunications infrastructure. By extension, the application of sound national policies to the use of telecommunications in the sectors of public concern can be predicted to produce similar positive results.

There have been a myriad of experiments and user trials in telecommunication. Many of these trials have been well documented and evaluated and lessons can be learned from these experiences.

- Positive examples of trials of telecommunication services in the public sector offer models for the adoption of similar services in other countries.

Strategies for the future : Policy recommendations

Education, science, culture, communication and information will have a major influence on the society of tomorrow, and particularly on telecommunication development. Education forms future telecommunication users and specialists, while the media are instrumental in moulding public opinion in this area. Researchers and enterprises in informatics, science, culture and the media are conceptualizing, experimenting with, and already applying the innovative uses of telecommunications which will form the basis for future, advanced public services. Telecommunications can be a major factor in enabling these key sectors to develop and meet their needs effectively. However, these sectors are facing serious problems in their use of telecommunications. The Report provides 16 policy recommendations, of a general nature, which can help shape the continuing evolution of telecommunications in support of the UNESCO communities of interest. These are:

- *The need for improved dialogue between governments, telecommunication entities and users in these sectors of public concern.*

- *The need for users to capitalize strategically on their collective investments, their international purchasing power, their contribution to national development goals and their potential ability to spur the development of national telecommunication infrastructures. This can be facilitated by the strengthening or formation of user groups at the national, regional and international levels.*

In the emerging telecommunications environment, dialogue at the **regional** level can provide particularly fruitful opportunities.

- *Users in the UNESCO sectors of public concern should actively participate in regional conferences and other meetings of telecommunication operators and users and should encourage the formation of such fora where they do not yet exist, and they should engage in a systematic effort to document and define their generic requirements for telecommunications at the regional level and make these known to regional organizations.*

Further:

- *It is in the long-term interest of telecommunication entities to accord users in sectors of public concern "most valued customer" status and to give them high consideration concerning access, flexibility and pricing as is done for large government and business customers.*

- *National operators, private service suppliers and users in sectors of public concern might consider the formation of joint ventures, with appropriate support from governments and regulatory authorities.*

Large organizations have been able to benefit from cost savings and increased efficiency by drawing together the different elements of their networks, creating customized networks involving a mix of suppliers, systems and services.

- *Agencies in sectors of public concern should consider aggregating their collective regional demands for telecommunication networks and services and presenting these to national and regional organizations. This would include the consideration of new services and applications.*

- *The purchasing, sharing and management of networks and services might be carried out by a common service agency acting on behalf of the joint interests of member countries or entities of public concern within a region.*

The World Telecommunications Advisory Council (WTAC) of the ITU suggested that the role of telecommunications infrastructure in overall national development should be raised to the highest political level.

- *The importance of telecommunication policies to permit shared and common use solutions should be part of any deliberations of Heads of State and other world leaders on the role which telecommunications play in economic and social development.*

Investment in telecommunications in the developing world will no doubt continue to come primarily from financial agencies, governments and from international aid. New telecommunication networks and services can be expected to improve the delivery of social services at reasonable cost, subject to the formulation of supportive policies and regulations.

- *Investment by governments and international agencies to support telecommunications in the sectors of public concern promises a twofold return. It will permit the more effective delivery of social services and will contribute to stronger telecommunication infrastructures.*

- *Users can encourage investment in telecommunications by making long-term usage commitments, perhaps through shared or "common" networks, thereby providing the justification for building and improving networks and facilities, and creating opportunities for commercial investment.*

The trend towards cost-oriented tariffs, both nationally and internationally, could pose difficulties for the sectors of public concern.

- *The cost-effective use of telecommunications by the sectors of public concern is highly dependent on reasonable and transparent national and international tariffs. The interests of public sector users should be taken into account in the further evolution of tariffs.*

While an improved policy and tariff environment would be of benefit, telecommunications will continue to be a significant budgetary item to the UNESCO user community.

- *Users of telecommunication services need to be able to collaborate in the planning of their networks and services on the basis of benefits and outcomes. A full appreciation of the costs of telecommunications is a necessary element in this planning process.*

News agencies and broadcasting unions in developing countries are in most cases legally non-profit organizations and for many years have attempted to obtain lower telecommunication tariffs. Requests for lower tariffs have largely gone unnoticed, and many of these important organizations now find that their very survival is threatened.

The technological changes that have occurred in recent years should encourage the development of co-operation between telecommunication operators and the media with the aim of establishing new partnerships which would fully meet the needs and interests of both parties at the technical and commercial levels.

- *Governments and decision-makers in developing countries are urged to support the granting of lower tariffs, taking account of the commercial interests of the carriers as well as the developmental roles of news agencies and broadcasters.*

Telecommunications and related information technology standards have not, until now, been a major issue for the publicly funded sectors. However, the technologies now being employed by networks are heavily influenced by standards promulgated by the ITU and the International Organization for Standardization (ISO), as well as by *de facto* standards developed, for example, by the Internet (which uses the TCP/IP protocols). While international efforts are under way to harmonize standards, users need to maintain an awareness of the issues and their impact on the use of telecommunications.

- *Standards can have a direct effect on the costs and interoperability of networks. Users will need to ensure that their needs and requirements are understood and taken into account by standards setting bodies. Representation of these needs should be made to the ITU, ISO and other national and international bodies.*

- *Shared, multi-user networks will require the creation of an overall planning framework or model, based on common (international) standards.*

6. RECOMMENDATIONS

Solutions to the problems identified in the study addressed the basic issues of availability, access and costs, with emphasis on the needs of users in the fields of education, science, culture, mass media and information in developing countries.

The following recommendations[1] are offered which, if put into effect, would begin to create the favourable environment outlined in the strategies above. In the interpretation of the recommendations, Article 6.1 of the International Telecommunication Regulations dealing with tariff questions should be fully recognized.

It is recommended that:

The following recommendations, as well as the strategies outlined above, should be submitted for consideration at international fora beginning with the ITU World Telecommunication Development Conference in Buenos Aires in March of 1994. It is intended that ITU and UNESCO work together to promote their implementation in co-operation, as appropriate, with governments, regulatory authorities, telecommunication operators and users.

6.1 Definition and organization of demand

Strong user groups are a precondition for definition of common needs and successful negotiation with telecommunication operators.

It is recommended that:

6.1.1 *UNESCO should assist users on a national or regional level to identify and clarify their needs and barriers to access, and to strengthen, and where necessary create, effective user groups;*

[1] The numbering of the recommendations in the full document has been retained for ease of reference.

6.1.2 *UNESCO, in co-operation with regional organizations and national decision-makers, and with the assistance of ITU, should encourage partnership between users and telecommunication operators and private service suppliers to develop appropriate telecommunication facilities and services, through practical activities such as:*

- *Organization of global, regional and national fora to maintain a dialogue between operators and users, taking account of the ongoing ITU activities in this area;*
- *Carrying out pilot field testing of innovative market-oriented tariff schemes and of new technologies and services;*
- *Joint sponsorship of user-oriented research and development, including the collection and sharing of market data;*
- *Consideration of joint ventures in the light of the above activities.*

6.2 Standards

In order to ensure the development of compatible telecommunication services available to the UNESCO sectors of interest, particularly in the developing countries, the concerned users and technical specialists should be actively involved in the standardization process.

It is recommended that:

6.2.1 *User groups in education, science, culture and information should be further encouraged by ITU-T to participate in its standardization activities or to be associated in this effort at the national level, in a manner similar to that in which the media are already participating. UNESCO should assist the users in developing countries to organize themselves for this effort;*

6.2.2 *The concerned international standardization organizations, in collaboration with bodies involved in research network development and interconnection, should address the issue of standards for international networks of interest to the publicly-funded sectors. In particular, joint efforts should be undertaken to ensure that network standards do not inhibit compatibility of or access to services in the developing world;*

6.2.3 *UNESCO should help to co-ordinate the development of models or frameworks for application networks and promulgate means to assist users to plan their utilization of telecommunications services.*

6.3 Tariff policy

It is important that tariff policies give special attention to the sectors of public concern, taking particular account of contributions to national socio-economic and cultural development, democratization and the newly emerging economic environment.

It is recommended that:

6.3.1 *Governments and regulatory authorities of developing countries should encourage, in co-operation with the ITU and UNESCO, a step-by-step reform by their operating Administrations or recognized operating agencies of the domestic and international tariffs, in order to promote the establishment of networks and services in the fields of education, science, culture, mass media and information;*

6.3.2 *Users in these sectors, with the assistance of regional and international organizations including UNESCO and ITU/BDT, should encourage national governmental and regulatory authorities to authorize innovative tariff arrangements to enable them to obtain quality services at reasonable cost and to ensure that they are informed of the most economic options.*

As an example, consideration may be given to applying tariffs based on incremental costs (the marginal cost to the carrier of expanding activity to include the additional usage) to users in UNESCO's field of interest;

6.3.3 *Taking into account the need to observe the general principle of non-discriminatory tariffs, ITU, working with national Administrations in the framework of alternative development policies, should consider strategies based on the subsidization of services in some specific sectors of public concern. This should apply for a short period of time in each case with the aim of creating infrastructure to support concerned sectors;*

6.3.4 *To assist users in the sectors of public concern, the ITU should work towards a mechanism for wide dissemination of information on tariffs and tariff practices (including tariff discounts) throughout the world, with both aggregate and case-by-case data.*

6.4 Development assistance

Some developing countries may require assistance in following up and effectively benefiting from the above prospects.

It is recommended that:

6.4.1 *UNESCO and ITU/BDT should, in co-operation with telecommunication operators and users, respond to the needs of Member States for the establishment of common networks and services in the fields of education, science, culture, communication, mass media and information, to maximize their impact and benefit from lower costs. Projects of interest might possibly include teleports serving major concentrations of users and telecentres offering community access.*

PREAMBLE

The Right to Communicate - At What Price?

Within the apparent general consensus on the importance of the free flow of information, controversy still exists concerning two distinct and often contradictory global dilemmas. First, to what extent should technology or culture determine communication development? Second, how can societal goals be reconciled with commercial objectives? These dilemmas are of particular concern to the developing countries which need clear and resourceful policies if they are to benefit from emerging communication revolution.

Two worlds at the centre of this debate seem ready to understand each other better:

- The telecommunications sector, and particularly the International Telecommunication Union, have shown an increasing awareness of the need for dialogue with the user community, their potential customers.

- UNESCO's large community of interest in the education, science, culture, communication and information sectors is at the heart of the evolving information and communication society where access to knowledge will be the driving force in shaping society as a whole. These sectors not only have huge needs for telecommunications but also can play a crucial role in the development of telecommunication systems.

The challenge is to bridge the gap between the two worlds so that both may benefit.

From the telecommunication viewpoint, the UNESCO community of interest represents a difficult market. They are often financed by limited public funds and therefore lack the commercial flexibility open to other users of telecommunications (such as the banks). Further, they are a presently a fragmented market and have no spokesperson to articulate their needs and requirements.

This study, undertaken jointly by ITU and UNESCO - as the two organizations primarily responsible for communication within the United Nations system - is first of all intended to help bring together the different actors of the information and communication world in order to clarify the terms of the debate. In so doing, it will also try to identify opportunities in this time of major change in the telecommunication sector which presents multiple challenges for international cooperation, a time when new economic mechanisms seem needed to support traditional social objectives.

Indeed, the explosion of communication services, and the intense competition that has accompanied it, has completely changed the rules since the mid-1980s. In the new world of networks, the challenges and risks are spreading more than ever over national borders, and control over communication is becoming a critical element in the unequal relations among countries and among sectors of society.

Among the obstacles to the development of communication, the question of the cost of information products and services is becoming more and more important: On the one hand the extraordinary growth in data communication volumes and budgets tends to obscure for the end-user a marked tendency towards lower tariffs - particularly at the international level - and, on the other hand, the complexity and diversity of tariff practices, exacerbated by intense commercial competition, create a feeling of disorientation among the users. All of this underlines the need for a new approach to the problem of costs and tariffs with a view to ensuring greater transparency.

ITU and UNESCO previously prepared a joint study, published in 1986, on the question of cost reductions for news media as an extension of the established tradition of assistance to the press in the telecommunication area. But today a different approach is needed: the growing convergence of telecommunication, informatics and audio-visual technologies is breaking down institutional barriers, although they still exist, and the double tendency towards globalization and diversification makes an intersectoral approach necessary. The impact of telecommunication costs on the free flow of words and ideas will thus be considered here not only in the context of the media, but will take account also of the needs of the education and research sectors and of specialized information and documentation services.

It should be noted that, although the present study concentrates on the problems of the UNESCO community of users, the results may be applicable to other sectors of public concern such as agriculture or health. It is hoped that such implications could be considered as an aspect of the follow-up.

Limited by time and budget constraints to the examination of significant examples and overall trends, this study does not attempt to cover in detail all aspects of the information access problem. Rather, it will have attained its goal if it contributes a balanced, consistent analysis to the debate and provides a number of useful ideas for future effort and action.

INTRODUCTION

This report presents the main findings of a joint study carried out by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Telecommunication Union (ITU). It considers - particularly from the point of view of the developing countries - telecommunications in support of the education, science, culture, communication and information sectors which are all concerned with the circulation of information in electronic form and thus have common needs from the viewpoint of telecommunication use. The institutions in these sectors also have in common an orientation towards service to the public in the broad sense, often receiving support from public funds, and represent a dispersed, potentially vast demand for telecommunication services which is largely unsatisfied, particularly in the developing countries. For convenience these diverse institutions will be referred to in the present study as belonging to the sectors of public concern.

The study broadly covers the availability of telecommunication services and focuses on economic barriers to access (especially tariffs). It concentrates on the transmission of users' data in analogue or digital form (including audio/visual signals), generated and processed by computers or other electronic equipment - i.e. on telematics and data transmission services (sometimes referred to in the text simply as telematics[2] services). Routine interpersonal, voice and fax traffic is not of direct interest to the study[3] , and is only of concern insofar as it indicates a demand for data traffic or employs channels which could also serve for the transmission of user data. It should also be recognized that the tendency towards a single (digital) pathway for the delivery of telecommunications means that this differentiation between services will become less and less valid in the future.

Like many other user communities, the UNESCO community faces the problem of the uneven penetration of communications across the world, and the almost total lack of modern telecommunications infrastructure in some countries. The lack of a universal telecommunications infrastructure at the international level is also a barrier to effectiveness.

Even where telecommunications facilities are in place, they are not always readily accessible. The cost of terminal equipment, the routing of traffic, limitations on bandwidth, incompatibility of standards and other factors all create barriers which inhibit the full potential of telecommunications. A major bone of contention has been the cost of telecommunication services as reflected by tariffs, which will be accorded special emphasis in this report, but as part of the much wider problem of limitation of access.

The main hypothesis which is under consideration in this study is that telecommunications tariffs which are too high can have a detrimental effect on the development of the sectors of public concern. There is a concern that tariffs in operation in many countries are shaped mainly by the historical development of the services, political requirements and monopolistic industry structures. In particular:

- Tariffs for international services are generally still at an artificially high level, in particular because of the accounting rate system which acts as a disincentive to those countries and operators which cut their prices and/or which send out more calls than they receive (e.g. most developed countries);

- Tariffs in force in developing countries are unacceptably high for many users, and this situation is rendered worse by the fact that infrastructure is poorly developed and quality of service is often sub-standard.

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2 The widely used term "telematics" is used throughout in preference to the more technical "teleinformatics".

3 "Routine" fax does not include the highly advanced fax services now entering the market which may offer new and interesting possibilities to the UNESCO community.

- Tariffs for advanced services used in the sectors of public concern -- notably data communications, electronic mail, leased lines and programme exchange -- are often especially high in developing countries and hinder the development of innovative new services;

If it is true that telecommunications charges are too high then this would have a negative impact on the development of national economies as a whole. The UNESCO community of users, under review here, is particularly vulnerable because of its high dependence on telecommunication and data transmission services for the exchange of data in electronic format. The implication of high tariffs is that existing services would be under used and the development of potential future services would be delayed or cancelled because the costs to users would be prohibitive.

Historical background

The antecedent organizations of the International Telecommunication Union were set up in 1865 with the aim of establishing a framework for the development of international telegraph and telegram services. Very early it was found that the transmission of information did not fit exactly within the supply and demand scheme, but was also linked to political, scientific or cultural aims. Thus, in 1903 the special needs of the press were recognized in a recommendation that press telegrams should be accepted for transmission at just 50 per cent of the commercial rate. Today, several countries still maintain a special Press Bulletin Service (PBS) which offers subsidized tariffs for leased lines used by the press.

The interest of UNESCO dates from two studies published in the 1950s concerned with "News Agencies and Transmitting World News". A special UNESCO working group on international telecommunication tariffs was set up in 1979 and made a number of recommendations (June 1980). These include the establishment of a Development Press Bulletin Service (DPBS) which would guarantee the provision of a low speed leased line (50 - 75 bits per second) for a maximum fee of US$ 200 per month for use by news administrations. Other recommendations relate to the continued provision of certain types of service (e.g. press telegram, press broadcast service) and the idea of rebates or discounts for telex and telephone calls made by particular types of user. One specific outcome of this work was the establishment of a global satellite project for electronic news gathering and dissemination by INTELSAT, the international satellite operator, in 1983. This experiment covered 30 countries in Africa, the Middle East and Asia.

In the mid-1980s, a joint study between ITU and UNESCO was carried out. The results were published in May 1986 in a report entitled "Telecommunications Tariffs for the Mass Media".(1) That study concluded that "... there is a gap between what telecommunications authorities consider they have to charge and what the media considers affordable". However, the issue of offering preferential or concessionary tariffs remained unresolved. Specifically, "... the question of affording lower and specific charges for particular telecommunication services pertains to national policy formulation and decision within a country". Subsequently, the problem of high tariffs for the media has been raised in numerous international fora, including seminars on promoting independent and pluralistic media organized jointly by UNESCO and the United Nations in Windhoek (1991) and Alma Ata (1992) and ITU's Regional Telecommunication Development Conferences in Harare (1990), Prague (1991), Acapulco (1992), Cairo (1992) and Singapore (1993).

The objectives of this study are similar to those of the 1986 study. However, the scope has been extended to cover the full range of UNESCO's field of competence, and the gamut of technologies under consideration is now far broader than the telegram and telephone service which was the main focus of the earlier study. Nevertheless, from the user point of view, the same basic question of strategy is being posed: How much emphasis should be given to seeking preferential treatment for specific sectors as opposed to focusing on reducing tariffs for the users as a whole?

Universal service (2) and telecommunications policy reform

The telecommunications sector has a long tradition of universal service. This concept is rarely defined in precise terms but it has been interpreted in two ways, the first essentially politico-philosophical and the second economic:

- At the most basic level, universal service means access to telecommunication services as a basic right to all citizens (the right to communicate) which is essential for full participation in the community and as a basic element of the right to freedom of expression.

  In this sense, it is the concern of the political authorities who must determine which kinds of service deserve specific support and the means of financing them.

- In its application by telecommunication operators, universal service is an economic concept which can be broken down into a number of subsidiary concepts such as:

  -- universal geographical availability, or the provision of service on demand irrespective of whoever, wherever and whenever the user requests it;

  -- non-discriminatory access, which means that all users are treated alike in terms of price and provision of service quality;

  -- reasonable costs or affordability, which is a more subjective concept relating to the comparative cost of the service and the relative purchasing power of the user.

  The first concept clearly represents a very long term goal, and the last two are thus more commonly applied in practice. But even this limited approach raises ambiguities since, when one considers a particular sector of the community (e.g. the sectors of public concern), there is, for the users, a clear contradiction between the aim of obtaining affordable services and the goal of non-discriminatory access.

The concept of universal service is now under pressure on a number of fronts. If anything, the pace of change has accelerated since 1986 when the last ITU/UNESCO study was published. Specifically:

- Many countries now permit infrastructure competition. Since the mid 1980s, several countries, principally in the developed world (e.g. Australia, Canada, Finland, Japan, New Zealand, Sweden, the United Kingdom, and the USA) but including some developing countries such as the Republic of Korea, have licensed new competitors in the fixed link network. More than 100 countries have also licensed mobile services to operate alongside the fixed link network and in many cases multiple operators have been licensed. Competition has generally had a potent effect in bringing down tariffs and raising the quality of specific services;

- Most countries have separated the functions of the telecommunications networks and services from that of the state and many have privatized their public telecommunications operator (PTO). Although this means that many countries have relinquished the right to set tariffs directly, the authorities of almost all of these countries are still concerned with tariff strategies and still control tariffs indirectly, for example through price-cap regulation.

- The telecommunications industry has changed immensely through technological development, which has enabled it to provide new and better services and to reduce its costs. In particular, new developments in mobile services, in data communications and in satellite technology have brought substantial benefits to the information services sector. For instance, the use of satellite telephones has permitted reporting from war zones and the scenes of natural disasters which would have been impossible if reporters relied on the fixed-link network.

- Most countries have now split regulatory and operational functions. Regulators have generally favoured tariff rebalancing schemes which have purported to bring tariffs closer in line with costs (cost-based or cost-oriented tariff policy). The main elements of this rebalancing process have been:

  - raising access charges (connection and subscription charges) relative to call charges;

  - raising local call charges relative to long-distance and international call charges;

  - extending the range of off-peak discounts, particularly for long distance and international call charges;

  An increasing number of regulatory authorities are now permitting national network operators to offer tariffs which are targeted at particular market niches, for instance by offering low volume calling options, or high volume discounts.

- In several industries, interest groups and user groups have been active in creating their own networks based, to be sure, on lines leased from telecommunication operators. In the banking industry, for instance, the SWIFT network has taken an increasing share of funds transfer traffic away from public telecommunication operator (PTO) networks. In the airline industry, the SITA network and other competitive networks now handle much of the traffic in seat reservations. Generally speaking, networks in the sectors of public concern are less well developed but the "Internet", a network of networks based on leased lines, is attracting a rapidly increasing proportion of traffic from the academic and research communities. In the media industry, press bulletin services such as Reuters, Agence France Presse or Dow Jones Information Service are now competing as commercially-oriented networks. These specialized networks have benefited from the progressive liberalization of the CCITT's D Series recommendations which govern the use of international leased circuits.

These five new trends -- network competition, restructuration and privatization, technological change, deregulation and special interest networks -- have had a substantial impact on the whole issue of the use of telecommunications in the sectors of public concern. In the light of this discussion, it is possible to rephrase the question under consideration:

> In what ways has change in the telecommunication sector impacted the development of electronic information services and how can users in the sectors of public concern benefit from these changes? What examples exist of best practice use and applications?
>
> Are telecommunication tariffs still too high? If so, what steps, if any, do policy-makers need to make to ensure that the benefits of competition, privatization and technological change are fully passed on to users, including those in the sectors of public concern?

The changing telecommunications environment

Thirty years ago, telephony was an undifferentiated service supplied on a monopoly basis at the same price to all users, whoever and wherever they were and whenever they used it. Today, there is a variety of different telecommunication services available. Many customers, at least in several developed countries, have a choice of at least two suppliers and can choose which service to use and how to use it. In thirty years time, most of the services on offer today, plus many more still to be developed, will be available on a customized basis, suited to the needs of each individual client or group of customers. The client will be able to choose between a wide range of generalist or specialist suppliers and will be able to buy as little or as much of each commodity service as he wishes.

FIGURE 1.1
Keywords for the changing telecommunications environment

	30 years ago	Today	In 30 years
Supplier	Monopoly	Oligopoly	Competitive
Service	Single	Many	Multiple
Market	Users	Customers	Clients
Price	Unitary	Differentiated	Customized

There should be no real surprise in these trends. Most consumer-led industries, such as cars, consumer electronics or soft drinks, are now offering highly differentiated product ranges and suppliers are producing to order rather than providing from built-up stocks. In the service industry too, the range of options available to customers in banking, insurance or travel has grown enormously and suppliers are increasingly targeting narrower segments of the market in order to gain competitive advantage. What makes telecommunications different from these other product and service markets is the fact that it has traditionally been highly regulated. In most countries, the state has played an influential role in the development of telecommunications services, initially as a service supplier and latterly as a market regulator. Thus market competition has not been the natural mechanism for price setting in telecommunications as it has been in other industries. The tariff structures of most telecommunications service providers are regulated. This has reduced the perceived options for service differentiation and price flexibility. But times are changing, and telecommunications suppliers can no longer afford to ignore market trends.

Overall, it is clear that the recent trend in tariffs has been downwards, but the pace of change has varied greatly among countries. Generally, those countries which have introduced competition and which have clarified the financial relationship between the PTO and the state, have tariff structures which are set at a more reasonable level, and produce levels of profitability which, while still high, are less excessive. However, other countries, particularly the developing countries, have not yet significantly benefited from world tariff trends, and still have tariffs which are very high in comparison with general living standards. These countries will require a concerted telecommunication development effort, based on low-cost, modern technology and gradual reform of tariff policies, in keeping with the national situation and level of development. The developing countries, where investment and infrastructure have been weak, have special opportunities in the present context to narrow the gap with the industrialized countries. For this reason, the latter countries are not presented in this study as a model for development, but only as source of useful experience.

STRUCTURE OF THE STUDY

In this introductory chapter the scope of the study has been outlined, and the changing telecommunication environment has been reviewed with emphasis on tariff trends. In the following chapters, some of these themes will be examined in more detail and with particular reference to the needs of the education, science, culture, media and information sectors. Chapter one defines the user groups under consideration and gives an overview of their needs for and usage of telematics and data transmission services. Chapter two presents the "user viewpoint" based on a survey of user institutions in UNESCO's areas of competence and of relevant documentation. It presents country-specific information on preferential tariff treatments and other special arrangements which are designed to benefit these sectors. In chapter three, the general principles which have historically applied in the development of tariffs are surveyed (in particular, the work of Study Group 3 of the former CCITT - now the ITU Telecommunication Standardization Bureau), and the various factors impacting on tariffs and the resultant trends are analyzed. Finally chapter four looks at some of the options open to policy makers to address the problem of under-usage of telecommunication services in the sectors of public concern. Inter alia, this chapter examines the role of the players:

the service providers, the users and public authorities. It deals with the balance between service to the public and the principle of non-discrimination, and with the roles of international agreements and of national and local policies. Finally, a series of "strategies" or general approaches is suggested, and specific recommendations for action are made.

1. THE SECTORS CONCERNED BY THE STUDY: EDUCATION, SCIENCE CULTURE, COMMUNICATION AND INFORMATION

In discussing the telecommunication needs and problems of the education, science, culture, media and information sectors which represent the UNESCO community, it is important not to lose sight of the common characteristics of these user groups. First of all, the technology and telematics services required are clearly converging, even if users' perceptions of needs may still differ considerably. Secondly, although it is no longer possible in this era of rapid political and economic change to strictly distinguish between profit-making and not-for-profit, commercial and non-commercial, and between public and private, the user groups considered in the present study are all involved to a large extent in missions of public concern which have an important role in development. The corresponding organizations and infrastructures at the national level are often financially disadvantaged and are having great difficulty as a group in benefiting from modern telecommunication services, particularly in the developing countries. This observation applies also to the newly emerging private media and press in many developing countries, which are often struggling against official restrictions, insufficient professional and management experience and slowly changing social attitudes, and cannot be expected to be commercially viable enterprises comparable to their counterparts in developed countries before many years of effort.

This report will therefore emphasize the common principles which will enable telematics users in education, science, culture, communication and information to work together, and with telecommunications operators, governments and international organizations, in order to make full use of the power of modern telematics and data transmission facilities for development.

The major communities of telecommunication users and user institutions concerned by UNESCO's programme are as follows:

- researchers working in universities and specialized research centres;
- teachers in universities and other educational establishments, and by extension their students;
- information specialists responsible for providing access to databases and information services in documentation and information centres, libraries and archives;
- cultural experts concerned with the access and retrieval of images and data to support the protection, promotion and study of cultural heritage;
- journalists and other staff working in news agencies and newspapers;
  professionals and organizations responsible for radio and television programme development, exchange and broadcasting;
- other professionals, managers, policy makers and information users in the fields of education, natural and social sciences, technology, culture and communication (for example, users of networks for warning and emergency relief for natural or man-made disasters).

Several general comments are made below on the evolution of telecommunication use by the above groups, which will be presented in more detail in the next chapter. It will be seen that the various groups of end-users have distinct needs in terms of low-speed data transfer (e.g. messaging, computer conferencing), higher speed data transfer (e.g. information retrieval, certain research applications) and broadband transmission, but that the tendency for all the groups is towards more diverse and sophisticated applications:

a) Research and development depends by its very nature on effective access to and sharing of data and information, and research institutions have traditionally been well placed in terms of budgets and technological expertise to take full advantage of new telematics techniques. This

has led to the worldwide development of "research networks" - private computer networks to provide a number of basic telematics services (electronic mail, electronic conferencing, file transfer and access to databases) as well as specialized computer resource sharing applications like supercomputer access and distributed processing.

Although researchers were the first users of such networks and still have the greatest demands concerning complexity and volume of data flow, research networks are more and more widely used by professional communities of all types and are beginning to compete in the area of value-added services with public data networks run by telecommunications operators (see section 2.1.1). The first category of telematics applications to be discussed in the next chapter, "research networks and general telematics support", will therefore not be limited to the needs of researchers and research institutions in the strict sense, but will also cover the general professional needs of other users in the areas of interest to UNESCO.

b) Educators and education systems have traditionally focused on the transfer of messages and textual data, and could thus be seen as sub-set of the general research and professional world as described above. However, this community also relies heavily on a number of special applications strengthening inter-institutional links (audio and video conferences, "white boards", etc.) and presents immense potential demand for broadband audio-visual transmission.

c) The needs of information specialists include, in addition to basic telematics support, interactive information retrieval applications and high-speed, high-volume transmission of documents.

d) The cultural information community is a relatively new one which has particular interest in the transmission of high-resolution and three-dimensional images, and in providing information to the public af large.

e) For journalists, newspapers and news services, rapid transmission of news (articles and photographs) is a necessity, and for this reason this user community has long had a privileged relationship with the telecommunications world, mediated by public policy (this relationship led very early to the according of preferential tariffs for the press, reviewed in the introduction and discussed in more detail in chapter two).

At the same time, telecommunication costs have long been a major factor in publishing budgets, ensuring that the press community has always made extensive use of the newest telecommunication technologies. In addition to news transmission, telecommunication is used by the press in management applications (automation of the editorial and production chains), access to source databases, distributed printing, and more recently production and dissemination of databases and multimedia products. Telecommunication use by this community will certainly continue to increase as news media develop throughout the world and adopt ever more sophisticated strategies for the collection, management and dissemination of information.

f) The radio-television community is a major user of telecommunication channels for audio or video transmission, e.g. for programme exchange and remote news gathering. Its needs differ markedly from those of the press in the sense of the higher bandwidths required, but it is also true that telecommunication costs represent a smaller proportion of the budget of radio-television operators for which the information itself (the programmes) are typically the major expense.

At a more general level, the technologies associated with broadcasting and with telecommunications are rapidly converging, particularly with the expansion of cable media and of satellite direct broadcasting. However, the radio-television industry and the telecommunication service industry are still quite distinct in most countries, from the points of view of clients, institutional actors, economics and regulation; the present study will therefore limit itself to the use of telecommunication facilities by the radio-television industry, rather than covering all of the latter's communication activity (e.g. terrestrial broadcasting).

It should be stressed that today the problem of transmission of audio and video-based data is far from being the privileged concern of the radio-television community as it was when analogue techniques were the rule and telecommunication channels could not offer the required bandwidth. Now, with the ever-increasing capacities of telecommunications for data communication and the convergence of technologies for transmission of a-v and textual data, two complementary tendencies have developed: i) radio and television organizations are increasingly relying on telecommunication services for data transmission among themselves and to end users and ii) although these organizations still represent the largest demand for broadband telecommunication, distinctions are blurring between the needs of the radio/television community and those of other users as audio-video data become more important in many areas of endeavour: cartographic/graphical data in research, image and multimedia databases in information services, a-v teaching modules and distance learning conferences in education, transmission of news photographs and video in journalism. Solutions to the needs of the radio-television community will therefore be of potential interest to a variety of other user groups and *vice versa*.

2. THE PROBLEM FROM THE POINT OF VIEW OF THE USERS

For potential and newly initiated telematics users, particularly in the developing countries, telecommunication operators and services can present a bewildering complexity of facets. Commercial telecommunication operators usually aim at providing basic services, which may not in themselves fully satisfy specific user needs, with the result that users must be capable of seeking out or developing appropriate value-added services. And for users of all levels, insufficiencies in telecommunications infrastructure and administrative constraints such as connection procedures, tariff structures or terminal equipment restrictions may be dissuasive in attaining optimal, cost-effective service. To overcome these obstacles, users must first come to understand their own possibilities and responsibilities in telecommunications use, those of the operators and those of their governments. They have to reach sufficient levels of economic power, self-organization and technical competence to benefit from existing services and facilities or to participate, when required, in negotiating new and more satisfactory arrangements.

2.1. Present practices and trends in telematics use

Today users have, in many cases, the choice of terrestrial, satellite or mobile pathways, often offered by different suppliers. When public services are not considered adequate and affordable, the users are increasingly exercising the option of "by-passing" them by establishing private facilities, which represents both an opportunity for the users and a challenge for the national operators. This section provides an overview of the present situation concerning the use of telematics and data transmission services by the different groups of users under study, as well as of tendencies in development of such use. The problems faced by the users and examples of solutions will be presented in section 2.2.

2.1.1. Research networks and general telematics support

This section will treat the problem of basic telematics support for professionals in the areas of education, science, culture and communication, with special emphasis on the particularly important needs of researchers. In discussing this problem one must consider two types of network service that have developed in parallel - public data networks (PDNs) available to all users and private "research" networks which are in principle restricted to specific user groups.

Public data networks developed by telecommunications operators, generally based on the X.25 packet switching protocol of the ITU Telecommunication Standardization Bureau - ITU-T (the former CCITT) which conforms to the lower levels of the OSI model of ISO, have been available in the developed countries for more than a decade. They have been very successful in providing dependable, national and international "data highways" to the public at large, particularly for commercial applications, but the absence until recently of standard "higher-level" services such as messaging (X.400) and user directory (X.500), and to a lesser extent speed and cost considerations, have historically limited their use by the research community and certain other professional groups of interest to this report.

At the same time, research networks linking cooperating institutions through private channels have widely developed in the industrialized world thanks to strong user communities and telecommunication facilities and support from both government and industry. The most impressive development in this field is undoubtedly the Internet which is said to be the world's largest computer network with more than 1.3 million connected computers and about 8 million users. The Internet is actually a "metanetwork" of about 12,000 computer networks in 56 countries which are interconnected by a common protocol (TCP/IP) and a much larger number of common services (e.g. help facilities, mailing lists, e-mail, bulletin boards, file transfer, database access, software exchange) than are generally available in standard, network-wide form on public data networks (3,4,5).

Development of the Internet began with the Arpanet set up in 1969 by the U.S. Department of Defense to link military researchers and contractors, and its interlinking in 1977 with several similar private networks organized by governmental, research and educational institutions.(4) Starting in mid-1992, full access to the Internet has been possible in the U.S.A. for all interested users, although some parts of the system restrict use to research and education. This enlarged access is arranged on a commercial basis or, in many cases, on a non-commercial or "freenet" basis (3) by which a university or other non-commercial network member opens access to the general public, typically a local community initiative.

In 1991 the U.S. Congress passed the High-Performance Computing Act of which a key component was the establishment of the National Research and Education Network (NREN) which will work at gigabits per second, cost nearly US$ 200 million to develop but lead to between US$ 170 and US$ 500 billion of GNP growth by the year 2000, and is expected by one former high-level government manager to "increase the productivity of American researchers by 100%, 200%, or more."(6) The NREN concept has subsequently been subsumed in a future National Information Infrastructure (NII) - a seamless web of communications networks (both "research" networks and public networks), computers, databases, and consumer electronics that will put vast amounts of information at the public's fingertips as an extension of the Universal Service concept; plans for implernentation emphasize the role of industry with governmental support through tax incentives and changes in telecommunications laws.(7)

In France, cooperative regional research networks have been developing since the 1980's with substantial financing from local government authorities (8), while national and international links developed on an *ad hoc* basis. The national authorities are now pursuing a policy of interconnecting the regional research networks among themselves and with foreign and international research networks such as the Internet. The major national research organizations (research agencies, universities) formed a legal entity in 1992 to develop a national research network (RENATER), which is being implemented by the national telecommunications operator. RENATER will provide a national e-mail and directory service, will ensure data transfer at very high rates (up to 140 Mbits/s) for distributed computing applications, and will support the TCP/IP as well as OSI protocols.(9) Although the costs to the end users are not discussed in the paper cited, it seems clear that the government's support for the network, the pooling of traffic, and introduction of technological innovations (e.g. ATM) will lead to substantial cost reductions as well as to superior services.

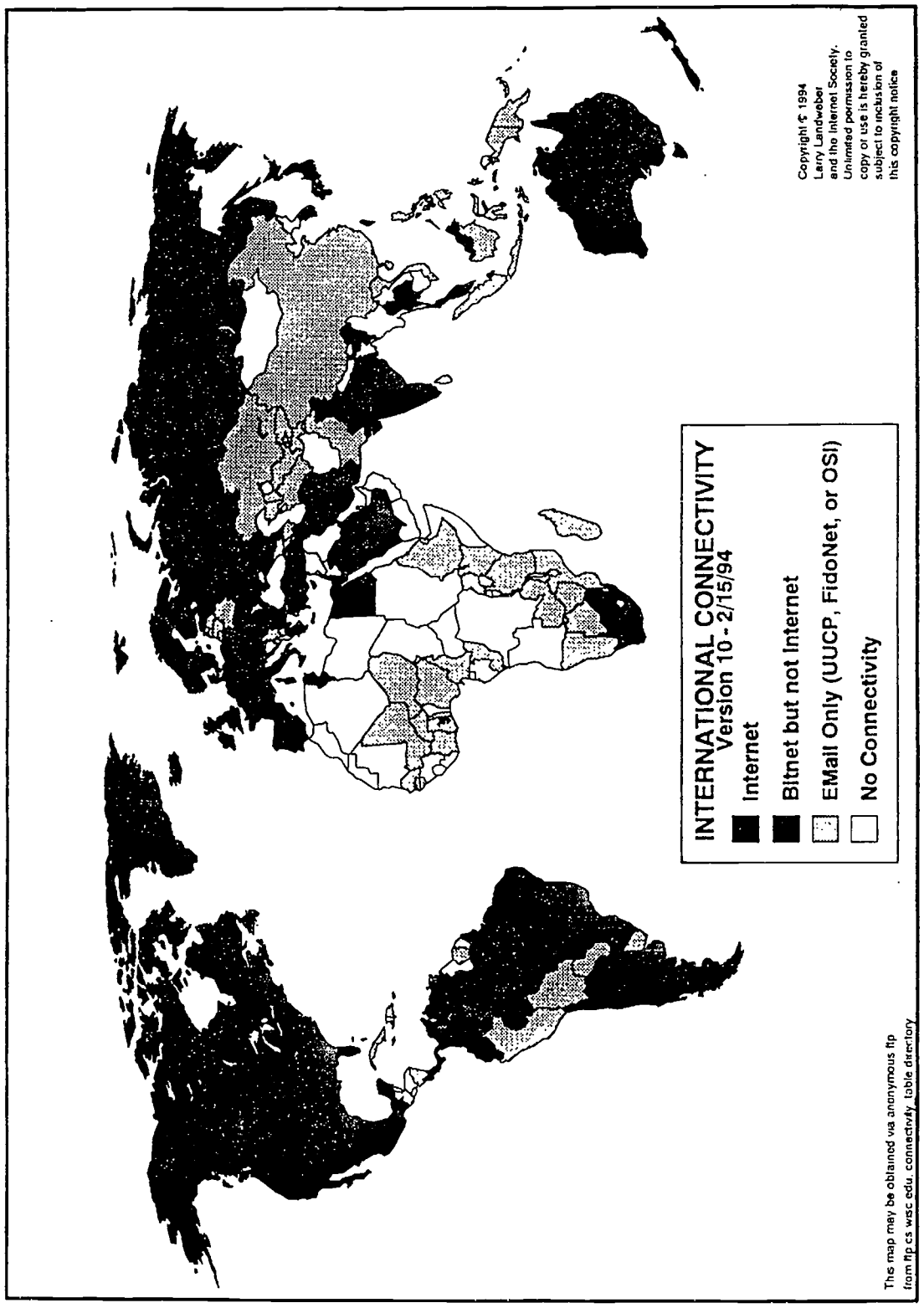
Several other industrialized countries are planning or considering the development of a national research network as a basic tool for improving productivity and competitiveness. For example, in Canada the federal cabinet has given approval for the first phase of creation of the Canadian Network for the Advancement of Research, Industry and Education (CANARIE) which is expected to cost C$ 1.2 billion (about US$ 1 billion).(10)

A number of initiatives have been undertaken to facilitate access to research networks by non-governmental organizations and users in developing countries. The Association for Progressive Communication (U.S.A.), which operates several international e-mail networks, provides economic communication services to non-profit institutions by grouping messages and making use of high-volume channels (high speed modems, PDNs, etc.); it also provides gateways to most commercial e-mail services and almost all research networks.(11)

The use of research networks for interactive remote login, e.g. for on-line database searching and remote e-mail access, may not be practical in many developing countries, since this facility involves significant additional costs for the network and should be carefully planned.(12) A popular, economical approach is to constitute a network of mini-computers or even personal computers which transmit messages by dial-up connection (e.g. through the UUCP or FidoNet protocol); usually one computer in the network provides a gateway to the international research networks for e-mail and file transfer, but the network users cannot generally benefit from remote login or other more advanced international services.

It has been estimated that the existing, interconnected, global research network community, with all protocols and modes of access considered, now reaches over 10 million users of 1.5 million computers in more than 127 countries (5). Figure 2.1 shows the extent of research network development as of early 1994.

FIGURE 2.1
Research network connectivity as of February 1994



Source: Internet Society News, *Vol. 2, No. 2 (Winter 1994)*

The penetration of public data networks and research networks in the developing countries varies greatly as can be seen from the following examples:

a) In **Latin America and the Caribbean**, X.25 public packet switching networks are generally technically sound but are having difficulty in market development due mainly to local access problems and also to insufficient regional interconnectivity. On the other hand, research network use and integration, starting only in 1988 with about 2000 users, accelerated markedly in 1990-91 to about 40,000 users connected (but not necessarily active) which implies connection of 20% of the estimated population of researchers.(12) In Central America, for example, the development of research networks has been notable, and has been greatly facilitated by regional cooperation of the telecommunications operators (Comisión Técnica Regional de Telecomunicaciones - COMTELCA) in promoting intraregional data communications.(13) There is still, however, a great disparity in development among Latin American and Caribbean countries (from 0 to 80% coverage), and in addition most research network growth is decentralized, relying on PC-based networks (e.g. UUCP) rather than more powerful dedicated facilities (e.g. the Internet or BITNET). Despite progress, research networks are seen to be falling short of their potential of growth because of problems in attracting the necessary traffic.(12)

b) In **Africa**, where telecommunication infrastructures are grossly insufficient, and where professionals and researchers have particularly critical needs to communicate more effectively among themselves and with colleagues outside the region, the use of electronic networks to access databases and exchange information was still virtually unknown in 1989.(14) Since that time, robust networking protocols and modems have made e-mail connections possible over the public telephone network for users in a number of countries in Eastern, Southern and Western Africa (see Figure 2.1), although about half of the countries of the continent lack any connection(15), and only in South Africa and two North African Arab countries are full research network services available.(16) A 1991 survey showed that only four sub-Saharan African countries (other than South Africa) had public data networks (none of which provided e-mail or bulletin board services), although an number of others had remote nodes of foreign networks and/or planned to introduce a national network in the near future;(17) the impact of these networks on science and education appears to be minimal at present, except perhaps at the national level in a few countries.

   A project to promote electronic communication within its Pan African Development Information System (PADIS) network was initiated by ECA (the United Nations Economic Commission for Africa) in 1990, with international financial support from IDRC (International Development Research Centre); activities include provision of terminal equipment and training to PADIS nodes and initiation/testing/evaluation of intraregional and inter-regional computer communication for messaging and database access.(14) In 1992, UNESCO launched the RINAF (Regional Informatics Network for Africa) project to promote the interlinking of African institutions among themselves and to international computer networks through regional nodes. The first phase of this experimental network covers eight African countries.

   Particular attention has been paid in Africa to the needs of health researchers and professionals who require: i) access to up-to-date research and reference information, ii) facilities for rapid information exchange (e-mail, conferencing, distance learning, electronic publishing), and iii) access to urgent advice and diagnostic assistance from centres of excellence. To resolve these problems the HealthSat satellite was launched in 1990 by SatelLife, an international non-profit organization which is financed by foundation support and some sale of satellite capacity. HealthSat is a store-and-forward satellite operating in low-earth polar orbit and can support 500 ground stations (PCs linked to modified amateur radios), which can send or receive up to 1800 pages of text per day near the equator (and more at higher latitudes). Ground stations will primarily be located in developing countries, particularly in

Africa; in industrialized countries, existing computer communication networks will be employed to connect many users to a single ground station (gateway). The HealthSat project is seen as an experiment which will be continuously refined and evaluated with a view to ultimately providing sustainable, affordable and appropriate data communications for developing countries in the health field.(18)

c) In **the other developing regions** - Central and Eastern Europe (including the countries formerly belonging to the Soviet Union), the developing countries of Asia, and the Arab States - the situation in the data communications area can generally be considered as intermediate between that of Latin America and the Caribbean and that of Sub-Saharan Africa.

The optimum organizational or technical approach for satisfying basic telematics needs - development of PDNs, research networks or a combination of the two - depends on the particular situation of each given country or region. It should be noted that the two approaches are in fact converging as research networks evolve into a market-oriented growth pattern with more limited options for external or "top down" support. This factor is especially critical for developing countries which are initiating networks in this new economic environment; in these countries a wide user community is particularly needed to ensure network impact and viability, which in turn implies a "bottom up" approach emphasizing user needs and services.(19)

The generalization of research networks represents both a challenge and an opportunity for telecommunication operators: a challenge because of increased competition, and an opportunity in terms of enlarged markets of both end-users and networks (it should be remembered that the research networks generally make use of existing telecommunication infrastructure, at least for setting up basic communication channels; one expert estimates that about 60-70% of the not-in-kind budget of research network nodes is to defray telecommunication charges(19)). In any case, research networks are now well-established and represent a confirmed user viewpoint on service requirements which cannot be ignored by telecommunication operators - questions of cooperation and particularly of interconnection should be intensively addressed in the interests of all parties concerned.

2.1.2. Educators and education systems

The main application of unique interest here is distance education, which has been the subject of many experiments using telecommunications in the past two decades. Various modalities of education have been supported, ranging from transfer of lectures to interactive sessions and conferencing, but educational television has been accorded particular interest.

The Canadian province of Saskatchewan, for example, has established the Saskatchewan Communications Network (SCN) to produce and interactively distribute video training programmes to receive-sites set up across the province in both urban and rural areas for formal education at the university and secondary levels, as well as for community service and business training telecasts. Although the existing fibre optics networks are used in the highly developed, southern part of the province, a multipoint, one-way satellite system was overlaid on the existing infrastructure to reach the sparsely populated northern areas (with interactive student feedback ensured through telephone and fax). The network has been highly successful: formal education offerings have tripled in the first four years of operations, and a review has suggested that university courses can be delivered over the network at 76% of the cost of on-campus courses. The reasons for the installation of a new satellite network were threefold: geographic and geological constraints to extending the existing fibre optics networks to the north; relative advantage (estimated at 4 to 1 in this case) of satellite costs over terrestrial tariffs for wide-area, multi-point communications; the unwillingness of the public telecommunications carrier to negotiate an alternate rate for educational applications.(20)

Another approach is that of the National Technological University (NTU) in the United States which offers Master of Science Degree programmes in eleven technological fields through video modules produced and shared by more than forty member universities. The students generally follow courses at their workplace using facilities operated by their employer. Transmission costs are minimized by using state-of-art video compression technique and broadcasting continually; students view pre-recorded sessions at the sites and interact with their teachers as required by e-mail, telephone, fax or correspondence.(21)

In Indonesia, a distance learning telecommunication network called SISDIKSAT was initiated in 1984 using two dedicated voice channels on the national Palapa satellite to link ten widely-dispersed universities and teacher training institutes for the planning, administration and delivery of common courses. One channel was dedicated to interactive teaching and meetings (audioconference) with the other available for facsimile and telewriting, personal communications, and back-up. Costs were reduced by using the satellite channels for all intersite communications (at the cost of allowing only one site to talk at a time). The network was implemented as a bilateral cooperation project, and is seen as a success concerning both benefits and technical functioning.(22)

Mention should also be made of the potential of public telematics services for use in education. For example, the widespread videotex service of France Télécom hosts many private and public sector educational applications (educational databases and games, courses, sample examinations, assistance to students, collective writing and artistic creation projects, etc.).(23) More recently, France Télécom has developed specifications for a "virtual classroom" using satellite communications and ISDN, within the ACT (Advanced Communication for Training) project of the European Union's DELTA programme, and has developed and tested pilot multimedia modules for university and professional training.(24)

2.1.3. Information and databases

In the library area, there is a growing need for telecommunications for access to and sharing of information, and particularly for telematics services for information retrieval, library loan requests and electronic document delivery. Access to telematics applications in and between countries in different geographic and development situations is in addition becoming an increasingly important requirement.(25)

Demand for information retrieval is expanding rapidly, due to the growth and increasing decentralization of automated library systems in school, public, academic and corporate libraries, as well as to increased use of larger information centres.(25)

Demand for electronic interlibrary loan services is expected to increase as the international standard protocol for this application (ISO 10161) is implemented on a wide scale.(25)

Electronic document delivery use is presently low, but should parallel that of the preceding two applications if low-cost, high-bandwidth networks become available to allow this alternative to compete with telefacsimile which is already in use for priority requests.(25)

In Europe large organizations have high volumes of database use and can consider more costly solutions such as leased lines and X.25 connections and are therefore receiving better quality telecommunication service (6.7% failure rate) while individual professionals and smaller organizations require inexpensive, convenient, reliable channels for regular but limited on-line database access without major equipment costs. It appears that the present public telecommunications facilities in Europe still fall short of the needs of these latter users in terms of reliability (failure rate of about 13.6%).(26)

In Western Europe, due to competition and the liberalization policies of the European Commission, independent data networks running on a profit-making or non-profit basis (e.g. research networks) are carrying a significant and growing share of the on-line database access traffic relative to the public data networks run by national telecommunication operators.

In the United States, most major database hosts had offered access via the Internet by Autumn 1992.(3) This mode of communication is cited as providing faster and wider access to databases than the public data communication networks (wider because mainframe terminals without modem facilities can be used for external database access). Another advantage is the ability to have access to sophisticated features, like automatic login, data log and multiscreen display facilities, with only a dumb terminal.(27)

Developing countries require efficient and affordable telecommunication services to provide speedy access to local, regional and international information sources.(25,28) However, as discussed in the preceding section, the existing data communication facilities severely limit these possibilities in many developing countries. In addition, structural adjustment programmes have resulted in drastically reduced financial support for library and information services in many of these countries, exacerbating their already difficult problems of information dissemination and access.(28)

2.1.4. Culture and heritage

Organizations responsible for access to cultural and heritage materials have wide-ranging potential uses for telecommunications. Those concerned with works of art use data communications, throughout the world, to access catalogues and databases. This use has expanded from narrow band data requirements to sophisticated image retrieval. Communication among cultural institutions is receiving initial emphasis, with a view to future development of telecommunication applications open to specialized researchers and eventually the public at large.

Certain multimedia applications of telecommunications are already envisaged using image, sound and data within the same channel, perhaps in conjunction with other physical media such as CD-ROM and videotape. In several cases the transmission of three-dimensional images (such as information on monuments) is foreseen. Such applications may expand the capability of museums and galleries to allow clients in even the most remote parts of the world to have visual access to the world's most valued treasures. Highly advanced applications, such as the "virtual museum", have been demonstrated by Apple Computer in the USA.

Of course, broadband telecommunications also serves a cultural role in the distribution of the performing arts, often in conjunction with broadcast or cable television. These applications will be assimilated in the present study to those of radio and television (section 2.1.6 below).

2.1.5. Journalists and the press

Journalists use messaging services to submit stories and photographs and also access databases, including press archives, for background information. They rely to a large extent on the public switched telephone network for data transfer. The present survey has not revealed to what extent they use specialized telecommunication facilities such as public data networks or research networks in their work.

Newspapers and press agencies use telecommunications to disseminate current news bulletins and compile news databases which are often made available to the public through database hosts. It should be remembered that press bulletins still provide most of the substantive content of written or spoken media, and their acquisition thus represents a major expense for these media. Press organizations are traditionally heavy users of leased telex (teletype) and voice grade lines for data transfer, but are making ever greater use of specialized or public data networks.

The evolution of computer technology over the past fifty years has led the press to progressively automate the entire production chain, from the elaboration and editing of articles, through the transmission and management of photographs, to the formatting and printing of the final product; this has in turn resulted in vastly increased demand for telecommunication services. One important example is the transmission of text layout for printing in decentralized facilities by many international and national newspapers. This technique, which originally involved relatively simple scanner technology, has been greatly improved through digitization and data compression. The transmission time (and consequently the cost) has thus decreased considerably: today it requires two to six minutes (depending on the number of photographs) to transmit a newspaper page compared to 27 minutes in the first trials in 1959.

The technological revolution is still encouraging new and closer partnerships between press enterprises and telecommunication operators. Thus, following the granting of a licence by the responsible national authorities, l'Agence France Presse and France Télécom have recently established a joint subsidiary with for the development of news services abroad, particularly in Central Europe. This company recently concluded (in 1992) a contract with the Czechoslovak news agency for the setting up of satellite network for the diffusion of news services.

2.1.6. Radio and television

Radio and television organizations use telecommunication channels to transmit audio, video and data signals, to exchange programmes and news among themselves and to reach their audience via on-the-air broadcasting and cable. Television differs from radio mainly in the much larger bandwidth that is required, although new digital compression techniques are continually improving the throughput of data.

Television organizations in particular are heavy users of leased channels, which are required on both long-term and temporary conditions. In many cases, these circuits are combinations of terrestrial and satellite network sections. In developing countries, telecommunication administrations are usually responsible for radio and television transmission and for satellite links. The broadcasting organizations are normally under state control, and their telecommunication costs are thus covered by the state, which also is responsible for their international links, negotiated on a case-by-case basis.

For the purpose of programme and news exchange, broadcasters often associate within regional unions such as the Arab States Broadcasting Union (ASBU), the Asia-Pacific Broadcasting Union (ABU), the Caribbean Broadcasting Union (CBU), the European Broadcasting Union (EBU), the Union of National Radio and Television Organizations of Africa (URTNA), which arrange for inter-member transmissions. For example, the Unions lease national and international circuits for daily news exchange among their members, including reserve circuits as necessary. International assistance has been instrumental in creating the operational networks of the unions of developing regions (AFROVISION, ARABVISION, ASIAVISION, CARIBVISION) which concentrate on news exchange.

In Africa, where insufficiencies in telecommunication services have been most critical, several initiatives have been taken with a view to improving news and programme exchange and transmission within and between countries. Over twenty years ago, a UNDP/ITU project entitled PANAFTEL was launched, which, already at that time, took account not only of telecommunication needs but also of those of broadcasters. Networks had been dimensioned according to those needs and many new microwave links have become operational.

Another project, RASCOM, aims to establish an African satellite network capable of meeting the needs of all users. It has now reached its operational phase and the RASCOM organization started up in November 1993, with its headquarters in Abidjan (Côte d'Ivoire).

Portable video transmission terminals are being used more and more by major television organizations for news gathering from remote sites. This technology is unfortunately out of reach for most organizations in developing countries.

At present, digital radio and television technology is still mainly limited to broadcasting studios, but some programme acquisition and exchange applications are already operational. Digital direct broadcast satellites will soon be widely available.

Constant progress is being made with digital compression technology, and there are good grounds for believing that a data rate as low as 2 Mbit/s per television channel may be realistic. Thus, a 16-transponder satellite will probably be able to handle 200 separate services, providing new possibilities for cost sharing and tariff reduction, and for applications such as distance education and cultural programmes which are of particular interest to developing countries.

There is an acute need for approved recommendations and standards on sound and video digital compression techniques, and intense studies are being carried out at present at different standard setting organizations (ITU Radiocommunication Bureau included).

Digital compression is bound to revolutionize communication satellites and broadcasting transmission and will probably affect the whole public media industry, sparking off a struggle for new markets. Many service providers have been quick to spot the potential savings and operational benefits offered by video compression. The cost of signal processing equipment for this new technology is, however, still relatively high for broadcasters, despite the benefits of signal compression for transmission. This is a handicap for stations in developing countries which cannot afford such equipment.

2.2. User difficulties and examples of solutions

The problems faced by users are multiple and can require diverse approaches depending on the specific needs and situation:

One approach to benefiting optimally from existing facilities is for the users to directly apply appropriate technology to develop needed services. For example, in several countries of Latin America and the Caribbean, where the terrestrial telecommunication networks are severely overloaded and geographically unbalanced but there is good international satellite coverage, VSAT technology is being introduced as an immediate solution for priority applications (e.g. in Argentina, Brazil, Mexico, Peru).(12) In other simpler situations, a relatively inexpensive technological element, such as a more versatile modem or computer program, can yield manyfold improvements in the use of existing telecommunication channels.

In some countries and regions, inequitable tariff practices are seen by users as contributing to high costs or inefficiency in telecommunications use. In Southeast Asia and the Pacific, for example, the present tariff structures for international leased lines have been seen as failing to encourage the use of potentially inexpensive regional links rather than more expensive intercontinental links.(29)

Another example can be taken from Western Europe, where, despite an impressive effort to open the telecommunication service industry to competition and to adjust tariffs to better reflect real costs, there is still wide tariff variation within and between countries. One major user organization believes, however, that: "The most pressing need is for [tariff] transparency, a lacuna which the private operators have tackled through their 'flat rate' tariffication policies ... with no hidden extras or unknowns such as character charges. The public services have tended [to] offer tariffs which are opaque, where it is impossible to predict the costs. This inability to plan or budget the costs [rather than the 'cost based tariffs' issue] has been the biggest barrier to entry for small organizations wishing to use data communication facilities, and also for less developed countries."(30)

Particularly in the developing countries, users may find real or perceived structural or development problems, which can only be resolved by consultation among all of the concerned parties, political decisions and investment. In Jamaica, for example, one user notes that: "A vigorous programme of expansion [of telecommunication services] is taking place ..., but there is, and will be for some time, considerable delay in the provision of certain advanced services available to industrialized countries....", and also that an international corporation owns 90% of the national telecommunication service industry, and that the present long-term agreement with the government gives this company extensive powers to define services and control equipment used at customers' premises.(28)

Certain users facing financial difficulty in defraying the costs of needed services may choose to present a case for special consideration to the operators and/or the government. In keeping with the tendency towards deregulation and commercialization of telecommunications, the operators can be expected to be responsive mainly to commercial approaches - for example offering special conditions for pilot use with a view to expanding their market - while governmental authorities may well be interested in supporting specific telematics applications in the national interest.

2.2.1. General telematics use including information services

One major user problem appears to be the high cost of public data network services. A study in Latin America showed that the cost of international transmission via PDN varies greatly from country to country (by a factor of up to three to one) and that for relatively high volumes (e.g. a 25 page report), the PDN is in nearly all countries more expensive than direct international dialling.(11) In Jamaica, a PDN has been available for some time, but tariffs for its use are cited as almost prohibitive for libraries and information centres; for this reason ordinary voice grade lines, with high error rates, are still widely used for intra-regional data traffic.

In Africa, where PDN facilities are still rare and users must rely on the public switched telephone network, a user view is that: "Communication costs between African countries remain exorbitantly high"; the minimum charges frequently imposed (typically one or three minutes) are cited as further discouraging the use of potentially cost-effective techniques such as computer communication.(31) Local telecommunication tariffs are also considered to be obstacles to information flow in many developing countries, and can be so high (up to eight times those charged by telecommunication operators in developed countries) that they may inhibit the development and use of the new, cost-effective international data communication networks, like the Internet.(32) In Latin America, telecommunication costs are seen as the principal constraining factor in the use of research networks, particularly for international links but in some cases also for national connections.(12)

Another user complaint is that data circuit terminating equipment may be provided at high, non-competitive prices by the telecommunication operator, and obtaining permission to use equivalent, affordably priced equipment may be difficult to obtain in practice.(28,31) A more general problem, common in Africa, is unavailability or high cost of terminal equipment and software (due in part to import restrictions) (13,31) and scarcity of skilled personnel to ensure installation and training(31).

A major problem for researchers and other professionals using data communication services has been that public data networks and research networks have not in general been compatible, either technically or in terms of their organizational and development strategies, and until recently their respective users have had little possibility to interconnect. Similar, but less serious, problems also occur in communicating between PDNs or between research networks.

In Africa, unavailability and poor quality of lines have been cited as a serious problem restricting the development of data communication, as well as lack of awareness of, and cultural barriers towards, such communication.(31) The latter problem has been cited in a milder form for the Caribbean, as one of providing users with incentives to initiate access to existing information resources.(33)

A number of successful approaches to reducing the costs of telematics services have been identified:

a) Support to priority user groups.

In Colombia, discounts of 15-35% for national calls and 15-25% for international calls are offered to the higher education sector by the national PDN, COLDAPAQ. In the same country, the initial connection fee to the RUNCOL research network is offered at a 62.5% discount to institutions in the higher education sector; in addition the national telecommunication operator has assumed 25% of the cost of connecting the network to BITNET (USA).(34)

In Africa, the telecommunications authorities in four East African countries have already licensed HealthNet ground stations (see section 2.1.1.b), apparently free of charge; the rationale used was that the network is an emergency service analogous to emergency numbers in the industrialized countries which are not tariffed.(18)

b) Cooperation of telecommunication operators in the development of research network services.

In the Dominican Republic, a prototype agreement has been signed with the international telecommunication operator (CODETEL - a GTE subsidiary) to establish a research network as a partition within its commercial e-mail system (CODEMAIL), free of charge for 150 users for 18 months. A gateway to the Puerto Rican research network by dedicated line was also provided free of charge. The justification used to negotiate this agreement included: i) promotion of future demand, ii) attraction of incoming (paying) traffic from outside the research community, and iii) enhancement of the image and contacts of the telecommunication operator.(35) In Cuba and in Venezuela, the research community has been involved as a partner in the development of public data networks and, in exchange, has been accorded for special facilities and tariffs.

c) Use of research networks for database access

Access to databases for users is typically considerably cheaper via the Internet compared with access through public data communication networks; some major hosts are charging users in the United States only about a quarter of the normal telecommunication charges for Internet access (26), and similar advantages presumably accrue to users in other connected countries.

In Latin America and the Caribbean where Internet connections are not yet widespread, the U.S. National Library of Medicine (NLM), the Pan American Health Organization and the University of Chile have initiated a system of off-line access to NLM databases by e-mail (BITNIS) which significantly reduces the cost of information searches. BITNIS provides users with custom PC-software to enable searches to be formulated off-line and transmitted to NLM as e-mail through any of the major research networks available in the region (BITNET, the Internet, UUCP, FIDONET); NLM then answers back to the users through electronic mail. Efforts are currently underway to offer BITNIS in countries in other developing regions.(32) The Latin American and Caribbean Centre for Health Sciences Information (BIREME) in Sao Paulo is coordinating access to BITNIS in the region for PAHO; the cost to the user is only about US $2-4/search plus the direct cost of the user's local research network connection.(36) This solution was made possible by the availability of research network facilities, a strong regional sponsoring institution, and technical skill to develop user-specific linking software.

d) Technical and administrative innovations

Access of diverse user groups to telematics applications is being facilitated in many countries by the establishment of standard services by public operators on the one hand, and by increased flexibility and administrative simplicity in dealing with the users on the other. Standardization and simplification of access to a wide range of applications through the videotex service in France can be cited.(23) Two salient characteristics of this service are i) the provision of basic terminals free of charge to telephone subscribers and ii) the establishment of public host services which enable pay-as-you-go "kiosk" access to public and private applications without administrative formalities (the cost of the communication and of the application are both charged through the telephone bill); savings to the end user come from volume-based and other cost reductions linked to standardization and public support, and from access convenience leading to savings in time. The same approach can apply to application hosts: in the Caribbean, for example, the Telecommunication Services of Trinidad and Tobago (TSTT) has introduced an "Outdial" service to permit X.25 access to hosts from the PDN without the necessity of a leased line, making it easier for them to initiate services without unaffordable operating costs.(33)

2.2.2. Educators and education systems

It is clear that existing tariffs are a serious impediment to the use of telecommunications in distance teaching, but the examples in section 2.1.2 show that the implementation of viable systems can be facilitated through the use of state-of-the-art technologies, realization of economies of scale, and support from public authorities and carriers.

An attempt to apply these principles to the Pacific region is being proposed by the Commonwealth of Learning, an organization set up by the British Commonwealth in 1988, in the form of a satellite-based network with several levels of service ranging from interactive video-conferencing at major institutions, to interactive audio-conferencing and e-mail at key population centres and to semi-interactive audio-conferencing at outer island sites. The success of this scheme, which is still in the planning stage, will depend on the cooperation of the education systems of the region in procurement of telecommunications facilities and services on a common basis, and in administration and management of the resultant network on a cooperative basis.(37)

2.2.3. Journalism and the press

The idea of preferential telecommunications tariffs was in a sense born due to the needs of news professionals, and specifically of the major news agencies, at the end of the last century. It has a long history which is closely linked to politics.(1)

In order to ensure full liberty of expression and the public's right to information, many countries, especially in Europe, have built up systems of assistance to the press, notably for in the area of telecommunications, which include direct support (subventions, reimbursement of expenses) or indirect assistance (tax exemptions, preferential tariffs). Today these systems, very heterogeneous, are under debate at the national and regional levels (for example in the framework of the European Union since the commencement of a single market in 1993); the reduction of telecommunications tariffs poses particular problems for international competition, and is the subject of difficult negotiations which are far from being completed.

In the Caribbean as an example of a developing region, media systems are reduced to operating at a bare subsistence level because of their limited revenue and high telecommunications costs; intraregional and other international communication flows are thus seriously restricted. Governments are felt to be indifferent or reluctant to provide incentives for greater media volume, even if they would be likely to ultimately increase revenue; government ownership of telecommunication operators leads to pressure for short-term profits, and foreign partnership in international telecommunication operations has reinforced conservative approaches.(38)

In this context, the Caribbean News Agency (CANA) is unable to increase intraregional news flow because of high telecommunications charges; 52-84% of the total news subscription cost is for telecommunications (not including the local connection of the client to the international leased line). 30% of CANA's total 1989 expenditure was for telecommunication and allied services. A UNESCO consultant recommended a discount of at least 50% of the commercial rate for leased circuit channels to receive CANA's General News Wire Service, as minimum support to permit healthy development of the Agency. A Press Broadcast Service tariff was suggested as a means of implementing this policy.(39) This situation is still critical with tariffs generally increasing for technologies which are now outmoded (e.g. more than a 60% increase between 1992 and 1993 for leased telephone circuits between CANA and two countries in the region), leading to constraints in the development of new markets and services.

In Africa, the situation of the news agencies is even more dramatic (see the box on the following page). The Panafrican News Agency (PANA) undertook a pilot project on regional news exchange with assistance from the SHARE Project of INTELSAT, but several African countries could not participate because of the high tariffs requested by their Administrations for the required ground links, and the experiment stopped after the free period of satellite services was over.

Several approaches to reducing telecommunications expenses of press and news agencies exist at the national level:

- Several developing countries, such as Indonesia and Oman, offer substantial telecommunication discounts for press use.

- In India, part-time leasing of circuits (e.g. leasing for short periods according to needs) is provided to the press.(39)

NEWS AGENCIES IN AFRICA

In Africa, the news agencies are still generally governmental information organs, whose funding has traditionally come from the state budget and whose revenues return to the state. But, the transition in progress towards a democratic and pluralistic press, accompanied by disengagement of governments, is leading inexorably towards a market orientation.

The agencies provide service by means of terminals installed in the clients' premises (teleprinters), using public or leased telephone lines. In addition, they publish press bulletins. The information is processed in most cases by computer which would allow speeds well above 50 baud, but the quality of the telecommunication networks and the scarcity of modern terminals does not yet permit this.

As a result of deregulation and privatization, most of the major international news agencies (Reuters, AFP, UP, etc.) now transmit their services by satellite, which obliges their clients to acquire earth stations. The international agencies provide the stations and encode the information, giving them total control of the information transfer process. Technically, these transmissions are more reliable and efficient than the traditional radio transmission method, but most small African agencies find the new technology constraining and exorbitantly expensive, which represents a threat to free access to information.

The Panafrican News Agency (PANA), currently being restructured, aims to facilitate the flow of news within and with the region through a network of self-sufficient sub-regional and national agencies. The transition in progress towards democratic press structures presents a critical financing problem for the news agencies which are being forced to cut costs and develop new products to remain competitive. This is a challenge, especially in the difficult economic situation of most African countries. Very often, the agencies criticize the high cost of telecommunication (about 20-40% of their operating budgets) which leaves them little means to modernize their operations. In a 1992 seminar, the directors of Central African agencies (CANAD) stressed their need for reduced telecommunication tariffs or for their own private networks

The introduction of appropriate telecommunication services could be a major aid for the collection and dissemination of news in the region, provided that the telecommunication networks are commensurably improved and the services offered are affordable. PANA has already decided to launch a VSAT news distribution system which is expected to reduce its costs by more than 50%.

- In France, as part of a general system for assistance to the press, the national PTO grants news agencies and the daily newspapers 50% reduction for leased telegraph lines. The same reduction, financed from the general state budget, is accorded for national switched telephone network use, leased telephone lines and ISDN; under this scheme the reduction for facsimile transmission for remote printing has recently been decreased from 50% to 40%.(40)

- In Italy, a 1984 law stipulated that all press circuits be charged at one quarter of the commercial rate.(39)

- In Germany, a Press Bulletin Service (PBS) is available from the national telecommunication operator for international connection to about 100 overseas destinations outside Europe; a discount of about 50% was originally offered but discounts are now typically about 35% (e.g. 37.5% reduction for a 50 baud circuit and 32% reduction for a 75 baud circuit).(41)

- Several other Western European countries (Spain, Switzerland and the Scandinavian countries) offer some press reductions.(39)

These solutions have generally been insufficient to make telecommunications affordable for the press. In addition they are not universally available and are in continual flux as the result of political debate. In this context press organizations, and particularly news agencies, are increasingly searching for autonomous solutions and are turning to new communication technologies. Several major international news agencies already have replaced leased lines by private satellite networks, and this solution is also planned or already underway by some regional agencies in developing countries.

2.2.4. Radio and television

Transmission tariffs vary from country to country for terrestrial networks and satellite ground links, while the costs of leasing satellite transponders from international networks such as INTELSAT or INTERSPUTNIK are fixed by the members of these bodies. The cost of telecommunication is considered by most of the regional broadcasting Unions and their members to be exorbitant and disproportionate to the actual PTO costs, particularly for international links. As an example of tariff constraints, the ASIAVISION members each spend about US$ 500,000 annually on telecommunications which is threatening the very existence of this non-commercial service.(42)

The market volatility resulting from deregulation and commercialization of telecommunication services is accentuating difficulties for the management of radio and television organizations in developing countries, which are sometimes obligated to renegotiate contracts for transmission links on a day-to-day basis. In certain cases incompatibility among competing satellite systems represents an additional problem.

It is worth recalling the lessons learned from the PANAFTEL project operation in Africa during the last two decades. At first, there were difficulties in securing the necessary funds for the implementation of this internationally sponsored regional project. But eventually this microwave network was upgraded and capable of transporting professional quality sound and television signals in addition to the telephone traffic originally envisaged. Thus it was possible for African countries to enhance broadcasting with more information inputs and entertainment programmes from other countries of the region. However, the national tariffs established for such services were unaffordable compared with the broadcasters' budget provisions. This resulted in extremely rare use of these circuits. Subsequently, the telecommunication operators increased the rates further to recover their costs, with tariffs reaching prohibitively high levels. This lack of marketing flexibility in tariff setting has led to a vicious cycle, where both the service providers and the broadcasting users are losers.

The experience of television organizations in the Arab States provides another example. The Arab States Broadcasting Union (ASBU) leased a 24-hour-a-day TV channel from ARABSAT to enable affordable, region-wide TV dissemination by Arab TV organizations which have no commercial activities and are almost fully dependent on state support. The system became operational in 1985 using earth stations run by the national telecommunication operators, and a Centre for News and Programme Exchange was established in Algiers in 1987. However programme exchange has not developed as expected because many of the national telecommunication operators levy very high ground sector charges which typically result in very high costs to the users (up to US$ 1000 for the first ten minutes, of which the space sector share is only US$ 80). In addition, several technical difficulties were encountered in dealing with telecommunication operators at the national level (insufficient capacity of the earth stations, problems in obtaining sound links to coordinate transmission).(43)

A number of different approaches have been used to facilitate access of broadcasters in developing countries to telecommunication services:

a) In the Arab States a major Regional Telecommunication Development Conference sponsored by ITU/BDT (43) requested the national telecommunication operators:

- "... to exempt Arab TV organizations from payment of ground sector charges (commercial charges) for news and programmes transmitted on ARABSAT TV channels leased by ASBU" (including sound coordination channels); any charges for the ground sector "should only be promotional and reduced to the minimum possible";
- "to authorize and provide facilities to Arab TV organizations to acquire fixed or mobile earth stations that can operate directly with Arab satellites in countries where such stations does[sic] not exist";
- "to regulate the procedures for using equipment of TV transmissions via ARABSAT by individuals and population communities ... [and] to promote the manufacture of reception equipment in the Arab World, a step that would ensure far-reaching economic gains";
- "... to equip the Arab earth stations operating with ARABSAT facilities for reception and transmission of two or more TV programmes at the same time ....".

This recommendation was subsequently adopted be the Council of Arab Ministers of Telecommunications (Cairo, 29 November-4 December 1992).

b) In Central America, the Comisión Técnica Regional de Telecomunicaciones (COMTELCA) oversees an agreement on transmission of non-profit cultural and governmental television programmes free-of-charge over the sub-regional microwave network.(44)

c) The Caribbean Broadcasting Union (CBU) and Helen TV in St. Lucia have reduced broadcasting costs by direct lease of satellite channels.(38) The concerned national PTO assisted CBU in obtaining the appropriate clearances to use a United States domestic satellite which was not available for public services in the region (see box).

d) Broadcasters in several African countries are making use of the multi-point multichannel distribution system (MMDS) technique to retransmit international satellite channels to viewers equipped with microwave receivers, without the cost of laying cable.(45) This technique might be effectively applied to the dissemination of African production in the future.

e) Major international satellite organizations are making substantial efforts to provide affordable commercial solutions for broadcasters. For example, INTERSPUTNIK grants substantial discounts for long-term leasing and provides wide flexibility concerning the capacity to be leased (46), while the recent INTELSAT tariff changes provide, *inter alia*, for 20% savings on non-preemptible, occasional television transmission and special facilities for the multiple access needs of news exchange (MAG - see box on the Caribbean).

The Inter-Union Satellite Operations Group (ISOG), made up of major broadcasters, public telecommunication operators and satellite system operators, has agreed on a series of measures to facilitate satellite news gathering (SNG), including recommendations on simplified approval of terminals and of temporary satellite connections and on a fair charging structure reflecting the actual costs of the authorizing operators.(47) This initiative will probably not provide relief to developing countries in the near future, since SNG is presently beyond the means of broadcasting organizations in the vast majority of these countries.

TELEVISION NEWS EXCHANGE IN THE CARIBBEAN
An example of Partnership

The Caribbean Broadcasting Union (CBU) is an association of radio and television broadcasting organizations in the Caribbean region which serve more than twenty territories, most of them small and poor islands. Their stations are struggling for survival, especially after deregulation opened up the market for private broadcasters.

In this difficult context, the PTOs of the region have been very cooperative in facilitating television news exchange: they have granted several grace periods, have been open to CBU's proposals for tariff changes, and have passed INTELSAT tariff reductions on to the broadcasters:

Phase I : Traditional Occasional Use

When the news exchange started in 1986 between Trinidad and Barbados, with Jamaica joining them after a while, each partner had to book its own uplink at US$ 8.00 per minute and downlink at US$ 4.00 (INTELSAT charge). The local PTO added a service charge of US$ 3.50 per minute.

Phase II : Multi-Origin/Multi-Destination
In March 1988 the CBU became the first Union in the world to make regular use of this new INTELSAT option which was introduced especially for news exchanges. This option permitted reduction of transmission time from 30 to 15 minutes and inclusion of Curaçao as a fourth partner--at 15% lower cost per station. The exchange now was called CARIBVISION.

Phase III : Multiple Access Guaranteed Service (MAG)
In order to make the news exchange affordable to more stations and to further rationalize it, CBU proposed to INTELSAT a "lumpsum pool price, regardless of the number of participants". After three years of negotiations, this principle became the basis of INTELSAT's MAG tariff which was introduced in July 1991. Under this system, the INTELSAT charge is equally shared among all participants, regardless of whether they transmit or only receive. The more participants (within or outside the region), the lower the INTELSAT cost per partner. This arrangement benefits the PTOs and - if passed on - the broadcasters. The average Caribbean rate at present is US$ 7.00 per minute including the PTO charge.

The MAG tariff appears to be an interesting option for other regions (and is already in use by ABU in Asia), but it only provides full benefit if PTOs waive their high set-up fees for the first ten minutes and grant a reasonable flat rate per minute, commensurate with their share in the INTELSAT pool rate.

Despite the reasonable PTO tariffs, regional TV in the Caribbean is still extremely expensive, as only six of the PTOs of CBU countries provide INTELSAT satellite service. Whenever CBU wants to make programmes available to the entire region, the INTELSAT signal has to be turned around to a United States domestic satellite (DomSat), whose signal can be received in all territories. This turn-around was first done by a commercial enterprise outside the region for about US$ 3000 per hour and then by Helen TV in St.Lucia for about US$ 2000 per hour. For further economy, CBU decided to acquire its own uplink and turn-around facility in Barbados, for implementation in early 1994 at dramatically reduced cost. The PTO in Barbados cooperated actively in this deregulation process, after it came to the conclusion that a PTO-mediated DomSat service would not be profitable for TV applications only.

3. THE PROBLEM FROM THE POINT OF VIEW OF THE ITU AND TELECOMMUNICATION OPERATORS

Although the telecommunication services that are planned or offered in the various countries may be broadly similar, tariff policy is highly variable and can depend on the following factors:

- stage in the development of telecommunications,
- level of economic development and the financial situation,
- various geographical factors,
- political system,
- managerial structure of telecommunication operating organizations,
- telecommunication policy.

Today the tariff issue is a topical one in many international and regional fora such the ITU, GATT, OECD and the European Union, as well as in national instances. The discussion on tariffs is far from being finished; indeed, the matter is complex, politically sensitive, and involves considerable financial repercussions for the telecommunications sector.

This chapter will attempt to present an overview of the tariff variations found today and of general trends in tariff policy, by placing them a wider institutional, economic and technological context.

3.1. General tariff principles as seen by the ITU

The ITU is a world-wide organization within which governments, in consultation with the private telecommunication sector and other interested parties, co-ordinate the establishment and operation of telecommunication networks and services.

One of the purposes of the Union is to facilitate the world-wide standardization of telecommunications, and the ITU Telecommunication Standardization Sector (ITU-T, former CCITT) deals with that problem.

Standardization in ITU-T is done by means of "study groups". Each study group deals with a specific area of telecommunications.

Study Group 3 deals with general tariff and accounting principles. It is unique among the various study groups of ITU-T in that it is virtually the only group dealing with purely non-technical standardization. The participants in Study Group 3 are also unique, because they include delegates of Administrations, recognized operating agencies, Scientific and Industrial Organizations (SIOs), other international organizations and also different user groups. The responsibilities of Study Group 3 cover the whole range of ITU-T defined services insofar as their general tariff and accounting principles are concerned. Some of Study Group 3's work goes beyond simple tariff matters into regulatory or economic issues which are of great significance to the member countries.

3.1.1. Evolution of tariff principles

The evolution of tariff principles has closely followed technical, economic and political developments. Although some of the tariff principles approved as early as 1865, at the inaugural meeting of the ITU in Paris, are still valid today (for example, the principle of uniform rates between two countries, the single national area principle and the unique transit rate for each country), other principles have been modified in accordance with the evolving telecommunication environment situation, as is the case for the collection charge determination principle.

Before 1973, under the ITU rules, the collection charge was derived more or less directly from the accounting rate which is agreed between the two terminal administrations. This implied that an administration was unable to fix on its own the charge to be collected from the customers. The charge depended on the amount of reimbursement to the other carrier, defined in terms of what are known as terminal and transit rates. The accounting rate, or the sum of terminal rates and transit fees where applicable, were expressed in a common monetary unit called the gold franc. The gold franc, as its name implies, had a defined gold value up to the 1973 Malaga-Torremolinos Convention, and it was relatively easy in the days of the fixed currency exchange system, based on gold par values, to convert the accounting rate into collection charges expressed in national currencies. The result was that the charges applied for a communication between two given countries were, in principle, symmetrical with respect to the direction of traffic.

In the Telegraph and Telephone Regulations adopted at the 1973 World Administrative Telegraph and Telephone Conference (WATTC), the collection charges were clearly stipulated as being "a national matter". In other words, each Administration could fix the level of the charges to be collected in accordance with applicable national law, independent of the accounting rate. The only international rule was that Administrations should make efforts to avoid too great a dissymmetry in charges. This was indeed an epoch-making change in the principle of charge setting, but it was really a natural consequence of the change in the world monetary situation, i.e. the change from the Bretton Woods regime to the Smithsonian regime. The fixed relationship of collection charges and the accounting rates had reached its limits as currencies started to float, and conversion rates with the gold franc became unrealistic. The decisive factor was the demonetization of gold by the International Monetary Fund in 1976, after which the accounting rate became solely a basis for international settlement of accounts, and the principle of equivalent charges being applied to customers at both ends lost ground. However, since that basic principle not only ensured equality of charges but also tended to balance the traffic in both directions, thereby minimizing the risks in international accounting, the objective of avoiding too great a dissymmetry was maintained in 1973, as well as in the new International Telecommunication Regulations adopted at WATTC 88 in Melbourne.

The general principles applicable to international leased private telecommunication circuits have been also evolved considerably. For example, until 1972 the leased circuit service was "normally authorized in international relations only when telecommunication circuits remain available after the needs of the telecommunications services have been satisfied" (Recommendation D.1, Mar del Plata, 1963). It was only in 1972 that Administrations accepted the addition of the following stipulation that in their planning work, "the Administrations should not forget the need in leased circuits." The other conditions of service were also originally very restrictive.

Because international leased circuits became a major commercial tool and an important information transport medium for the business community, Study Group 3 devoted considerable attention to the issue from 1989. The new principles adopted quite recently (revised ITU-T Recommendation D.1, 1991) advocate a certain degree of liberalization in the conditions for use of international private leased circuits, particularly in respect of the constitution of networks, and their use by third parties including the public as well as their interconnection to public networks. It is expected that liberalization of international leased private circuits and networks by the ITU will be a factor in the development of new transmission media, in line with the proposed GATT sectoral annex on telecommunications. It is also expected that it will result in increased competitiveness which will lead to a probable shift in tariffs among international, long-distance and local calls.

3.1.2. The present situation with regard to tariff principles

One of the purposes of the Union, as stipulated in Article 4 (paragraph 2 d) of the International Telecommunication Convention (Nairobi, 1982), is to "foster collaboration among its Members with a view to the establishment of rates at levels as low as possible consistent with an efficient service and taking into account the necessity for maintaining independent financial administration of telecommunications on a sound basis." In addition, Article 18 of the Convention concerning "the right of the public to use the international telecommunication service" provides that Member countries should recognize the rights of the public to correspondence and also that the services, charges and safeguards shall be the same for all users in each category of correspondence without any priority of preference.
Taking into account these principles, Study Group 3 elaborated several general tariff principles which will be found in the D-series Recommendations.

We have already mentioned the Recommendation D.1 - General principles for the leasing of international circuits. Another Recommendation containing charging principles is Recommendation D.5 which describes the following concepts:

1) principle of overall cost compensation (including capital interest);

2) recognition of cross-subsidization among services;

3) consideration of the value of the service rendered to the user;

4) avoidance of harmful competition among different types of services;

5) respect for the principle that the surplus income should not be greater than the amount required for the efficient running of services.

This Recommendation is interesting and important in that it indicates various elements which Public Telecommunication Operators consider in determining their rates, for example:

1) the importance of telecommunications, as a public utility, to general economic life and the national administration;

2) the need to provide various kinds of services, of which some are profitable and others are not. Therefore the possibility of cross-subsidization cannot be ignored, and rates need not necessarily be based on the cost of the service alone;

3) the necessity of undertaking cost analyses, so that the cost of individual services may be covered and reflected as far as possible;

4) a harmonious rate structure reflecting the value of each service;

5) uniformity with a view to equality of use;

6) uniformity with a view to simplicity;

7) no exaggerated competition leading to dispersion and inefficiency of the various services provided.

Recommendation D.10, governing the general tariff principles for the international public data transmission service over public data networks, enumerates also a number of factors which must be taken into account in establishing tariffs for this type of service. These factors are:

1) the provisions of Recommendation D.5;

2) tariff relationships with other services provided by the administrations;

3) flexibility, enabling new needs to be accommodated as the service develops;

4) maximum simplicity from the administrative viewpoint;

5) the geographical configuration of countries:

6) not to impart undue advantage or disadvantage to any category of user;

7) encouragement of customer choice, depending upon needs, concerning the use of circuit or packet-switched services where the alternative exists;

8) encouragement of the use of the public data network, meeting the needs of as many users as possible, and promoting optimum growth and utilization of the network;

9) the need to be easily understood by subscribers;

10) sustainability of the service on a long-term basis.

Another important Recommendation that administrations should take into account when establishing telecommunication tariffs is Recommendation D.140 covering accounting rate principles. Study Group 3 adopted this recommendation quite recently, establishing the principle that accounting rates underlying international telephone charges should be cost-orientated. While accounting rates are not the collection rates actually charged to the users, it is believed that the cost-orientated principle contained in the Recommendation will, *in time*, positively affect user charges taking into account the national situation of the countries concerned.

The possibility of awarding a reduced charge for a specific group of users has not been a significant concern within Study Group 3 because, as mentioned earlier, the level of charge is, in principle, a national matter, and therefore this Group deals only with general tariff principles. However, the following Recommendations do contain items which concern reduced charges:

In Recommendation D.40 on general tariff principles applicable to telegram service, the preferential tariff for the press telegram (50 per cent reduction) has been deleted. However, the charge for telegram concerning persons protected in time of war by the Geneva Convention of 12 August 1949 still subsists and a reduction of 75 % is accorded. The Tariff Group for Africa has also adopted Recommendation D.606R which recommends that "the conclusions adopted by the Plenary Meeting of the Tariff Group for Africa be applied, namely that as a general rule, preferential rates shall not be granted to users in international relations between countries in Africa".

This rapid review of the present situation with regard to tariff principles adopted within the ITU for the establishment of telecommunication charges can be summarized as follows:

- One of the purposes of the Union is to foster collaboration among its members with a view to establishment of rates at levels as low as possible.

- Member countries should recognize the rights of the public to communicate and also ensure that the same services, charges and safeguards are provided without preference for all users in each category of communication.

- The level of the charge is a national matter. However, two principles are involved: In establishing charges, Administrations should i) try to avoid too great a dissymmetry between the charges applicable in each direction of the same relation, but ii) admit reductions by either party which are in the interest of healthy competition.

- It is necessary to undertake cost analyses, so that the cost of individual services may be covered and reflected insofar as possible.

- The possibility of cross-subsidization cannot be ignored, and rates need not necessarily be based on the cost of service alone (Universal Service).

- A liberalization of conditions for the use of international leased circuits has been recommended.

3.2. Tariff policies at the national level

The objective of this chapter is to clarify the basic economic and regulatory principles behind telecommunication pricing, as related to the situation of different categories of public telecommunication operators (PTOs). It will concentrate on the influence of the changing telecommunication environment situation (technology and liberalization) on telecommunication pricing and will analyze to what extent the awarding of reduced price by PTOs may be possible.

Determining typical categories of PTO situations is not a straightforward task, since tariff policies of PTOs depend on multiple factors. For simplicity, one can define two extreme cases: monopoly and oligopoly/competitive.

3.2.1. The monopoly situation

Historical development of telecommunication began with the regulated monopoly under which the administrations chose their own technology and organizational approach, and designed the size of their plant to meet general needs. Regulatory and operational functions were concentrated in a unique body that, in the absence of competitors, decided both the charging principles and the services to provide. After the change in approach to the regulatory issue began in North America and in Europe, many countries all over the world moved gradually towards adopting a different legal status for telecommunication and then passed to the process of separating operational from regulatory functions.

In countries where the telecommunication enterprise is run by the state, an independent accounting system is generally adopted. Investments for modernization and expansion of business are largely funded from the enterprises' own resources so that rate levels are set in order to yield a profit margin adequate to cover these investments. Normally, no compensation is received from the general accounts of the government, but, in some countries, a fixed proportion of the operating revenue has to be transferred to the national Treasury.

In certain countries where the private sector has traditionally been operating the telecommunication services or where the state owned enterprise has been privatized, the principle of fair return has been adopted for the determination of tariffs. Although the tariffs for individual services are determined in principle by adding fair returns to the costs, cost allocation between services is fairly difficult to carry out. In practice, the historical background, value of each service, capacity of the user to bear costs, the public interest and other political factors are evidently taken into account.

Although the global trend towards telecommunications liberalization is now picking up speed in the developing countries, the monopoly situation is still dominant in these countries where telecommunication is developing slowly and many people still lack access to basic telephone services, particularly in poor urban and rural areas. Because its main objective is the development of basic telecommunication infrastructure, the monopoly service provider tends to be insensitive to the need for new and reliable services like high speed data or high volume options such as Virtual Private Network, and tends not to fully pass the cost savings from such services on to its clients. Commensurably, reductions in telecommunication charges are generally much slower in a monopoly situation than in a competitive situation, particularly in the developing countries where operators face high investment costs relative to client income and equipment purchase and maintenance costs that are usually higher than those in the developed countries.

PTOs in a monopoly situation, particularly in the developing countries, tend to maintain high prices on international services; these charges effectively finance their network. The imbalance in rates between countries with a monopoly situation and countries with a competitive situation has led to an imbalance in traffic and has upset the international accounting mechanism that, more or less, assumed balanced traffic. In recent years, many developing countries have been net recipients of revenue from their international telecommunication settlements. Most of the burden of this has fallen on the countries in a competitive situation. This state of affairs provides a short term advantage for the monopoly situation countries, but it clearly cannot be sustained in the long run because of balance of payment pressures.

3.2.2. The oligopoly/competitive situation

With new "enhanced services" or "value added services" being introduced one after another as a result of today's rapid technological development, the tendency to deregulate and to rely on market principles seems to be growing. The basis of this trend is the philosophy that competition among the operating agencies, rather than regulations imposed on them, will further accelerate the development of telecommunications and *eventually* meet the interest of users.

Monopolists had been following the principle that no specific market preference had to be accounted for, except that the service to introduce should have universal interest. Thus, when market dynamics called for new services, major users preferred to rent circuits for their own needs rather than being unsatisfied with public performances and prices.

This tendency was reinforced as, under pressure of economic forces originating in the "service" sector, a number of countries were driven to modify their national regulatory framework to allow competition in the part of the telecommunication market that the Administration and the traditional PTOs could not satisfy. In this first phase of deregulation, several national suppliers provide "value added services" while public operators "reserve" for themselves the basic telecommunication services.

When competition is allowed, operators generally try to maximize profit and to maintain or increase their market share over time. Operating costs and tariffs are the two key parameters which operators can manage to fulfil their objectives and remain competitive: they will try to minimize costs and to apply rewarding charges.

Competition combined with the introduction of new technologies creates new applications such as telebanking, database access and business information systems. Most of these innovations result in substantial cost reductions for the user, when compared to traditional way of doing things.

In the oligopoly/competitive situation, PTOs have had to opt for more market-oriented approaches, and there has been a rebalancing of tariffs towards costs with the general effect of lowering. Thus, for many sectors and services tariff reductions have resulted in response to competition, for example as a means of preventing new market entrants from attempting to "skim cream" off overpriced routes. However, tariffs have increased for certain other sectors and services for which prices had been set at artificially low levels under the monopoly system.

In the next section, the role of regulators in various countries will be discussed, but in general the oligopoly/competitive situation allows the PTO to establish market based tariff structures and even move further towards flexible tariff structures. In developed countries where competition has been introduced, tariff options are becoming more and more important and PTOs offer now a variety of options based mainly on volume discount.

3.2.3. Regulators and their objectives

The present scene shows a variety of different regulatory situations ranging from the case of a state PTT enterprise to the case of pure market competition. The regulatory function is generally left to the Post and Telecommunication Ministry or the Ministry of Communications or to an *ad hoc* government authority.

It is definitely assumed that, in the medium term, the majority of countries will have separation between regulatory and operating functions as well as a deregulated market, either for value added services or for full competition. The regulating entity should, then, give general planning guidelines and provide reasonable charging principles so the whole telecommunication sector will develop in an harmonized way.

From the charging point of view the fundamental duty of the regulating entity is to ensure the best possible deal for the end user in terms of quality, choice and value for money.

The objectives of regulators seem quite different depending whether they are in the monopoly situation or oligopoly/competitive situation.

In the monopoly situation the main objective of the regulators is to promote telecommunications as an essential component of economic development, since it is believed that telecommunication investment has a multiplier effect on the economy as a whole. Many regulators in the developing countries with a monopoly situation will therefore feel that increasing the penetration of telecommunication services must sometimes be put before pure profitability, and it is also presumed that monopoly rights are dependent on certain social goals being achieved, notably universal provision of telecommunication services. These regulators may also adopt a policy of privatization and liberalization in order to mobilize private capital resources for the necessary expansion of the national networks.

Monopoly regulators normally exercise direct control over the tariffs set by the PTOs, and this control is also used to regulate the national inflation rate. Pricing control is exercised through the following balance: Prices should be

1) sufficiently low to encourage economic growth and trade, while

2) ensuring sufficient profit for telecommunication development funding.

In the case of oligopoly/competitive situation, eventually the prices are set by market conditions but, when competition is first allowed, it is necessary to create conditions that allow competition. At the beginning, the regulators need to encourage new entrants into the business by ensuring that pricing is fair to the extent that a new entrant can compete. Once competition is introduced, the objective of the regulators is pursued principally by promoting efficient competition, so that customers are served by the operator which provides services most closely matching their needs at the lowest cost. It has already been seen that a balancing of the various tariff elements is also a condition for fair competition and regulators have to control this point too. The main control on price by regulators is at present the "price cap" on tariffs, by which charges are allowed to increase by an amount equal to the inflation rate (consumer price index) minus a specified factor (efficiency). Price control of this form has been adopted because it has good incentive properties: PTOs in fact try to reduce network costs more quickly than the efficiency factor in the price control formula, since under this form of regulation they are able to keep any above-normal profits if they conform to the price rules.

In the oligopoly/competitive market, the main role of regulators is to ensure the fair competition based on market forces. However, they have also the difficult task of guaranteeing the provision of universal service across a country or ensuring that former monopoly service providers do not abuse the dominant market position, and this task must be achieved without perturbing natural competition.

3.2.4. Possibility of awarding preferential tariff for a specific user

While a monopoly was assured by the state enterprises, special sectors of activity or groups of users could be given rebates and discounts on the telecommunication charges they had to pay. Such assistance was possible since the monopolist could rebalance its total revenue by subsidizing the concerned revenue from other categories of users or services. However, today more and more PTOs have been privatized and apply a policy of transparency and non-discrimination. Even PTOs in a monopoly situation come under similar pressures because they are increasingly obliged to ensure sufficient profit for telecommunication development funding. Now, in the competitive environment, the rebalancing role reverts to governments and regulators.

Recommendation D.606R mentioned previously summarizes the position at the national level as follows:

> "For some time now the telecommunication Administrations of African countries have been subject to solicitation on the part of a number of international organizations or specialized agencies with a view to granting of preferential rates.
>
> Considering further,
>
> 1) that the telecommunication Administrations of Africa have an important role to play in socio-economic development of each individual country and of the continent as a whole, which entitles them to a reasonable rate of return on investment to enable them to fulfil their mandate and practice some degree of self-financing;
>
> 2) that these Administrations should also be able to reimburse the loans contracted for the modernization and development of their telecommunication networks out of the revenue from the services they provide,
>
> [it is recommended] that the conclusion adopted by the Plenary Meeting of the tariff group for Africa be applied, namely that as a general rule preferential rates shall not be granted to users in international relations between countries in Africa."

Once the market turns to competition, the adoption of charging principles such as "cost-orientated" and "non discrimination" drives the charging structure into different schemes. When charges have to be "cost orientated", each type of service has to be profitable by itself: this argues against subsidization and favours competition. When charges have to be "non-discriminatory", no discount may be given to any group of consumers without justification; each has to be considered equally and charged at the same levels.

When the first UNESCO/ITU joint study on telecommunication tariffs for the mass media was undertaken in 1986, it concluded that "the gap between the tariffs established by telecommunication authorities and what the media can afford to pay will need to be bridged by national government by making the necessary financial arrangements." From the preceding analysis it is seen that, due to telecommunication environment changes, this type of "financial arrangement" cannot readily be taken in charge by the PTOs. However, considerable rationalization and harmonization has taken place in the telecommunication sector since 1986, and today most PTOs are able to partially answer the request of specific groups of users or institutions, i.e. to provide satisfactory telecommunication services within limited user budgets. The next section treats the diversity of tariffs which in turn provides opportunities for reduction of the users' telecommunication budgets.

3.3. Tariff variations in practice

This section will provide an overview of tariff variations and trends in the context of the different forces affecting tariffs today - charging practice, market forces and technology - and indicate several areas in which users could benefit more than they have from existing services.

3.3.1. Trends in telecommunications revenue and pricing

Telecommunications pricing is deceptively simple. There are three basic elements: access charges, usage charges and a tax. These can be broken down further:

- access charges comprise a one-off connection charge and an on-going subscription charge, usually in the form of line rental;

- usage charges vary by distance of the call, duration of the call and time of day or week when the call is made. In data networks, the duration charge may be replaced or supplemented by a volume charge for the amount of data transmitted or stored. For some services, a call set-up or call attempt charge is also levied; though this trend has been strongly resisted by user groups;

- tax, usually in the form of a sales tax but occasionally in the form of a service-specific tax such as that levied on mobilephone users in the UK.

A number of organizations and authors have looked at the variety of tariffs applied in different countries. OECD, which regards the telecommunication sector as a major factor of economic development, has studied ways of expanding the telecommunication industries in the developed countries.(48) The same organization sought to establish a ranking of the best telecommunication operators by comparing quality of service indicators with the level of service costs.(49) Using different criteria, IDATE has carried out studies on the networks of developed countries and has contributed some highly instructive socio-cultural data.(50) Siemens (51), working on its own, has compared tariffs in all countries of the world, developed and developing, but has gone no further than numerical comparisons without further comment. The value of these instructive and original studies is reduced by the fact that in effect only 1% of users are capable of identifying each of the different telecommunication charges they pay.(50) Over the past ten years other tariff studies have been carried out at the request of the ITU and OECD in a number of countries (developing

countries in Africa, the Caribbean and South East Asia) but have never been published because of their confidential nature. The lack of sufficient data for the developing countries therefore makes it impossible to firmly document their budgetary or charging rules.

The data presented in figure 3.1 show that, among the 24 industrialized nations of the OECD which account for just over 80 per cent of global telecommunication revenues, access charges contributed 37 per cent of total revenues from telephone services in 1991 with the remainder coming from call charges. This percentage has risen from 33 per cent in 1986. However, the ratio varies considerably among countries. Access charges are highest as a percentage of overall revenues in New Zealand and the USA (where some subscribers receive free local calls in return for a higher subscription charge) and in the Netherlands. Call charges form the highest component of telephony revenues in Turkey, Luxembourg and France.

FIGURE 3.1

Breakdown of revenues from telephony services, OECD countries, 1991

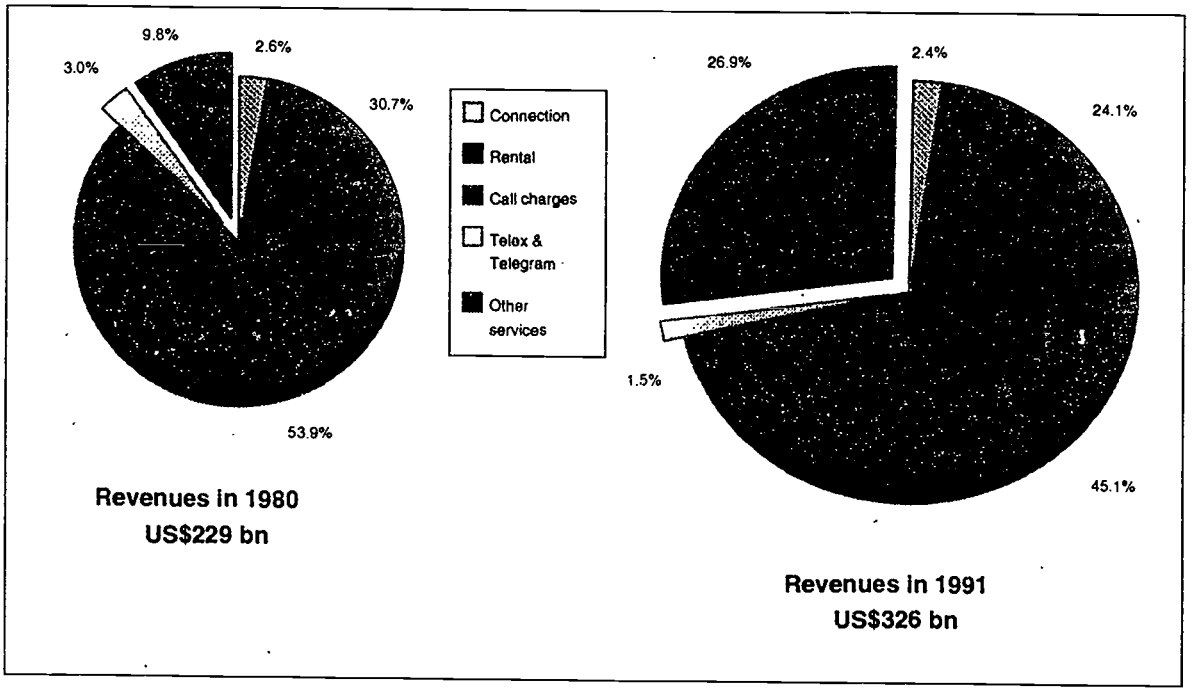
Country	Connection charges	(Centre = combined)	Rental charges	Call charges	Revenue in US$ M (1991)
Australia	---	30.2%	---	69.8%	7 428
Austria	2.1%		23.7%	74.2%	2 956
Belgium	2.0%		24.7%	73.3%	2 804
Canada	n.a.		n.a.	n.a.	11 783
Denmark	2.6%		29.6%	67.7%	2 378
Finland	6.7%		19.1%	74.2%	2 091
France	1.1%		18.4%	80.5%	22 397
Germany	0.8%		30.2%	69.0%	28 430
Greece	1.1%		25.6%	73.3%	1 345
Iceland	3.4%		19.0%	77.6%	89
Ireland	2.0%		19.9%	78.1%	1 272
Italy	3.1%		25.0%	71.9%	15 680
Japan	---	28.1%	---	71.9%	49 029
Luxembourg	1.6%		17.4%	80.9%	203
Netherlands	9.4%		43.5%	47.1%	5 532
New Zealand	3.5%		45.2%	51.3%	1 487
Norway	2.0%		23.7%	74.3%	2 202
Portugal	2.5%		23.9%	73.5%	1 916
Spain	6.4%		26.2%	67.3%	9 701
Sweden	8.5%		27.1%	64.4%	5 140
Switzerland	---	30.8%	---	69.2%	5 156
Turkey	10.2%		2.2%	87.6%	2 246
United Kingdom	---	38.0%	---	62.0%	23 605
United States	4.0%		44.3%	51.7%	121 560
Total/average	3.3%		33.7%	63.0%	326 430

Source: *ITU telecommunication indicators database.*
Note: *All data relates to 1991 or most recent data available.*

Over time, the revenue structure of PTOs is changing. In particular, as the diagrams below show, the proportion of revenues which come from non-telephony services has more than doubled from 13 per cent to 28 per cent between 1980 and 1991. The main sources of non-telephony revenue growth have been mobile communications, data communications and leased lines. These have more than offset the declining revenue from telex and telegram services. Nevertheless, telephony still provides just under three quarters of the total revenue for PTOs.

FIGURE 3.2

Breakdown of PTO revenues by source in OECD countries, 1980 and 1991



Source: ITU telecommunication indicator database with supplementary information from OECD.

At one level, it could be argued that telecommunications pricing is actually becoming less complex. Three of the traditional components of tariff schedules -- distance, duration and volume -- are becoming less significant as an element of the total price. In newer service offerings, such as mobile communications or data communications, the element of distance has been virtually eliminated, except for international services. As mobile communications begins to compete on price with the fixed-link telecommunications services, the distance-independent structure of mobile communications will force fixed-link operators to modify their own tariff structure. The factor driving this trend is the introduction of digital switching which undermines the rationale for pricing calls by distance travelled because the actual route taken to pass through the network depends on circuit availability not distance.

The rationale for volume-based tariffing, namely the need to ration network access to avoid congestion, is also becoming rapidly outdated. This is because PTOs are investing in high capacity fibre optic backbone networks. In the emerging telecommunications environment in which capacity is so plentiful that it is effectively free for individual calls, the practice of charging consumers according to the duration of their call or the amount of data transmitted is becoming meaningless. Instead the trend will be towards flat rate, leased line type tariffs for high volume users and call set-up charges for low volume users. A good illustration of this trend is the demise of X.400 based electronic mail networks compared with the exponential growth of the Internet. X.400-based tariff strategies were based on volume charges with little provision for volume discounts. Internet-based tariffing, on the other hand, is based on flat rate access charges which reflect the fact that the Internet is built around leased line capacity rather than being offered as a public switched service by a PTO.

If the argument is accepted that the traditional elements of cost-based telecommunications pricing -- distance, duration and volume -- are becoming less important, then other factors will no doubt take their place. These factors will necessarily be more closely related to the market value of a service rather than the cost of producing the service. For international services, for instance, it remains the case that most users don't have much idea of how much a particular call costs and don't bother to find out. Because of "brand name" advertising of calling cards and country direct services, many consumers choose calling options which are actually more expensive. This may be because they are happier with the way in which the service is billed, especially if they are business travellers. The future tendency is that the actual price of the service will be less significant than the way in which it is marketed and billed.

Are telecommunications tariffs too high?

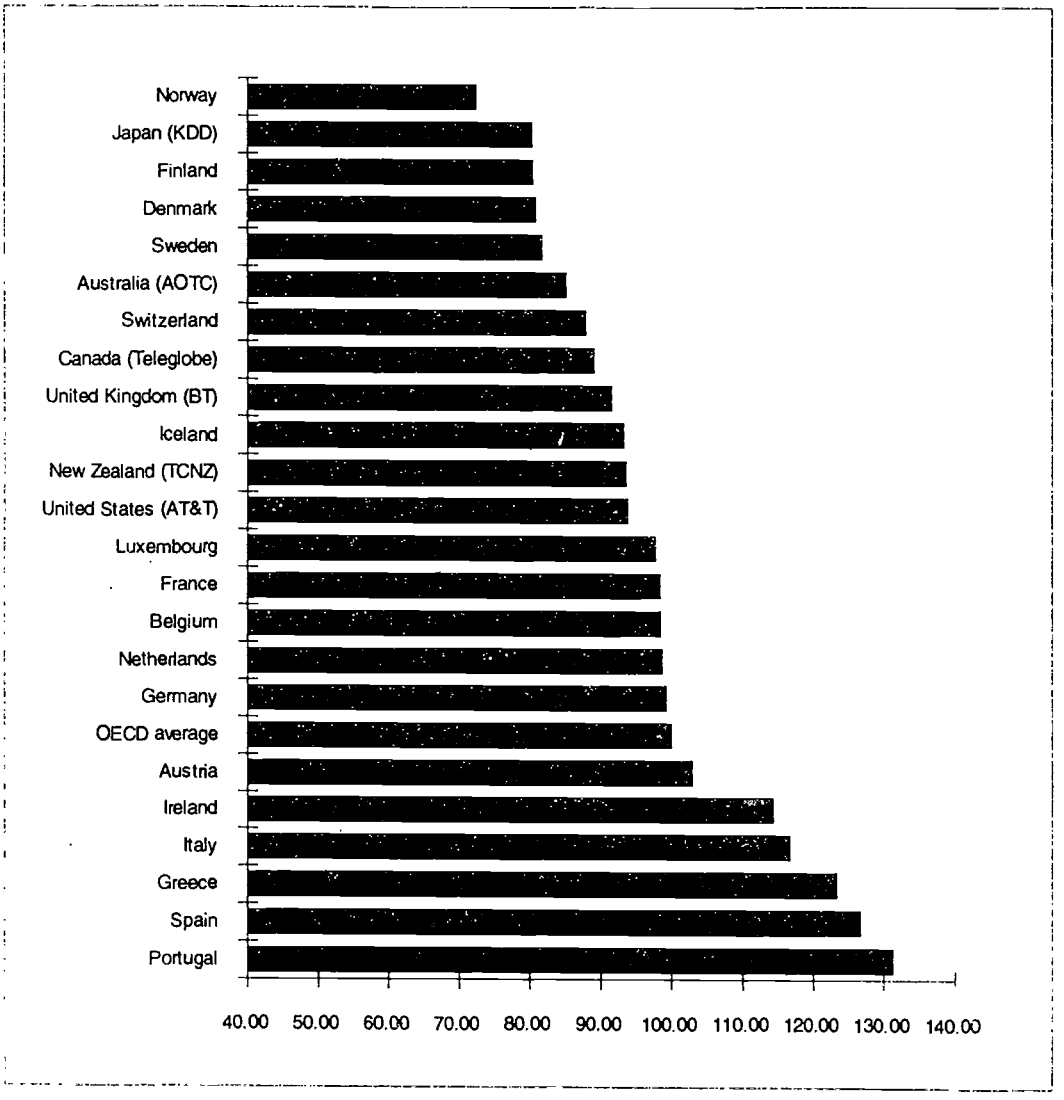
One of the central issues in this study is whether or not telecommunications tariffs are too high. This can be broken down into three subsidiary questions:

- Why do telecommunication tariffs vary so widely between countries?
- Is the level of profitability achieved by PTOs unjustifiably high?
- Are telecommunication tariffs too high as a percentage of *per capita* income as a measure of clients' resources?

For the first question, there is clear evidence of a wide variation in the cost of making the same call from different countries. Looking just at the OECD countries, the price of a basket of international calls varies from 72 per cent of the OECD average in Norway to more than 130 per cent in Portugal. Many bilateral calls, such as those between Australia and Belgium or between the UK and Spain, cost less than half as much as the same call made in the opposite direction. Such disparities reflect the fact that some countries are rebalancing their tariff structure and cutting international call charges at a faster rate than others.

FIGURE 3.3

Comparative international telephone call charges between OECD countries, January 1992



Source: *OECD tariff comparisons database.*

Note: *The basket is based on a call-pair methodology using Purchasing Power Parity exchange rates (PPPs). The call charges exclude tax and are indexed so that the OECD average equals 100.*

However, it is unlikely that such large differences in the price of making international calls will continue, because:

- Subscribers are making increasing use of call-back, country direct, freephone and calling card services to make use of advantageous tariffs offered by some operators;
- Many countries are liberalizing the resale of international leased line capacity thus allowing new companies to enter the market for capacity resale;
- The advent of global mobile satellite telephones in the latter part of this decade will offer an international service which is fully distance-independent and this will add to the downward competitive pressure on tariffs for terrestrial services.

These three factors should tend to bring the prices offered by international service providers closer in line with a global average and should reduce the large disparities which have been seen in recent years.

At a national level, the range of differentials in prices is much greater. However, comparisons are difficult because of fundamental differences in tariff structures, living standards, exchange rates, calling patterns, infrastructure costs, tax systems etc. To make effective comparisons, it is necessary to devise a basket of different calls of different distance and duration made at different times of day or week and also including access charges and tax. Research carried out at OECD (52) indicates that these variations between countries are increasing over time, particularly in the newer services such as mobile communications and leased lines.

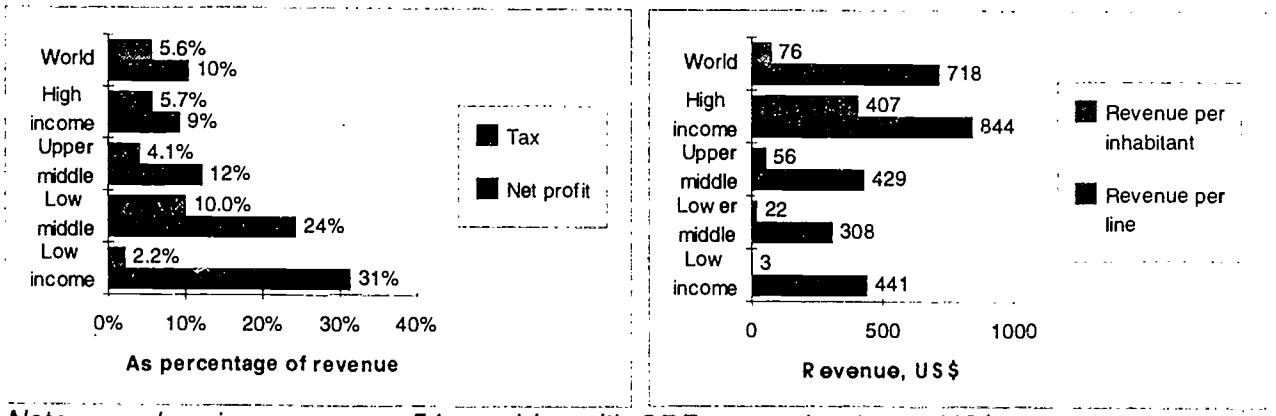
Moving to the second question -- is the level of profitability achieved by PTOs unjustifiably high? -- the answer appears to be: "it depends where you look." Figure 3.4 shows 1992 data for the level of profitability for PTOs in more than 200 countries and territories across the globe. The overall net margin of profitability is around 10 per cent of revenue with a further 5.6% being paid to governments in tax. Relatively few PTOs in the world make a loss. These average figures show an industry which is successful without being excessive. Certainly they contrast favourably with the high losses generated by other similar global industries such as airlines, steel making, car manufacture.

However, if one looks in detail, it is clear that some PTOs are much more profitable than others. The Low income countries (mainly in Africa, China and the Indian sub-continent) achieve an average level of profit on telecommunications operations which is more than three times that of the world as a whole, despite the fact that they gain less than US$ 3 per person per year from their inhabitants. This apparent paradox can be explained by the fact that the relatively few people within these countries who have access to telecommunications services can afford to pay high prices. Furthermore, a considerable proportion of the income comes indirectly from the accounting rate system. In Latin America and the Caribbean, for instance, settlement charges paid by US carriers alone amount to more that 10 per cent of overall national telecommunication revenues and more than 30 per cent in nine countries of the region. Another factor is that low income country PTOs pay relatively little tax (just 2.2% of revenue) though, as many of these PTOs are state-owned, the profits go directly to the state. In theory, these low income PTOs should have the lowest level of profitability because they should be operating major investment programmes. However, this does not appear to be the case. Rather it appears that governments in these countries prefer to use the telecommunications sector as a cash cow to pay for other parts of the economy and projects unrelated to telecommunications.

The PTOs of the lower middle income countries, which include parts of Eastern Europe, some Asian countries and some of the richer African nations, achieve a relative high level of profitability, but also pay the highest proportion of taxes. In these countries, the financial relationship between the PTO and the state is more transparent, but still an inadequate percentage of revenue is being invested and too high a percentage is being declared as profit.

FIGURE 3.4

Profitability, tax and revenue of public telecommunications operators, by income region, 1992



Note:
- *Low income covers 54 countries with GDP per capita below US$ 600 per year.*
- *Lower middle income covers 66 countries with GDP per capita between US$ 600-2,500 per year.*
- *Upper middle income covers 43 countries with GDP per capita between US$ 2,500-10,000 per year.*
- *High income covers 39 countries with GDP per capita above US$ 10,000 per year.*

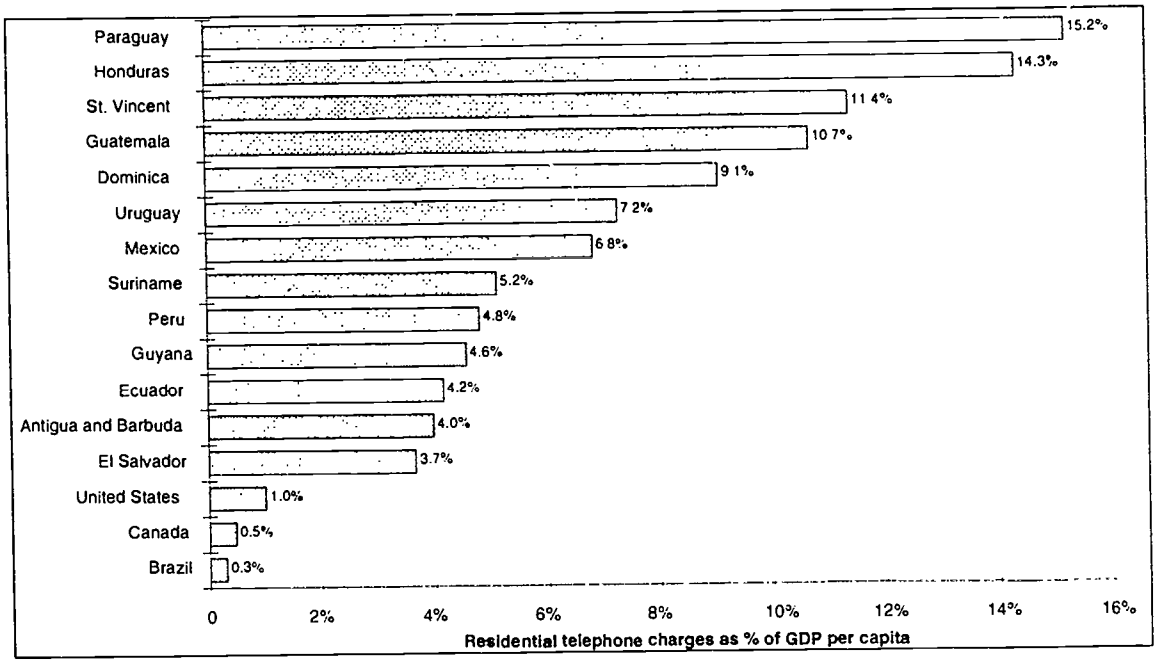
Source: ITU World Telecommunication Development Report, forthcoming 1994

Figure 3.4 shows that the countries with the lowest level of apparent profitability are the high income countries, though even here the figures achieved (15 per cent operating surplus; 9 per cent profit) would be the envy of other industries. One of the reasons that profitability is lower in these countries is because market competition is permitted in many of the most economically significant countries in this group including Australia, Canada, Japan, New Zealand, Sweden, the UK and the USA. Also, the financial relationship between the operator and the state is more transparent. These two factors have acted to keep prices at a lower level in these countries than would otherwise be the case.

The third question raised at the start of this section -- are telecommunication tariffs too high as a percentage of *per capita* income? -- can be best answered by looking at the relationship between average tariff levels and living standards. Again the simple answer to this question is: "It depends where you look." In Figure 3.5, a basket of residential telephone charges is compared with the level of Gross Domestic Product (GDP) *per capita* which is used as a surrogate for average living standard. Clearly, the countries with the lowest relative tariffs are the richest countries of the region, but nonetheless there are still major differences even between neighbouring countries such as Paraguay (15.2%) and Brazil (0.3%) or between Honduras (14.3%) and El Salvador (3.7%).

FIGURE 3.5

Residential telephone charges as a percentage of GDP in selected countries of Americas region, 1992



Source: ITU, Americas Telecommunication Indicators, 1993

Tariff diversity is largely explained by the diversity of situations and approaches among operators, treated above. The heterogeneity of demand is also important, as is the general economic situation as reflected in domestic market conditions (wage levels, inflation rates, effective tax levels, duties on imported equipment, etc.). The geographical factor is also important, since a cable is easier to lay in flat as opposed to mountainous terrain. Similarly while a densely populated area attracts infrastructure investments, it is costly to provide good service coverage in rural areas.

The developed countries apply time-based tariff differentials as well as reductions based on the volume of traffic. Different networks apply such reductions to major telecommunication service users (volume rebate on packet-switched data networks above a certain level of consumption, or cheaper rates for low traffic time blocks, etc.). Some operators favour professional users by offering them subscription rates lower than those of residential subscribers, whereas others penalize them because they hold them responsible for peak traffic which obliges them to over-dimension their network capacity.

3.3.2. The specific nature of data services

Unfortunately, most tariff studies have been restricted to telephone services of the public switched network.(53) Existing studies on charging in the data services are fragmentary and cover only a number of developed countries.

It is in fact hard to distinguish voice services from data services in any economic analysis, because telecommunication network infrastructures have traditionally been designed and equipped to transmit speech which, depending on the country concerned, still accounts for from two thirds to the quasi totality of the volume of transactions, and data transfers have gradually adapted to match the characteristics of those infrastructures. According to analysts, voice traffic should in the future take up a minority share only, given the suitability of modern networks for fixed image or video transmission and data transfers related to new services.

Operators are at present making use of existing resources, and a subscriber line intended to carry voice can also transmit facsimile or remote transaction monitoring signals or data signals exchanged during consultations with databases. The average use of each resource by each service should be known in order to establish real cost oriented charges, which is difficult in practice without putting significant burdens on the users. On the other hand, since service development differs from one country to another, it is only normal that charges should also differ.

It should also be noted that specialized networks for data communication (public data networks, ISDN, satellite services, etc.), which are rapidly being introduced in the new telecommunication market, are very often in the competitive, deregulated domain. Their tariffs are not covered by specific ITU-T recommendations such as those which apply to telephony, and, in addition, it is difficult to collect comparative tariff and traffic information from the operators who may not wish to provide it for commercial reasons. This problem is further compounded by the increasing data flows on "research networks" which are technically private networks.

In the light of this situation, the principal needs and opportunities for data communication may have to be inferred from the overall telecommunication situation, rather than awaiting specialized market and traffic studies in this area, which would require much additional effort.

3.3.3. The role of technology and investment in cost reduction

It is a well known fact that telecommunication prices fall regularly in real terms. For instance, the cost of a three-minute transatlantic telephone call between the United States and the United Kingdom between 1927 and 1983 fell by a factor of more than 100. An OECD study shows that telecommunication charges from Europe to the USA decreased on average 26.9% from 1985 to 1991. This trend is even more marked from 1991 to 1993 due to accelerating changes in the telecommunication environment. The price of the INTELSAT space segment between 1965 and 1985 fell from an index of 100 to 4, whereas over the same period the consumer price index rose from 100 to 280.(54) This reduction in costs and tariffs is due to improved techniques and the expanding use of telecommunication media.

The situation in Japan can be taken as an example of these trends in telecommunication charges:

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Telephone service was first offered to users in 1869 and is still enjoying a steady growth after 125 years. Perhaps one can say that this is truly one of the most successful products that has ever been brought to market. The development of terminals in conjunction with great enhancements in switching technology has enabled the transmission of signals other than simple voice over the telephone network. Today, on average, more than half of outgoing international telephone calls is facsimile traffic. In this sense, the switched telephone network is already an integrated services network.

Back in 1953 when the Japanese international PTO, KDD, started business, it cost 5,400 yen to call to the USA for 5 minutes. That amount was equal to about 50% of the monthly wage earned by an office worker just out of university. The transmission was via short wave radio and the quality was simply poor. Today, the same five minute call costs just less than 1,000 yen. If the call is placed during night time, then the price is 620 yen. This means that the office worker of today can make 300 such calls on his monthly salary. The transmission media employed are optical fibres and digital satellites. The quality is excellent. As a simple comparison, one can say that the relative price of an international telephone call has dropped 150 times in 40 years.

Even in the developing countries, telecommunication charges have fallen noticeably in recent years. A study carried out by the Tariff Group for Asia and Oceania in 1992 shows that international telecommunication charges decreased every year by an average of 3.5% within the region.

The emergence of digital techniques in the 1970s accelerated investment in communications infrastructure essential to economic take-off. Since a digital circuit costs least when switching and transmission are both digital, investors knew that the changeover was worthwhile provided that the whole project could be completed with the renewal and extension of the trunk network. Unfortunately it takes a long time to complete a programme of that sort within a major network, so that economies of scale and return on investment are still far from having been achieved. It may be noted that several national networks in Western Europe have not yet digitized more than 80% of their local transmission or trunk switching networks, and that with a few exceptions full digitization is not expected until about 2005.

Moreover, the traditional design of networks, even digital ones, is still based on a tree-type model with the subscriber still being the only user of his connection to the telephone exchange. Such distribution network links are relatively unreliable and costly to both parties, i.e. users and operators. Yearly expenditure on developing and maintaining the distribution network is generally estimated at 30-40% of the operator's general budget.

The reason for the high cost of the distribution network is that it is star-shaped: the central exchange is the centre of the star, and its branches are cables, split into metal pairs at junction points to serve individual buildings. Only very rarely are all the pairs in a branch used. The effective utilization rate of distributed cable pairs varies from network to network, mostly between 40 and 60%. Consequently, the costs of star-shaped distribution networks are higher than the theoretical values would suggest. The costs of service operation, and thus also the tariffs charged to users, will generally decrease as the efficiency of network utilization increases.

Many countries, particularly in the developed world, are introducing Integrated Services Digital Networks (ISDNs) which operate at higher speeds than packet-switched networks and are designed to carry voice and images as well as data. Other more advanced transmission and multiplexing techniques such as Asynchronous Transmission Mode (ATM) and Synchronous Digital Hierarchy (SDH) are being introduced into both private and public networks, and will surely lower costs and improve service quality for high-volume, high-speed data communication applications in the future.

A similar phenomenon is seen for the costs of (and therefore the charges for) periodic or occasional television transmissions which have already fallen considerably. The competition from large-scale transoceanic fibre-optic cabling is generally expected to lead shortly to a reconsideration of the basic role of satellites in relation to submarine links and, probably, a lowering of the relative cost of the satellite space segment, provided there are sufficient paying users.

Three additional facets of telecommunication technology are relevant here:

- The quantitative improvement in telephone service achieved over the past twenty years has brought about a relative fall in equipment costs owing to the resulting rise in world orders, international standardization and improved production techniques. This effect has tended to accelerate the impact of technological change.

- New technology has made possible innovative, cost-effective services which provide savings beyond those calculated by tariff considerations alone. As an example, one can cite the information and community service centres, or telecentres, which were established in the Nordic countries starting in 1985.(55) The concept was to offer communal access to telecommunications facilities, and to combine access with training, computers and social services. This concept has been extended to the developing world as an approach to solving the problem of "the missing link" - a combined problem of missing networks, missing access and missing relevant services. Telecentres are tailor-made solutions adapted to specific social, economic and cultural conditions. Certain technologies, such as time-division multiple access (TDMA), lend themselves to sharing of data which might be used as an extension of this concept. The latest findings in this field, including access to distance education, were presented at the Telecommunity '93 Symposium held in Queensland, Australia in November, 1993.

- Even current technologies can significantly reduce costs and tariffs. Over the past 25 years, some under-equipped networks have been radically improved on the initiative of the political authorities, who have considered investment in telecommunications to be both necessary and profitable to the national economy as a whole. That spectacular progress has sometimes been achieved without any technological renewal, simply through the use of available human and technical resources, with financial resources coming from national budgets and, especially, loans floated on the main international financial markets.

3.3.4. User groups in a commercial context

One strategy which PTOs can use to attract more appropriate types and higher volumes of traffic is to adopt a commercial approach aimed at specific user groups. Although such practice is now common for the business sector and its various specialized branches, this has not often been the case for public service and professional sectors such as the press, broadcasters, education and research.

In addition to the impact of cost-oriented pricing and new technologies in reducing tariff levels in general, the completion of modern networks will provide a number of new services which, being non-essential, will push PTOs to provide price differentials and service "value". This factor is expected to accelerate the decrease in telecommunication prices and lead to a new flexibility in the packages offered. However, the telecommunication users will need to understand the highly complex set of services offered and choose the right ones in order to optimize the utilization of their budget.

It would therefore seem useful to seek solutions aimed at matching the supply and demand of existing and potential services (dialogue between operators and users; better promotion of existing services, including initial pilot tariffs for the development of new applications and markets; pooling of communication facilities; study and better information on technologies suited to user needs, etc.). The approaches described below might be considered in that context.

Optimum utilization of existing services

The press, universities and broadcasters use telecommunication services as a tool for their professional activity. According to the objectives they have to satisfy, they should firstly define the type of message to be sent and the conditions of transmission. In particular, such specifications should include:

- types of message: press bulletins, telephone calls (including fax), telex calls, data transmission, video;
- duration of use: from a few minutes, to hours (occasional or at fixed time) or up to a year (permanent lease);
- traffic pattern and destinations;
- expected frequency of use events: e.g. regular transmissions, unpredictable events.

Based on an analysis of this data, a decision can be taken on the most appropriate transmission means, either by the users themselves or with the assistance of the providers. In particular, the choice involves:

- the capacity needed to transfer the message within the time limitation;
- type of support: public switched network, leased lines, dedicated terrestrial networks, satellite connection;
- appropriate terminal equipment technology.

To undertake this type of study, it is recommended that each group of users or user organization nominate a telecommunication manager to analyze and optimize the utilization of given budget for telecommunication. PTOs would cooperate closely with the telecommunication manager in order to define the optimum telecommunication network system or best combination of services for their users.

As an example one can consider basic services for newspapers and press agencies. The first task for the users is to check the number of terminals they have and the total volume of incoming and outgoing traffic. If the billing system is centralized in their organization, it is relatively easy to know the total telecommunication cost and investigate the possibility of obtaining a volume discount. Knowing the traffic destinations and pattern, the telecommunication manager should study the possibility of introducing leased circuits. This is a point-to-point service but, with liberalization as mentioned above, interconnection with the public network and shared use may be possible. With new technologies, it is easy to have six voice channels, one fax channel and one 4800 bps data channel with one 64 Kbps digital leased circuit (if digital circuits are available, which is unfortunately not yet the case in many developing countries). If the use of a permanent leased circuit is not economical, there is often the possibility of volume discount through a temporary lease at a fixed time of day (e.g. for three hours each morning).

If the traffic is highly spread or in general is not sufficiently great to warrant a temporary lease, there still exists the possibility of the Virtual Private Network (VPN) which is gradually being introduced throughout the world. By dialing a special code the calling party can remotely establish a connection to the chosen subscriber; once the transmission ends the link is disconnected and is available to other users. The VPN service is supported by the integrated services digital network; nevertheless, even in countries where the ISDN is not yet implemented, the service may be operated by special closed networks with intelligent nodes. It is available either between two subscribers (on-net) or between a subscriber and a user (off-net) calling from the public switched network (PSN). The service is generally offered at a discount of about 25% relative to the normal traffic charges.

Even if leased lines or VPN are not viable solutions, sizeable cost reductions can often be obtained by using the public switched networks making use of available discount tariffs and appropriate terminal technology. For example, the tariff reductions called for by news agencies (56) for press bulletins might well be accommodated, at least partially, by making better use of the present diversity of information transfer techniques. In recent years there has been a steady fall in modem prices and, at the same time, the performance of new modems has undergone a spectacular improvement; press bulletins could be transmitted cheaply over telephone circuits provided the news agencies standardize and coordinate acquisition of connectable terminals at the world level. One approach might be for the operators to encourage the press to make systematic use of modern terminal technology (e.g. specifically coded Group 3 facsimile terminals or 1200 bit/s full duplex videotex terminals or V.42bis modems connected to portable microcomputers), rather than 50-75 baud telegraphy whose use has been declining, particularly since 1987 in the developed countries, and will inevitably become increasingly costly until the telex and telegram service networks disappear, perhaps in 15-20 years' time.

Not all public operators today offer reduced rates at night, but such rates are now widespread, for example in Western Europe where most operators offer tariff reductions of up to 69% for 13 hours a day.(57) It should be possible to profitably extend the benefit of such facilities to priority users in sectors of public concern by generalizing the practice among public operators and informing the users which traffic hours are subject to reduced tariffs. Since modern terminal facilities (microcomputers, store-and-forward fax machines, etc.) enable such arrangements to be automated, data transfers could also be programmed for off-peak hours. Reciprocally, the worldwide adoption of such tariff measures would foster the dissemination of the necessary material. This reduction in call charges would have to be weighed against the cost of investment in automatic sending and receiving equipment.

"Closed user groups" and private networks

A category of users can create a "closed user group" in order to enable them to share capacity and reduce cost. In establishing "closed users group" it is also possible to aggregate collective demands for new telecommunication networks or services. Examples of such a strategy are the banking and air line services; by grouping, they have created, in co-operation with PTOs, the SWIFT and SITA networks. These closed user groups participate in the meeting of Study Group 3 and contribute to the establishment of new telecommunication orders. In forming closed user groups, it is also possible to request PTOs to lift restrictive conditions on the use of leased circuit networks or to quickly introduce new services like VPN, VSAT (very small aperture terminal) satellite systems or teleport services.

It may be feasible for a user group to obtain significant cost reductions by combining different transmission techniques through a multiplexing process. Press agencies and some scientific bodies often engage in tree-structured message collection and dissemination with transit from local users to national nodes and then to regional or international bodies, and vice versa. This increases their connection charges both upwards and downwards. In the immediate term costs could be reduced through a judicious choice of facilities for multiplexing and disseminating the messages to be transmitted, the solutions depending on the form the information takes (characters or graphics), the volume of each message, periodicity, urgency, the geographical locations concerned, the need to reprocess the information received, etc. Traffic from different customers can now be grouped thanks to the availability of new, relatively low-cost equipment which preserves data integrity and message confidentiality. Such an approach would of course require a good deal of common planning and cooperation on the part of the users.

A higher degree of user integration (and therefore greater potential for cost reduction and for customized service) can obtained through the creation of private networks. However, the planning and implementation of such networks is very complicated and may take several years. An alternative is to use a ready-made private network as offered by several PTOs. These PTOs undertake a traffic survey in close collaboration with the users and define the requirements of the end users. They can then allocate a portion of the existing digital network to create the best private network for the group of users. The PTOs can extend such a project to another country or add new technology or services, like a message handling system. Such a new private network can be considered at the beginning as a user pilot project and could thus perhaps benefit from a special tariff for an initial period.

Data transfer among universities and research institutions is increasingly carried out in the framework of "research networks" which often use the services offered by X.25 data networks and fibre-optic or satellite links to interconnect local institutional networks (see section 2.1.1). These networks have grown in importance because of the user-oriented approach they offer, and have been stimulated by major financial assistance from public and private bodies (RENATER in France from national and local authorities, EARN from IBM, the RACE project from the European Union, etc.) and from tariff reductions from the lease of high volume transmission capacity. But the reluctance of the PTOs themselves, at least until recently, to subsidize data traffic among research and educational institutions at the expense of commercial sector traffic has also undoubtedly been one of the driving forces behind the research network phenomenon. Such a strategy, including the interconnection of research networks and public networks for messaging, could, however, entail two commercial advantages for the operators: bringing new customers into the system who could otherwise not afford it and profitting from a higher volume of communications from the commercial sector to the research and education sector.

4. THE OPTIONS OF PUBLIC AUTHORITIES

Traditionally, the subject of telecommunications tariffs has been the preoccupation of monopoly carriers, the ITU and Administrations. With increased competition in the market-place, and the growth of national and international communications, the number of parties interested in tariff issues has mushroomed. First, there are the growing number of providers of services, including value added carriers, many of whom are more within the information technology sector than in the traditional telephone and telegraph community. Second, is the user community with its well organized corporate members (including financial institutions) and less organized, largely publicly funded institutional members (e.g. in UNESCO's fields of interest). Third, governments (national and local), regional and global organizations, whose interest is in planning generally, in addition to their traditional role as "the Administration" in the telecommunications sense. For example, government ministries concerned with national policies for education, science, transportation, the environment and health all now incorporate telecommunications into their strategic visions.

As the range of interested parties has expanded, it has become clear that tariffs must be considered in the larger context of communications. Within this context, issues of the **availability** of telecommunications and constraints on **access** to telecommunications facilities and services predominate. For users who have no telecommunications, or who are restricted in their access to available services, tariff issues may be only one of several concerns.

Tariff principles have evolved and the trend is now clearly toward cost-orientated, non-discriminatory mechanisms. Telecommunications entities would be quick to point out that telecommunications tariffs in general follow the GATT principles. They are based on objective criteria, cost-oriented, transparent, published and non-discriminatory. But authoritative spokespersons for the telecommunications community have also recognized the problems which might face users. The World Telecommunications Advisory Committee (WTAC), for example, commented that:

> *"...[the] shift to cost-based tariffing (and removal of internal cross-subsidies) [should] be accompanied by recognition of the need for policies and non-distorting mechanisms to encourage investment in rural and other "unprofitable" sectors" and that "...tariffs should be progressively moved to minimize the impact of distance and to accelerate the affordable use of services, including broadband services".*(58)

This conclusion has been reached after much debate and consideration of the public interest. However, it leaves with public authorities the challenge of developing the necessary policies and non-distorting mechanisms. What is, in effect, the closing chapter in a century-long debate in the telecommunications sector becomes the opening chapter in a fresh debate on bringing affordable and ubiquitous telecommunications to the publicly funded sectors.

As this debate begins, two points must be made. First, the publicly funded sectors have not, generally speaking, been viewed as a profitable source of revenue by the telecommunications industry. Second, cross subsidies and distorting mechanisms played a crucial role in bringing the telecommunications sector to the enviable position it enjoys today. In fact, it can be argued that such mechanisms are still being pursued by industrialized countries such as the United States, France and Canada with the support being shown for advanced technology networks such as NII, RENATER and CANARIE, in the framework of partnership of national and local authorities with industry.

In effect, public authorities are being thrown two major challenges. They must play a role, in the public interest, to extend the availability of services, particularly to meet the growing needs of the sectors of public concern, including those of concern to UNESCO. Through policy and regulatory decisions they must remove barriers to access, including those linked to the tariffing of telecommunications services.

Many of the barriers to access are technical or financial, but perhaps the most troubling barrier is the nature of the relationship between the telecommunications providers and the UNESCO community of users. Telecommunications providers have had difficulty in matching their services to the needs of the user community. The experience of introducing ISDN is a case in point. Users have become frustrated with the service providers because of the lack of appropriate services, difficulties of access and price. They have sought their own solutions, some of which are opportunities for the telecommunications sector and some of which present dangers for the sector as well as for the users.

- Researchers have established their own worldwide networks based on TCP/IP protocols rather than the telecommunications sponsored OSI standards;

- Broadcasters are publicly critical of the cost and access to telecommunications (including satellites) and are already establishing their own networks;

- Educators are unable to reach their clients with existing facilities and are looking to common, integrated, shared networks as an alternative.

Many efforts have already been made to overcome these barriers and these have been summarized.(59) In brief they include new industry structures, such as franchises for new services and unserved areas and the establishment of local companies. They include the generation of funds for underserved areas, such as through cross subsidies, special subsidies, and aggregating the needs of diverse users. In addition, incentives through regulation and to encourage investments have been used. Finally, operators in industrialized countries have been pressured to offer pricing options, such as discounts, reduced rates for spare capacity and free access for experimental purposes.

Each of the three major groups - governments, telecommunications entities and users - have a major stake in the outcome, but it rests initially with governments, in their role as public authorities, to set the framework within which further decisions can be made.

4.1. Service to the public versus non-discrimination

In the telecommunications field, and in other fields identified in the GATT and other trade fora, there is strong support for the adoption of non-discriminatory and cost-based tariffs. However, a universal adherence to these principles may act as a disincentive to the adoption of cost effective telecommunications applications in the sectors of public concern. Telecommunications may potentially be able to save money, and to deliver cost effective services for universities, schools and hospitals, but this potential is seriously eroded, particularly in the developing countries, by the lack of services and problems of access (including cost) to existing services. The problem is compounded, as mentioned earlier, by the widely held belief that tariffs for international services are being maintained at an artificially high rate.

Non-discriminatory tariffs may serve the public interest from a telecommunications policy viewpoint, but they may not be in the public interest from the viewpoint of other sectors.

At a conceptual level this would appear to be a classic case of one set of public interest objectives being in conflict with another. However, there is a fertile "middle ground" in this case which offers room for compromise.

There are a number of mechanisms already in place (e.g. off-peak discounts, high-volume discounts, experimental tariffs) which fall within the practical definition of "non-discriminatory". These mechanisms, when applied judiciously and in conjunction with other policies, can help reduce the cost of access to services.

At a deeper level of analysis, the telecommunications industry can, to a large extent, thank the distorting mechanisms of the past (e.g. cross-subsidization) for the success of the industry today. The sectors of public concern, such as education, are in some ways in a situation analogous to that of the carriers in the 1930s facing the need to extend services to rural areas. Special efforts were needed then to extend services, an investment which has been returned many times in profits to the telephone companies, and to the countries concerned in terms of contribution to the national economy.

Special efforts are needed now to encourage investment in support of the sectors of public concern, and these will undoubtedly produce commensurate returns.

4.2. International agreements

The education, science, culture, communication and information sectors are all increasingly becoming part of the global economy. This is reflected in the description of the networks described earlier. It is incumbent on the ITU and UNESCO, as the responsible agencies for communications within the UN system, to adopt positive measures to improve the availability of and access to telecommunication within these sectors. However, the use of telecommunications by these sectors can also advance the goals of other multilateral organizations, such as ICAO, ILO, WHO and WMO. They too should be encouraged to include measures in their programmes and agreements to encourage the use of communications in their sectors.

At the regional level, the use of communications by the sectors of public concern can bring about improved effectiveness, economic benefits and savings. This is as true for Asia and the Pacific or Africa as it is for the European Union. Positive steps can be taken in regional economic organizations, such as the Asia Pacific Economic Cooperation (APEC) forum, to support the use of communications networks through regional agreements. Such agreements might foster cooperation (e.g. aggregating demands for services), the sharing of facilities, promulgating the use of special tariffs and training. Specialized regional conferences, on such matters as education, research and information, might consider the inclusion, in their regional agreements, of international arrangements in these same areas. An example of such a step may be found in the recommendation of the 1992 Regional Telecommunication Development Conference for the Arab States which was discussed in section 2.2.4.

4.3. National policies

A recent report documents the current status of telecommunications in the Asia-Pacific region and identifies some significant shifts since 1984.(60) The report notes that the region has seen a 70% growth rate in main lines over the last decade. It shows that telecommunications plays a facilitating role for growth in sectors which depend upon the rapid transfer of information. The report describes the connection between the level of economic development, or wealth, and the state of telecommunications development, or teledensity. It concludes, that the gap between the developed and the developing economies can be closed given the right conditions for growth. The telecommunications transition, advancing from 10 to 30 main lines per 100 inhabitants, is becoming easier over time. The governmental policies being pursued in, for example, the Republic of Korea, Malaysia, Singapore and Taiwan have clearly demonstrated the formula for success. Based on these examples the ITU report identifies three main priorities for the region: investment, regulatory reform and service development, and stresses the need for regional cooperation.

There are well documented "models" where national policies, properly applied, have resulted in dramatic growth of telecommunications infrastructure. By extension, the application of sound national policies to the use of telecommunications in the sectors of public concern can be predicted to produce similar positive results.

Experiments and user trials in telecommunications, although practised extensively, have had mixed results. Many of these trials have been well documented and evaluated. A common criticism of such trials has been the lack of follow-up and adequate provision for on-going services. There are, however, positive examples which might offer models for other nations. Two such examples are the introduction of ISDN services into Singapore and the use of distance education in China where INTELSAT's project SHARE ultimately resulted in an extensive operational educational network throughout the country.

Positive examples of trials of new services in the sectors of public concern offer models for the adoption of similar services in other countries.

4.4. Local government options

Telecommunications development has historically been driven as much by local government initiatives as by policies at the national level. In the United States, for example, the Rural Electrification Administration (REA) has been used to bring telephone service to areas ignored by the large carriers.(59) In France and in Canada, regional research networks became well established and were later integrated at the national level. Some local governments, such as the Canadian Province of Ontario, have promulgated far-reaching and comprehensive communications policies including consideration of the needs of educational and other publicly funded users. A number of options are available for local government initiatives, including local companies, franchises for underserved areas, subsidies and incentives.(59)

5. STRATEGIES FOR THE FUTURE

Education, science, culture, communication and information will have a major influence on the society of tomorrow, and particularly on telecommunication development. Education forms future telecommunication users and specialists, while the media are instrumental in moulding public opinion in this area. Researchers and enterprises in informatics, science, culture and the media are conceptualizing, experimenting with, and already applying the innovative uses of telecommunications which will form the basis for future, advanced public services.

Telecommunications can be a major factor in enabling these key sectors of public concern to develop and meet their needs effectively. However, these sectors are facing serious problems in their use of telecommunications, particularly in developing countries. These include the lack of available facilities, difficulties of access and the pricing of services. High level bodies, such as the World Telecommunications Advisory Council (WTAC), established to provide advice to the Secretary-General of the ITU, and the Telecommunications Development Advisory Board (TDAB) are concerned with these problems more generally and have suggested steps to overcome them.

For example, the WTAC Report (58) identifies the importance of raising the level of awareness of telecommunications as an engine for economic and social growth at the highest level, especially in the developing countries and countries of Eastern Europe. The Report notes that "... more emphasis needs to be placed on social benefit applications" of telecommunications, suggests that "The direct and indirect benefits of telecommunications ... need to be highlighted in various public forums to create visibility, concern and commitments among key decision-makers ....", and recommends the "... establishment of a contact forum for operators, users and industry".

In view of this situation, the following eight strategies, incorporating sixteen policy recommendations, are presented for collective consideration of the various concerned parties - governments, regulators, telecommunication operators and users. The recommendations cover a wide range of topics. Some of the policy recommendations are political, others suggest pragmatic approaches which might be taken to improve effectiveness and to make better use of scarce public resources, while others could make a contribution to national telecommunications infrastructures.

Strategy I : **A Need for Continuing Discussion**

There are deep cultural and institutional divisions between the UNESCO communities of interest and the telecommunications world. Telecommunications specialists are justly proud of the dramatic technological advances brought about by their industry, and the continuing decrease in prices for many of their services. However, little attention has been paid to the particular needs of the UNESCO community which is dispersed and has limited financial means as compared to large revenue-producing corporate and government users. As a result, users in this community are often frustrated by the high cost of services and by problems in gaining access to technologies appropriate to their sectoral needs.

Public policies, stemming from governments and regulatory bodies, often prevent telecommunications operators from being more flexible in their provision of services to these customers. Such policies often fail to take account of how the delivery of services to the public can be facilitated by telecommunications. This leads to the first policy recommendation[4]:

1. *There is a need for improved dialogue between governments, telecommunications entities and the users in these sectors of public concern.*

Users in the UNESCO community are at a severe disadvantage in their discussions with telecommunications entities, and in articulating their needs to government policy makers. The telecommunications world is highly complex and changes daily. Large corporate users of telecommunications employ highly skilled experts to represent their interests, an impossible solution for educators and researchers with limited and dwindling resources. The UNESCO community can, however, by working cooperatively, define and aggregate their needs, share technological expertise and maximize their political and purchasing power to bring about change, which in turn can justify new telecommunications infrastructure and bring commercial benefits to the providers of telecommunications services and products.

2. *Users in the UNESCO sectors of public concern can obtain better services and negotiate new arrangements by capitalizing strategically on their collective investments, their international purchasing power, their contribution to national development goals and their potential ability to spur the development of national telecommunications infrastructures. This can be facilitated by the strengthening or formation of user groups at the national, regional and international levels.*

In the emerging telecommunications environment, dialogue at the regional level can provide particularly fruitful opportunities.

3. *Users in the UNESCO sectors of public concern should actively participate in regional conferences and other meetings of telecommunications operators and users and should encourage the formation of such fora where they do not yet exist and*

4. *They should engage in a systematic effort to document and define their generic requirements for telecommunications at the regional level and make these known to regional organizations.*

4 The other policy recommendations are numbered consecutively in the remainder of this chapter.

To participate productively in a continuing dialogue with telecommunications entities, the UNESCO community will need to be able to assess their own possibilities and responsibilities for telecommunications, as well as those of the telecommunications operators and governments which regulate these operators. They have to collectively develop or acquire sufficient technical competence, be well organized and exhibit sufficient purchasing power to participate. Participation will then bring them better services and facilities and the chance to negotiate new and more satisfactory arrangements.

Strategy 2 : **The User Providing Service to the Public as a Valued Customer and Partner**

The world-wide use of telecommunications by users in the sectors of public concern is already significant and, given the stimulus of innovative policies and a cooperative telecommunications industry, can be expected to grow rapidly creating new business opportunities.

Users in these sectors will continue to make significant investments in telecommunications services and deserve to be recognized as important customers, and if possible partners, by the telecommunications and information technology industry. Service providers could create a less adversarial relationship by targeting their products more directly to sector needs through a strategy of market segmentation. They could, for example, make greater efforts to sensitize users to potential low cost applications, or serve on the management bodies of user-oriented private networks. In addition, recognizing their communality of objectives, users in sectors of public concern and PTOs can consider joint pilot projects or the creation of joint ventures for the development or provision of specialized networks or services.

Specific steps which might be taken will obviously vary widely between and within regions but could include approaches such as the telecommunication operators' allowing the use of underutilized X.25 services at minimum rates, allowing easy interconnection with e-mail services and ready access to e-mail directories, and the packaging of management software for use in private networks.

5. *It is in the long term interest of telecommunications entities to accord users in sectors of public concern "most valued customer" status and to give them high consideration concerning access, flexibility and pricing as is done for large government and business customers.*

6. *National operators, private service suppliers and users in sectors of public concern can consider the formation of joint ventures, with appropriate support from governments and regulatory authorities.*

Strategy 3 : **Aggregating the Demand**

Large organizations have been able to benefit from cost savings and increased efficiency by drawing together the different elements of their networks, creating customized networks involving a mix of suppliers, systems and services. The sectors of public concern could obtain similar advantages by identifying and consolidating their demands for telecommunications, choosing an appropriate supplier or suppliers and then managing its networks on a collective as opposed to an individual basis. There are various models available for aggregating the demands of a large number of users. Generally speaking, they all enable users to share capacity and reduce costs. There are however two fundamentally different strategies which might be pursued depending on the tariff structure for the services to be purchased and the long term goals of the agencies concerned.

The first approach is to take advantage of cost reductions through "bulk purchasing". User organizations, having contributed their requirements to the aggregated demand, will gain access to networks or facilities at lower costs than they could have independently.

The second approach involves a trade-off between current expenditures and long term growth. Users, based on their large aggregate demands, might be able to negotiate cheaper rates for higher capacity networks and more sophisticated facilities, allowing them collectively to move more rapidly into more advanced networks. This approach might allow users to contribute to the creation of new national or regional telecommunications infrastructure.

Both of these approaches would require agreement on some form of "broker" agency.

7. *Agencies in sectors of public concern should consider aggregating their collective regional demands for telecommunications networks and services and presenting these to national and regional organizations. This would include the consideration of new services and applications.*

Strategy 4 : **Sharing the Supply**

The aggregate demand for telecommunications in support of the sectors of public concern can naturally be expected to require a much larger supply of networks and services than would be required for a single user organization or institution. The supply of these networks and services might productively be coordinated by a single entity with the responsibility for the procurement of telecommunications facilities and services on a common basis.

A single regional entity, or common service agency, might act as a broker to procure the user defined network capacity and services. These might then be resold back to the user institutions at preferred rates with a low "overhead" charge retained by the agency. It may be necessary to remove regulatory barriers in some countries to allow this to happen.

8. *The purchasing, sharing and management of networks and servi s might be carried out by a common service agency acting on behalf of the joint terests of member countries or entities of public concern within a region.*

Strategy 5 : **Sensitization of Decision Makers and Encouragement of Investment**

The WTAC suggested that the role of telecommunications infrastructure in overall national development should be raised to the highest political level. Supportive national, regional and international telecommunications policies are essential to the implementation of telecommunications networks and services. Such policies can also create confidence and the necessary conditions for investment and the commitment of funds. Regional economic organizations, in particular, should identify telecommunications as a high priority and encourage its application to the sectors of public concern.

The evolving goal of regional, international, shared, multi-application networks with broadband, multimedia capability poses a particular problem in that it might be difficult to implement in some areas of the world because of existing policies. These include highly sensitive policy areas such as sharing and resale, earth station ownership and licensing and tariff structures.

9. *The importance of telecommunications policies to permit shared and common use solutions should be part of any deliberations of Heads of State and other world leaders on the role which telecommunications plays in economic and social development.*

Investment in telecommunications in the developing world will no doubt continue to come primarily from financial institutions and governments and from international aid. New telecommunications networks and services can be expected to improve the delivery of social services at reasonable cost, subject to the formulation of supportive policies and regulations. These networks and services can also contribute to the creation of improved national, regional and international telecommunications infrastructures and thus to economic growth.

10. *Investment by governments and international agencies to support telecommunications in the sectors of public concern promises to have a two-fold return. It will permit the more effective delivery of social services and will contribute to stronger telecommunications infrastructures;*

11. *Users can encourage investment in telecommunications by making long-term usage commitments, perhaps through shared or "common" networks, thereby providing the justification for building and improving networks and facilities, and creating opportunities for commercial investment.*

Strategy 6 : **Tariff Principles and Practice**

The trend towards cost-orientated tariffs, both nationally and internationally, could pose difficulties for the sectors of public concern. The WTAC has suggested that cost-based tariffing be accompanied by "... policies and non-distorting mechanisms to encourage investment in rural and 'unprofitable' sectors". They further suggest that "... tariffs ... be progressively moved to minimize the impact of distance and to accelerate the affordable use of services, including broadband services". ITU documents, such as the D.1 document of the Telecommunications Standardization Bureau offer principles for the setting of tariffs, but the actual tariff levels will be largely decided by ITU members and their carriers. As important and growing user groups, the UNESCO community can be expected to have a strong interest in the ongoing discussions on tariffs and tariff reform.

Within this framework, national governmental and regulatory authorities might authorize innovative tariff arrangements to enable users in sectors of public concern to obtain quality services at reasonable cost and to ensure that they are informed of the most economic options. As an example, consideration could be given to applying tariffs based on incremental costs (the marginal cost to the carrier of expanding activity to include the additional usage) to users in UNESCO's field of interest, as a means of making use of underemployed capacity and encouraging market development.

Another approach would be for the national authorities, in the framework of alternative development policies, to consider the subsidization of services in some specific sectors of public concern. This should apply for a short period of time in each case with the aim of creating infrastructure to support concerned sectors. The highly successful experience of telecommunications in the now-industrialized world provides an ideal historical precedent for such measures.

12. *The cost-effective use of telecommunications by the sectors of public concern is highly dependent on reasonable and transparent national and international tariffs. The interests of public sector users should be taken into account in the further evolution of tariffs.*

In addition to an improved policy and tariff environment, UNESCO's community of users would benefit from stability and predictability of tariffs. Since researchers, educators and others are, unlike corporate telecommunications customers, unlikely to be able to pass on costs, it becomes important for costs to be predictable. Telecommunications entities can be of assistance if they understand the full context and cost implications of the telecommunications components within the overall user system. Telecommunications networks and services can then be customized to better meet overall needs, and costs negotiated accordingly.

13. *Users of telecommunications services need to be able to collaborate in the planning of their networks and services on the basis of benefits and outcomes. A full appreciation of the cost of telecommunications is a necessary element in this planning process.*

Strategy 7 : **The Special Problems of Broadcasting and News Media**

News agencies and regional broadcasting unions in developing countries are in most cases legally non-profit organizations and have to provide their services at cost. For many years these organizations have attempted to obtain lower telecommunication tariffs in order to achieve their specific goals of regional integration and providing access of the public to information.

These efforts have resulted in few changes to the burdensome telecommunication costs to these organizations; requests for lower tariffs have largely gone unnoticed, and many of these important organizations now find that their very survival is threatened.

The position of news agencies has been worsened by obsolete technology which constrains expansion into new markets and services. Telecommunication carriers should thus address opportunities for lower rates for possible new means of transmission including VSAT options. The technological changes that have occurred in recent years should encourage the development of cooperation between telecommunication operators and the media with the aim of establishing new partnerships which would fully meet their needs and interests of both parties at the technical and commercial levels.

Broadcasting unions could especially benefit from tariffs based on incremental costs, as proposed above, to make use of the significant spare capacity of the present satellite systems. In addition, flexible conditions for part-time or irregular leasing of channels, and long-term lease under fixed conditions with appropriate discounts, are needed. Finally, the lack of standardization of earth stations among international and domestic satellite systems is a significant barrier to use of these systems by the unions.

The above problems also apply to other news and broadcast media at the national level in developing countries, which are using terrestrial and satellite links in their work.

14. *Governments and decision-makers in developing countries are urged to support the granting of lower tariffs, taking account of the commercial interests of the carriers as well as the media's mandate, to facilitate the special developmental roles of news agencies and broadcasters.*

Strategy 8 : **Standards and Model Networks**

The issues of telecommunications and related information technology standards have not, until now, been a major issue for the UNESCO community of users. However, the technologies now being employed by networks are heavily influenced by standards promulgated by the ITU and the International Organization for Standardization (ISO), as well as by *de facto* standards developed, for example, by the Internet (which uses the TCP/IP protocols). While international efforts are underway to harmonize standards, users need to maintain an awareness of the issues and their impact on the use of telecommunications.

Standards are important to the creation of "models" or "frameworks" within which future networks and services can evolve. Ideally, such models should be based on "open" standards, that is, not restricted to proprietary standards. Such models are essential where "common" services are planned and where a certain amount of customization can be expected to satisfy special needs. Networks in Canada, for example, have made extensive use of the X.400 standard, but have customized it to reflect the need in Canada for accented capital letters, according to the national practice. Various model approaches, such as "layering" of services, can be employed to illustrate how different applications and needs can be satisfied for different users.

15. *Standards can have a direct effect on the costs and interoperability of networks. Users will need to ensure that their needs and requirements are understood and taken into account by standard-setting bodies. Representation of these needs should be made to the ITU, ISO, and/or other concerned national or international bodies.*

16. *Shared, multi-user networks will require the creation of an overall planning framework or model, based on common (international) standards.*

6. RECOMMENDATIONS

Solutions to the problems identified in this paper must address the basic issues of availability, access and costs, with emphasis on the needs of users in the fields of education, science, culture, mass media and information in developing countries.

Within this context, the following recommendations are offered which, if put into effect, would begin to create the favourable environment outlined in the eight strategies in the preceding chapter.

In the interpretation of the recommendations, Article 6.1 of the International Telecommunication Regulations dealing with tariff questions should be fully recognized.

It is recommended that:

The following recommendations, as well as the strategies outlined above, should be submitted for consideration at international fora beginning with the ITU World Telecommunications Development Conference in Buenos Aires in March of 1994. It is intended that ITU and UNESCO work together to promote their implementation in cooperation, as appropriate, with Governments, regulatory authorities, telecommunication operators and users.

6.1. Definition and organization of demand

Strong user groups are a precondition for definition of common needs and successful negotiation with telecommunication operators.

It is recommended that:

6.1.1. *UNESCO should assist users on a national or regional level to identify and clarify their needs and barriers to access, and to strengthen, and where necessary create, effective user groups;*

6.1.2. *UNESCO, in cooperation with regional organizations and national decision makers and with the assistance of ITU, should encourage partnership between users and telecommunication operators and private service providers to develop appropriate telecommunication facilities and services, through practical activities such as:*

- *Organization of global, regional and national fora to maintain a dialogue between operators and users, taking account of the ongoing ITU activities in this area;*

- *Carrying out pilot field testing of innovative market-oriented tariff schemes and of new technologies and services;*

- *Joint sponsorship of user-oriented research and development, including the collection and sharing of market data;*

- *Consideration of joint ventures in the light of the above activities.*

6.2. Standards

In order to ensure the development of compatible telecommunication services available to the UNESCO sectors of interest, particularly in the developing countries, the concerned users and technical specialists should be actively involved in the standardization process.

It is recommended that:

6.2.1. *User groups in education, science, culture and information should be further encouraged by ITU-T to participate in its standardization activities or to be associated in this effort at the national level, in a manner similar to that in which the media are already participating. UNESCO should assist the users in developing countries to organize themselves for this effort;*

6.2.2. *The concerned international standardization organizations, in collaboration with bodies involved in research network development and interconnection, should jointly address the issues of standards for international networks of interest to the publicly-funded sectors. In particular, joint efforts should be undertaken to ensure that network standards do not inhibit compatibility of or access to services in the developing world;*

6.2.3. *UNESCO should help to coordinate the development of models or frameworks for application networks and promulgate means to assist users to plan their utilization of telecommunications services.*

6.3. Tariff policy

It is important that tariff policies give special attention to the sectors of public concern, taking particular account of contributions to national socio-economic and cultural development, democratization and the newly emerging economic environment.

It is recommended that:

6.3.1. *Governments and regulatory authorities of developing countries should encourage, in cooperation with the ITU and UNESCO, a step-by-step reform by their operating administrations or recognized operating agencies of the domestic and international tariffs, in order to promote the establishment of networks and services in the fields of education, science, culture, mass media and information.*

6.3.2. *Users in these sectors, with the assistance of regional and international organizations including UNESCO and ITU/BDT, should encourage national governmental and regulatory authorities to authorize innovative tariff arrangements to enable them to obtain quality services at reasonable cost and to ensure that they are informed of the most economic options.*

As an example, consideration may be given to applying tariffs based on incremental costs (the marginal cost to the carrier of expanding activity to include the additional usage) to users in UNESCO's field of interest;

6.3.3. *Taking into account the need to observe the general principle of non-discriminatory tariffs, ITU, working with national Administrations in the framework of alternative development policies, should consider strategies based on the subsidization of services in some specific sectors of public concern. This should apply for a short period of time in each case with the aim of creating infrastructure to support concerned sectors;*

6.3.4. *To assist users in the sectors of public concern, the ITU should work towards a mechanism for wide dissemination of information on tariffs and tariff practices (including tariff discounts) throughout the world,* with both aggregate and case-by-case data.

6.4. Development assistance

Some developing countries may require assistance in following up and effectively benefiting from the above prospects.

It is recommended that:

6.4.1. *UNESCO and ITU/BDT should, in cooperation with telecommunications operators and users, respond to the needs of Member States for the establishment of common networks and services in the fields of education, science, culture, communication, mass media and information, to maximize their impact and benefit from lower costs. Projects of interest might possibly include teleports serving major concentrations of users and telecentres offering community access.*

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LIST OF ACRONYMS

AAAS	American Association for the Advancement of Science
ABU	Asia-Pacific Broadcasting Union
ACM	Association for Computing Machinery
AFP	Agence France Presse
ASBU	Arab States Broadcasting Union
ATM	Asynchronous Transfer Mode
BDT	Telecommunications Development Bureau (ITU)
BIREME	Latin American and Caribbean Centre for Health Sciences Information
CANA	Caribbean News Agency
CANAD	Central African News Agency Development
CANARIE	Canadian Network for the Advancement of Research, Industry and Education
CBU	Caribbean Broadcasting Union
CCITT	International Telegraph and Telephon Consultative Committee (now ITU-T)
CD-ROM	Compact Disc Read - Only Memory
CTU	Caribbean Telecommunications Union
DELTA	Developing European Learning through Technological Advance
DPBS	Development Press Bulletin Service
EARN	European Academic Reserach Network
EBU	European Broadcasting Union
ECA	Economic Commission for Africa (United Nations)
ECLAC	Economic Commission for Latin America and the Caribbean (United Nations)
e-mail	Electronic mail
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product

GNP	Gross National Product
GTE	General Telephone and Electronics
ICAO	International Civil Aviation Organization
ICCP	Information Computer Communications Policy
ICSTI	International Council for Scientific and Technical Information
IDATE	Institut de l'Audiovisuel et des Télécommunications en Europe
IDRC	International Development Research Centre
IFLA	International Federation of Library Associations and Institutions
IIC	International Institute of Communication
ILO	International Labour Organization
INTELSAT	International Telecommunications Satellite Organization
INTUG	International Telecommunication Users Group
IPS	Interpress Service Third World News Agency
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ISOG	Inter-Union Satellite Operations Group
ITR	International Telecommunication Regulations
ITU	International Telecommunication Union
ITU-T	ITU Telecommunication Standardization Sector
KDD	Kokusai Denshin Denwa (Overseas Communication Japan)
LEO	Low Earth Orbit
MAG	Multiple Access Guaranteed Service
MMDS	Multi-point Multi-channel Distribution System
NII	National Information Infrastructure
NLM	National Library of Medicine (USA)
NREN	National Research and Education Network
OECD	Organization for Economic Cooperation and Development

OSI	Open System Interconnection
PADIS	Pan-African Development Information System
PAHO	Pan-American Health Organization
PANA	Pan-African News Agency
PANAFTEL	Pan-African Telecommunication Network
PBS	Press Bulletin Service
PC	Personal Computer
PDN	Public Data Network
PSN	Public Switched Network
PSDN	Packet Switched Data Network
PTO	Public Telecommunication Operator
RACE	Research and Development in Advanced Communications for Europe
RASCOM	Regional African Satellite Communication Organization
RDC	Regional Telecommunication Development Conference
REDALC	Red de America Latina y el Caribe
RENATER	Réseau National de Télécommunications pour la Technologie, l'Enseignement et la Recherche
RINAF	Regional Informatics Network for Africa
RUNCOL	Red Universitaria Nacional de Colombia
SCN	Saskatchewan Communications Network
SDH	Synchronous Digital Hierarchy
SEANAD	Southern and East Africa News Agency Development
SNG	Satellite News Gathering
SHARE	Satellites for Health and Rural Education
SITA	Société Internationale de Télécommunications Aéronautiques
SWIFT	Society for Worldwide Interbank Financial Telecommunications
TCP/IP	Transmission Control Protocol:Internet Protocol
TDAB	Telecommunication Development Advisory Board

TDMA	Time Division Multiple Access
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa (same as ECA)
UNESCO	United Nations Educational. Scientific and Cultural Organization
UP	United Press
URTNA	Union of National Radio and Television Organizations of Africa
UUCP	Unix to Unix CoPy protocol
VPN	Virtual Private Network
VSAT	Very Small Aperture Terminal
WANAD	West African News Agency Development
WATTC	World Administrative Telegraph and Telephone Conference
WDTDC	World Telecommunication Development Conference
WHO	World Health Organization
WMO	World Meteorological Organization
WTAC	World Telecommunications Advisory Council

ANNEX

Invited Experts participating in the final meeting on the study (Geneva 6, 8 and 9 November 1993)

This meeting was organized jointly by ITU and UNESCO at ITU Headquarters in order to bring together representatives of the users in the education, science, culture, communication and information sectors and representatives of the telecommunication sector, especially members of the ITU-T Study group 3 "Tariffs".

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