



This electronic version (PDF) was scanned by the International Telecommunication Union (ITU) Library & Archives Service from an original paper document in the ITU Library & Archives collections.

La présente version électronique (PDF) a été numérisée par le Service de la bibliothèque et des archives de l'Union internationale des télécommunications (UIT) à partir d'un document papier original des collections de ce service.

Esta versión electrónica (PDF) ha sido escaneada por el Servicio de Biblioteca y Archivos de la Unión Internacional de Telecomunicaciones (UIT) a partir de un documento impreso original de las colecciones del Servicio de Biblioteca y Archivos de la UIT.

(ITU) نتاج تصوير بالمسح الضوئي أجراه قسم المكتبة والمحفوظات في الاتحاد الدولي للاتصالات (PDF) هذه النسخة الإلكترونية نقلاً من وثيقة ورقية أصلية ضمن الوثائق المتوفرة في قسم المكتبة والمحفوظات.

此电子版（PDF 版本）由国际电信联盟（ITU）图书馆和档案室利用存于该处的纸质文件扫描提供。

Настоящий электронный вариант (PDF) был подготовлен в библиотечно-архивной службе Международного союза электросвязи путем сканирования исходного документа в бумажной форме из библиотечно-архивной службы МСЭ.



THE MISSING LINK

REPORT OF THE
INDEPENDENT COMMISSION
FOR WORLD WIDE
TELECOMMUNICATIONS
DEVELOPMENT



THE MISSING LINK

**REPORT OF THE
INDEPENDENT COMMISSION
FOR WORLD WIDE
TELECOMMUNICATIONS
DEVELOPMENT**

COMMISSION INDEPENDANTE POUR LE DEVELOPPEMENT MONDIAL DES TELECOMMUNICATIONS

INDEPENDENT COMMISSION FOR WORLD WIDE TELECOMMUNICATIONS DEVELOPMENT

COMISIÓN INDEPENDIENTE PARA EL DESARROLLO MUNDIAL DE LAS TELECOMUNICACIONES

Chairman

Genève.

Sir Donald Maitland GCMG, OBE

22 January 1985

Vice Chairmen

**Mr. Abdul Rahman K Al Ghunaim H.E. Mr. J. S. Malecela
H.E. Mr. Achmad Tahir H.E. Mr. Armando Vargas Araya**

Mr. R.E. Butler
Secretary-General
International Telecommunication Union
Place des Nations
CH-1211 Geneva 20

Dear Secretary General

The Independent Commission for World Wide Telecommunications Development set up by the Administrative Council of the Union in May 1983 has completed the task entrusted to it in Resolution 20 (COM 6/15) of the Plenipotentiary Conference at Nairobi in 1982. I now have the honour to transmit to you our Report.

In view of the urgency and importance of the various actions we recommend, I express the hope on behalf of all Members of the Commission that when it comes to consider our Report the Administrative Council will meet at ministerial level.

We are grateful to you for inviting us to join the Commission. The challenge was formidable. But we have found the task rewarding.

Yours sincerely

Donald Maitland

DONALD MAITLAND
Chairman

Room 1212 International Telecommunication Union
Place des Nations CH 1211 Genève 20

Telephone: National (022) 995111 International + 41 22 995111

Tg: BURINTERNA Genève. TX: 421 000 UITCH
TELEFAX (Groupe 2/3) + 41 22 33 72 56

T H E M I S S I N G L I N K

REPORT OF THE
INDEPENDENT COMMISSION FOR
WORLD-WIDE TELECOMMUNICATIONS
DEVELOPMENT



DECEMBER 1984

MEMBERS OF THE COMMISSION

Professor Dr Sukhamoy CHAKRAVARTY

Chairman, Advisory Council to the Prime Minister
Planning Commission
India

- Professor of Economics, Delhi School of Economics, University of Delhi.
- Served as a consultant to various United Nations agencies.
- Member of the Indian Delegation to the Seventh Non-Aligned Summit.
- Chairman of the Indo-Dutch Committee for Research and Social Sciences (1981) and of the Advisory Committee on Research in areas relating to planning (1982).
- Member of Planning Commission, Government of India (1971-1977).
- Chairman, Fuel Policy Committee, Ministry of Steel and Mines (1971-1974).
- Visiting Fellow, Netherlands School of Economics (1957-1959), Assistant Professor, MIT (1959-1961) and various professional appointments.

Mr William M ELLINGHAUS

Formerly President
American Telephone and Telegraph Company (AT&T)
United States

- Executive Vice-Chairman, New York Stock Exchange.
- AT&T New York, Vice-Chairman of the Board and President and Chief Operating Officer (1976-1984).
- New York Telephone Company, President (1970-1976).
- AT&T New York, Assistant Vice-President, Vice-President and Executive Vice-President (1965-1970).
- Various posts with the Bell System in telephone companies in Maryland, Virginia, West Virginia and Washington, DC (1940-1965).
- Affiliated in the capacity of Director, Co-Chairman, Trustee and Member, to various companies, corporations, councils and orders, as well as educational civil and philanthropic institutions.

Mr Abdul Rahman K AL-GHUNAIM

(Vice-Chairman)

Under Secretary
Ministry of Communications
Kuwait

- Presently Director of: The Bank of Lebanon and Kuwait; The United Insurance Company Ras Al Khaima; and The Merchant Bank Corporation, South Korea.
- Member of the Board of Governors, University of Kuwait.
- Member of the Board of Directors, Kuwait Port Authority.

- Member of the Environmental Protection Council and Chairman of Research Group in Kuwait for Environmental Protection.
- Member of National Defence Council, Kuwait.
- Governor for Arab Group III, INTELSAT Board of Governors since 1973. Represented Kuwait as Plenipotentiary and Head of Delegation at INTELSAT meetings since 1969.
- Represented Kuwait at various meetings of ITU, ATU and UPU since 1963.
- Chairman of INMARSAT for two terms (1978-80, 1980-81).
- Deputy Chairman INTELSAT Assembly of Parties (1978-80) and of meeting of Signatories, 1973.
- Served as Director or Chairman of several banks and financial institutions.
- Assistant Under-Secretary in charge of Telecommunications for five years.
- Deputy Chief Engineer 1964.

Dr Koji KOBAYASHI

Chairman of the Board and Chief Executive Officer
NEC Corporation
Japan

- President of NEC Corporation, Tokyo (1964-1976), Director (1949-1964).
- An officer and/or member of a number of industrial, professional and governmental organisations.
- In addition to honours awarded by the Emperor of Japan, has received decorations from the Governments of Brazil, Egypt, Jordan, Paraguay, Peru, Poland, Thailand and Madagascar.

Dr Volkmar KOEHLER

Parliamentary Secretary of State
to the Federal Minister for Economic Cooperation
Federal Republic of Germany

- Member of the German Federal Parliament since 1972.
- Member and Vice-Chairman of the Committee for Economic Cooperation (1972-1982).
- Responsible for management training at the Volkswagen Company (1962-1982).
- Vice President of the German-Arab Association and of the German-Moroccan Association.
- Member of the Planning Committee of the Konrad Adenauer Foundation.
- First Mayor of the City of Wolfsburg, 1972.

His Excellency Mr Mohand LAENSER

Minister of Posts and Telecommunications
Morocco

- Head of the Moroccan delegation to the ITU Plenipotentiary Conference, Nairobi, 1982.

- Head of the Moroccan delegation to the Baghdad Congress of the Arab Postal Union (UPA), 1980.
- Head of the Moroccan delegation to the UPU Rio de Janeiro Congress, 1979.
- Attended the UPU Lausanne Congress, 1974.
- Author of diploma thesis on "Town planning and national development policy", 1970.
- Previous posts in Ministry of Posts and Telecommunications include: Head of the Budget and Equipment Division; Director of Personnel Budget and Equipment Department; Director of Posts and Financial Services; Secretary-General.
- Has taken part in various regional and international meetings connected with posts, telecommunications and savings banks.

Mr Louis-Joseph LIBOIS
Chairman, Caisse Nationale des
Télécommunications (CNT)
France

- Graduated engineer from "Ecole Polytechnique" and "Ecole Nationale Supérieure des Télécommunications".
- Senior Engineer in Telecommunications.
- Senior Counsellor, Court of Audit.
- Vice-Chairman of the Interministerial Board for data processing and office automation, chairman of the permanent Committee.
- Vice-Chairman, FRANCETEL.
- General Director for Telecommunications (1971-1974).
- Chairman of both SOTELEC and SOCOTEL Societies (1971-1974).
- Director of the "Centre National d'Etudes des Télécommunications" (1968-1971).
- Director of the "Centre de recherches des Télécommunications" in Brittany (1963-1968). Starting of the French digital electronic switching system design.
- Head of the Electronic switching division, Centre National d'Etudes des Télécommunications (1957-1963).
- Professor at the "Ecole Nationale Supérieure des Télécommunications" (1953-1957).
- Head of the Microwave radiolinks laboratory of the Centre National d'Etudes des Télécommunications (1947-1957).
- Former Chairman of the Société Française des Electriciens, des Radioelectriciens et des Electroniciens (SEE).
- Former Chairman of the France section of the Institute of Electrical and Electronics Engineers (IEEE).
- Fellow member of IEEE.
- Commander, Ordre de la Légion d'Honneur.

Sir Donald MAITLAND, GCMG OBE
United Kingdom

(Chairman)

- Permanent Under-Secretary, Department of Energy (1980-1982).
- Deputy Permanent Under-Secretary of State, Foreign and Commonwealth Office (1979-1980).
- Ambassador and United Kingdom Permanent Representative to the European Communities, Brussels (1975-1979).
- Deputy Under-Secretary of State, Foreign and Commonwealth Office (1974-1975).
- United Kingdom Member Commonwealth Group on Trade Aid and Development, 1975.
- Ambassador and United Kingdom Permanent Representative to the United Nations, New York (1973-1974).
- Chief Press Secretary to the Prime Minister (1970-1973).
- Ambassador to Libya (1969-1970).
- Various diplomatic service appointments in the Middle East, North Africa and the Foreign and Commonwealth Office (1947-1969).

His Excellency Mr John S MALECELA, MP
Minister for Communications, Transport and Works
Tanzania

(Vice-Chairman)

- Elected Member of Executive Committee of Commonwealth Association, 1982.
- Elected Chairman of PAPU, 1982.
- Minister for Minerals of the United Republic of Tanzania (1980-1982).
- Minister for Agriculture of the United Republic of Tanzania (1975-1980).
- Minister for Foreign Affairs of the United Republic of Tanzania (1972-1975).
- Minister for Communications, Research and Social Services of East African Community.
- Chairman of Communications Council and Research and Social Council of the East African Community.
- Elected Vice-President of Emergency Session of ICAO, June 1970.
- Minister for Finance and Administration of the East African Community.
- Chairman of the Finance Council of the East African Community (1969-1971).
- Ambassador Extraordinary and Plenipotentiary Permanent Representative of Tanzania to UN.
- Elected Vice-Chairman of a Seminar of Decolonisation (Committee of 24 - 1966).
- Elected Vice-Chairman of a Seminar on Apartheid held in Brazilia, Brazil.
- Member of UN Mission to Equatorial Guinea (which Mission led to Independence of Equatorial Guinea in 1968).
- Elected Chairman of International Seminar on Apartheid and Colonialism in Southern Africa, Kitwe, Zambia.
- Tanzanian Ambassador to Ethiopia (1964-1968).

- Tanganyika Consul to the United States and Secretary of Tanganyika Mission to the United Nations in New York.
- Regional Commissioner for Lake Region.
- Chairman of Western Tanganyika Cotton Advisory Committee.
- Member of Tanganyika Lint and Seed Marketing Board (1962-1963).

Dr Manuel PEREZ GUERRERO

Minister of State for International Economic Affairs
Venezuela

- President of Interpress Service - Third World since 1983
- Secretary-General of the United Nations Conference on Trade and Development (UNCTAD) (1969-1972).
- President of the Economic and Social Council (ECOSOC) (1968).
- Minister of Finance, Director of the Department of Planning and Coordination, Minister of Mines and Hydrocarbons (1946-1966).
- Various posts within the United Nations system (1946-1968).
- Served with the Secretariat of the League of Nations (1937-1940) and the ILQ (1943-1944).

His Excellency Mr Jean PING

Director of the President's Office of the
Republic of Gabon
Gabon

- Ambassador Extraordinary and Plenipotentiary, Permanent Delegate of the Republic of Gabon to UNESCO.
- First Counsellor at the Gabonese Embassy in France (1978).
- International Civil Servant, UNESCO (1972-1978).
- Member of the Association Nationale des Docteurs Es Sciences économiques (ANDESE, France).
- Member of the Executive Board of UNESCO.
- Member of the Inter-Governmental Council of the International Programme for the Development of Communications.
- Chairman of the UNESCO African Group.
- Vice-Chairman of the UNESCO Group of 77.
- Participates in various International Conferences and activities specifically in the field of Education, Sciences, Culture and Communications.

His Excellency Mr Alioune SENE

Ambassador of Senegal in Switzerland and
Permanent Representative of Senegal
to the United Nations Office in Geneva
Senegal

- Former Director in the office of President L S Senghor.
- Former Secretary of State for Information.
- Former Minister of Culture.
- Chairman of the Diplomatic Conference on the Revision of the Paris Convention (Protection of Industrial Property).
- Chairman of the Group of Experts on the Right to Development.
- Former Ambassador of Senegal in Zaire, Cairo and Beyrouth.

Professor Dr Alexandru SPATARU
Head of Applied Electronics Department
Bucharest Politechnical Institute
Romania

- Head of the Applied Electronics Department, Bucharest Politechnical Institute.
- Vice-President of the National Council for Science and Technology.
- President of the Romanian Commission for Space Activity.
- Scientific Manager, Telecommunications Research Institute.
- General Manager, Ministry of Post and Telecommunications.
- Deputy Technical Manager, Romanian Broadcasting Committee.
- Head of the Romanian delegations to UN Science and Technology Conference and Outer Space Conferences and to ITU, CCIR and CCITT meetings.

His Excellency Mr Achmad TAHIR (Vice-Chairman)
Ministry of Tourism, Posts and Telecommunication
Indonesia

- Member of Consultative People's Congress 1983.
- Chairman, Indonesian Veterans Legion since 1979.
- Secretary-General Department of Communication (1976-1983).
- Ambassador Extraordinary and Plenipotentiary to France, concurrently to Spain (1973-1976).
- Member of Consultative People's Congress 1972.
- Governor Military Academy (1966-1968).
- Leader of the Indonesian Delegation to the ITU Plenipotentiary Conference Montreaux 1965.
- Deputy Chairman, Indonesian Telecommunication Council (1963-1966).
- Leader of Indonesian Military liaison group to the United Nations 1963.
- Chief of Staff, Mandala joint command of armed forces for liberation of West Irian (1962-1963).
- Military Attache, Indonesian Embassy Rome (1956-1959).
- Commander of Military police (1946-1947).
- Founder and commander of the 4th division peoples defence army (North Sumatra) (1945-1946).

Professor Dr Leonid E VARAKIN

Rector

All-Union Telecommunication Institute by Correspondence
Ministry of Posts and Telecommunications
Union of Soviet Socialist Republics

- Professor of Technical Sciences since 1973 and Doctor of Technical Sciences since 1970.
- Member of Scientific and Technical Council of the Ministry of Telecommunications of the USSR.
- Member of the Praesidium of the Council of Rectors of the City of Moscow and Chairman of the Moscow Commission of Extra-mural (by correspondence) Education of the Council of Rectors.
- Member of the local Council of People's Deputies of the VOROSHILOV District of Moscow and Chairman of the Permanent Commission of People's Education.
- Since 1974 Head of Department of Radio receivers of the All-Union extra-mural Electrical Institute.
- Since 1963 involved in lecturing activity in the field of communications in the Moscow Institute of Telecommunications.
- Author of more than 140 scientific works and some books on telecommunications, mobile communications, statistical radio techniques, theory of signals, digital techniques and radio receivers.
- Publications: "Theory of complex signals" 1970, "Theory of systems of signals" 1978, "Statistical Theory and its application" (co-author) 1979.
- Participant in many international conferences on telecommunications.

His Excellency Mr Armando VARGAS ARAYA (Vice-Chairman)
Minister of Information and Communications
Costa Rica

- Appointed Presidential Adviser and Minister of Information and Communications by President Luis Alberto Monge in May 1982.
- In 1981 ran the election campaign for the National Liberation (Social-Democratic) Party which obtained two-thirds of the votes in the elections.
- Involved in activities for the international development of information and communications since 1975.
- Founded the Telecommunications Centre for the Third World in 1979.
- President of the World Association for Christian Communication (Latin America - Caribbean region), (1977-1982).
- Led Costa Rican delegation to ITU Plenipotentiary Conference, Nairobi 1982.
- Attended World Administrative Radio Conference, Geneva, 1979.
- Chaired WCY Seminar Meeting, Region 2, San Jose, 1983.
- Attended UNESCO DEVCOM Conference establishing the International Programme for the Development of Communication, Paris 1980.

- Vice-Chairman National Information System Activities (ASIN).
- Manager of Latin American Special Services Agency.

His Excellency Dr Faisal ZAIDAN
Deputy Minister of Telephones
Ministry of Posts, Telegraphs and Telephones
Saudi Arabia

- Joined Ministry of Posts, Telegraphs and Telephones 1962.
- Member of INTELSAT Board of Governors.
- Chairman of the Board of Directors of ARABSAT.
- Member of the High Commission on the development of Riyadh City.
- Former lecturer, King Saud University.

ACKNOWLEDGEMENTS

We have received a number of generous contributions in cash and in kind without which we would not have been able to carry out our task. We are grateful in particular to the following:

AT&T, USA

Bahamas Telecommunications Corporation

Banque de Paris et des Pays Bas, The Netherlands

Bavarian Government, Federal Republic of Germany

Bell Canada Enterprises, Inc., Canada

British Aerospace plc, United Kingdom

British Telecom

British Telecom International

Cable and Wireless plc, United Kingdom

Caisse Nationale des Télécommunications, France

Committee for World Communication Year, Kuwait

Communications Corporation International Ltd, USA

Communications Satellite Corporation (COMSAT), USA

Continental Telecom, Inc., USA

Department of Communications, Canada

Department of Telecommunications, Malaysia

Department of Trade and Industry, United Kingdom

Deutsche Bundespost, Federal Republic of Germany

Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) GmbH, Federal Republic of Germany

The Dun and Bradstreet Corporation, USA

Farhan Commercial Company Ltd, Saudi Arabia

General Directorate for Telecommunications, France

Government of the USSR

GTE Corporation, USA

Instituto Postal Telegráfica, Venezuela

I.T.T. Corporation, USA

ITU Association of Japan

Arthur D Little, Inc., USA

Kokusai Denshin Denwa Co. Ltd., (KDD), Japan

Kenya Posts and Telecommunications Corporation

MCI Communications Corporation, USA

Ministry of Communications, Transport and Works, Tanzania

Ministry of Communications, Australia

Ministry of Information and Telecommunications, Senegal

Ministry of Posts and Telecommunications, Japan

Ministry of Posts, Telegraphs and Telephones, Saudi Arabia

Ministry of Tourism, Posts and Telecommunications, Indonesia

Motorola, Inc., USA

NEC Corporation, Japan

New York Times Company Foundation, Inc., USA

Nippon Telegraph and Telephone Public Corporation (NTT),
Japan

Norconsult A.S., Saudi Arabia

Northern Telecom, Inc., Canada

Office of Posts and Telecommunications, Senegal

The Organisation for Economic Cooperation and Development
(OECD)

Pacific Telecommunications Council

Philips and Ericsson Joint Venture, Saudi Arabia

Posts and Telecommunications Corporation, Zimbabwe

Radiográfica Costarricense S.A., Costa Rica

RCA Corporation, USA

Rockwell International Corporation, USA
Satellite Communications Users Conference, USA
Siemens A.G., Federal Republic of Germany
SNC Manufacturing Company, Inc., USA
S.R. Telecom, Canada
Telecommunication Services, Jamaica
Teleglobe Canada
Maurice Tobin, Washington D.C., USA
United States Agency for International Development
United Telecommunications, Inc., USA
U.S. Council for World Communications Year 1983
U.S. Foundation for World Communications Development
Wang UK Ltd
Western Electric, Saudi Arabia
The World Bank
Young & Rubicam, Inc, USA
Zentralverband der Elektrotechnischen Industrie e.V.,
Fachverband Fernmeldetechnik, Federal Republic of Germany

We are also indebted to;

- Those who organised our meetings and offered us hospitality at Geneva, Leeds Castle, Munich, Arusha, Jakarta and Bali.
- The Secretary-General of the ITU and Members of his staff for their advice, support and help in many other ways.
- John Gilbert, our Secretary, and the staff of the Secretariat; and to the Department of Communications of the Government of Canada, for making John Gilbert's services available.
- All those who participated in our discussions as advisers and observers.

CONTENTS

	Page
Preface.....	1
Introduction.....	3
Objective.....	5
1 The Role of Telecommunications.....	7
2 The Situation Today.....	13
3 International Cooperation.....	25
4 The Choice of Technology.....	29
5 Internal Organisation and Management of Telecommunications.....	37
6 Training.....	43
7 Research and Development and Local Manufacture....	47
8 A Centre for Telecommunications Development.....	53
9 Financing the Development of Telecommunications...	57
10 Conclusions and Summary of Recommendations.....	65
Appendices	
I The Commission's Mandate	71
II Comments and suggestions on the Commission's task	75
III Telephone density	103
IV Telephone density in city and non-city locations in selected countries	107
V Supply, demand and registered waiting list in selected countries	109
VI Quality of telephone service	113
VII Investment levels and growth rates in selected countries	117
VIII Sectoral distribution of World Bank Group loans	121
IX Indicative cost per line of urban and rural telecommunications	123
X Resolutions of the ITU Plenipotentiary Conference, Nairobi 1982	125
XI Bibliography	127
XII List of advisers to the Commission	129

PREFACE

1 In the autumn of 1982 the Plenipotentiary Conference of the International Telecommunication Union (ITU) at Nairobi decided to set up an Independent Commission for World-Wide Telecommunications Development. For the first time in the history of the Union those present at Nairobi recognised "the fundamental importance of communications infrastructures as an essential element in the economic and social development of all countries" to which the General Assembly of the United Nations had drawn attention in Resolution No. 36/40 of 1981. In essence the mandate they gave the Independent Commission (Appendix I) was to recommend ways in which the expansion of telecommunications across the world could be stimulated.

2 The Independent Commission was established in May 1983 and we met for the first time in Geneva in October of that year. We met subsequently on four occasions in the course of 1984 - at Leeds Castle in England in May; at Munich in the Federal Republic of Germany in August; at Arusha in Tanzania in October; and at Jakarta and Bali in Indonesia in November.

3 For two reasons we have not commissioned any original research. First, the time and funds at our disposal did not permit this. Secondly, there is already an extensive literature on the subject of telecommunications in the developing world; we felt that the best service we could perform would be to draw conclusions from the existing situation and recommend remedies. For background information and statistics we have drawn on the various publications of the ITU, and notably the study "Telecommunications for Development" prepared jointly by the ITU and the Development Centre of the Organisation for Economic Cooperation and Development (OECD) in 1983; the World Development Reports 1983 and 1984 by the International Bank for Reconstruction and Development (IBRD); the World Telecommunications Report 1980-1990 by Arthur D. Little; and the proceedings of the three Seminars on telecommunications for development held in San José (Costa Rica), Lomé and Kuala Lumpur, and the Commonwealth Telecommunications Conference at Leeds Castle, all of which were held in World Communications Year, 1983.

4 Our analysis of current problems has been helped immeasurably by contributions by individual Members of the Commission and by the responses to the 700 requests for suggestions and comments on our task which we sent to heads of government, international and regional organisations involved in telecommunications, development and financing, telecommunications administrations, equipment manufacturers, recognised private operating agencies, and scientific and industrial organisations (Appendix II).

INTRODUCTION

1 The Members of the Commission come from different regions of the world and represent a variety of disciplines and experience. Some of us have spent a life-time in telecommunications; others have been concerned with different aspects of public affairs. Yet from the beginning we all recognised the political character of our task. At an early stage of our work we concluded unanimously that the gross and growing imbalance in the distribution of telecommunications throughout the world was not tolerable. There are some 600 million telephones in the world. Of these, three-quarters are concentrated in nine advanced industrialised countries. The remainder are distributed unevenly throughout the rest of the world. We recognise that telecommunication is not an end in itself. But, since telecommunication enables information to be made instantly available at a multitude of points on the other side of the globe - or just over the next hill - its relevance to human activity in various forms and to the prospects for human progress is obvious.

2 In the industrialised world telecommunication is taken for granted as a key factor in economic, commercial and social activity and as a prime source of cultural enrichment. Moreover, in these countries telecommunications have come to be regarded as an engine of growth and a major source of employment and prosperity. The pace of technological innovation is such that inhabitants of the industrialised world look forward to enjoying the full benefits of the so-called "information society" by the end of the century.

3 The situation in the developing world is in stark contrast. In a majority of developing countries the telecommunications system is inadequate to sustain essential services. In large tracts of territory there is no system at all. Neither in the name of common humanity nor on grounds of common interest is such a disparity acceptable.

4 It cannot be right that in the latter part of the twentieth century a minority of the human race should enjoy the benefits of the new technology while a majority live in comparative isolation. Apart from this, an expanded world telecommunications network would bring immense practical benefits not only to the developing world but also to industrialised countries, whether they are mixed economies or state traders. Decisions by telecommunications operators in developing countries to improve and expand their networks will create a major market for the owners of telecommunications technology and expertise, and the manufacturers of equipment. A more comprehensive world system will mean an increase in international traffic from which all operators will benefit. Where information flows so

does commerce. A growth in world trade and other contacts will increase understanding among peoples. Effective and expanded telecommunications both within and between countries will make the world a better and safer place.

5 In the course of the past year we have examined a wide range of ways in which the imbalance can be redressed. It is clear to all of us that the role telecommunications can play, especially in economic and social development and in enhancing the quality of life, is inadequately appreciated. We therefore begin our Report with a description and illustrations of the contribution telecommunications can make. We then analyse the existing deficiencies in general terms before turning to those particular aspects of the problem which we have thought it right to address in more detail. While acknowledging the important role of broadcasting, the mass media and private networks, we have concentrated on public telephone systems since it is by improving and expanding these that the greatest benefit can be brought to the greatest number of people throughout the world. In any event the ITU is already conducting separate studies into sound broadcasting.

6 We believe that our recommendations are practical and that, if adopted, they will lead over time to a narrowing of the telecommunications gap which otherwise will grow wider. There is in our opinion no good reason why by the early part of the next century virtually the whole of mankind should not be within easy reach of a telephone and of all the benefits this can bring. Many will regard this objective as ambitious. And so it is. But we believe that, if common sense, determination, and a dash of audacity are applied to the issues involved, it can be attained. The technology exists and the economics are promising. Action must be set in hand now. We therefore look to governments, telecommunications operators, manufacturers, regional and international organisations and all who can contribute to achieving this objective to give our Report urgent as well as sympathetic consideration. This is all the more important when the world economy faces serious difficulties and the inhabitants of large areas of the world are suffering extreme hardship as a result of natural calamities.

7 In the industrialised world some may argue that, since telecommunications systems should begin to earn money as soon as they are installed, the expansion of telecommunications world wide can best be effected through the operation of the market. Leaders of many developing countries, preoccupied with problems of hunger, poverty, disease and ignorance, aggravated all too often by natural disasters such as drought and flood, may believe that investment in sectors other than telecommunications is more urgent. There is substance in both points of view. But they are only part of the story. We attempt in this Report to tell the whole story. And so we say to all who can influence the situation, in developing and industrialised countries alike : please read on - with an open mind.

OBJECTIVE

1 The recommendations contained in this Report call for decisions at the highest political level. We believe that, if put into effect, they will bring all mankind within easy reach of a telephone by the early part of the next century. That should be the overriding objective. The way will then be open to all of the services that telecommunications can provide - the transmission of data, facsimile and an ever growing number of other services. Achieving this objective will require a range of actions by both industrialised and developing countries. These are described in detail in the chapters that follow.

2 For their part, developing countries may wish to set themselves specific targets, taking account of their own particular circumstances. They may wish to allocate a percentage of their gross domestic product to investment in telecommunications over a defined period; or to specify targets for increasing the density of telephones per head of their population in stages.

3 In setting targets and priorities, developing countries may want to distinguish between urban, rural and more remote areas. While the important economic advantage of satisfying demand in urban areas should not be ignored, extending the network into rural and remote areas is essential if the aims of development are to be achieved. In any event, developing countries should aim to ensure that the whole population has reasonable access to the telephone.

4 If developing countries are to achieve these objectives and become increasingly self-reliant they will wish to draw lessons from the experience of others. They will also require the goodwill and assistance of industrialised and other developing countries.

5 If our recommendations are implemented there will be a major expansion of telecommunications world wide and the way will be clear to the achievement of our objective. The rate of expansion needed will vary widely according to the circumstances of individual countries.

CHAPTER 1

THE ROLE OF TELECOMMUNICATIONS

1 The reasons why developing countries have been investing over the past several decades in food production, water, power, schools, hospitals and roads are obvious and need no justification. What is so special about telecommunications that they require the attention of an international commission? In this chapter we attempt to answer that question.

2 We begin with random examples.

A civil servant whose Minister has to make an urgent announcement in the capital needs a crucial statistic from a provincial centre.

A banker needs to confirm a customer's credit-rating to gain him a contract whose deadline is about to expire.

A health worker on an island devastated by a typhoon wants to know whether urgently needed medicine will arrive for an outbreak of cholera.

A farmer needs advice on combatting a fungus which is destroying his crop.

The manager of a cannery wonders when the next consignment of fresh fruit will arrive from the interior.

A rural cooperative wants to know what price it will get for its beans in the capital.

A mother worries about her son who has left the village in search of work in the city.

A villager needs urgent information on farming equipment.

All these people need information. Without rapid and effective communications they will have to wait for days or travel themselves to get an answer. In many cases they will have to do without the information they require. The result could be waste, inefficiency, even tragedy. An important ministerial statement could be incomplete. A contract might be lost. Children with cholera might die. A farmer might lose his crop. A cannery might have to close. Farming equipment might arrive after the need for it is past.

3 These are not isolated incidents. They happen time without number every day in the developing world. They cause frustration, delay, or despair for those concerned. But their cumulative effect goes wider. The absence of a system which enables timely information to be sent and received

engenders a sense of isolation and frustration, and so raises a barrier between different sections of the population. This cannot but undermine the process of development.

4 Recent advances in technology - from satellites to solar powered two-way radios - now enable reliable communications to be extended to any village in the jungle, encampment in the desert, or remote island. Progress in exploiting these new technologies has been painfully slow. Telecommunications have often been seen as a luxury to be provided only after other investments, for instance in agriculture, water and roads, have been made. The alternative is to regard telecommunications as an essential component in the process of development - a complement to other investments - which can raise the productivity and efficiency of agriculture, industry, commerce (including international trade and tourism) and the social services, and enhance the quality of life in the developing world.

5 The existence of an efficient telecommunications system confers direct and indirect benefits which entitle it to be regarded as a public good.

6 Telecommunications play a vital role in emergencies and in health services.

In India, Costa Rica, Egypt and Papua New Guinea it has been estimated that some 5% of telephone calls from rural and remote areas are for emergencies or for medical reasons. In the South Pacific the experimental PEACESAT satellite network has been used to summon medical teams to deal with outbreaks of cholera and dengue fever and to coordinate emergency assistance after typhoons and earthquakes. Basic health services have been extended to remote areas through telecommunications. In Guyana rural health workers, known as "medex", communicate with Georgetown by two-way radio to check on the delivery of drugs and other supplies and to receive advice on serious health problems. Flying doctor services in Kenya, Tanzania, Malawi and elsewhere in East Africa link nurses at rural clinics with headquarters by two-way radio, which is also used to coordinate the movement of aircraft and the evacuation of the seriously ill.

7 Telecommunications increase the efficiency of public administration, commerce and other economic activities.

Since the installation of satellite earth stations in the South Pacific, officials have obtained lower prices by inviting tenders by telex rather than by placing a standing order with one supplier. In Sri Lanka small farmers used newly installed telephones to find out the prices of coconut, fruit and other produce in Colombo. Instead of selling at 50% to 60% of the Colombo price they were able to get between 80% and 90%. Businesses can reduce their inventories if replacements can be ordered and delivered as they are required. Prompt ordering of spare parts can reduce time lost through breakdowns. In Kenya, a hotel and travel agency, a biscuit maker, a freight shipper, and firms

exporting fresh vegetables and flowers have calculated that the losses incurred through poor telecommunications were on average 110 times higher than the total cost of providing adequate telephone service and amounted to 5% of total turnover. They expected that a better system would bring savings through a cut in managerial time, lower inventories, fewer shut-downs of machinery and more efficient scheduling of vehicle journeys and loads. In Kuwait improved telecommunications have attracted commercial and business enterprises and so improved economic activity in the region.

8 Telecommunications can reduce the need to travel and facilitate better use of existing transport facilities.

In India the benefits to villagers of using long distance public telephones have been some five times the cost of the call, taking into account the bus fares they would have paid and the time lost from work in travelling to town to deliver the message.

9 While the benefits of an efficient telecommunications system in individual cases can readily be quantified, the same is not true of the benefits conferred at the national level. While a strong correlation has been established between the number of telephones per capita and economic development measured by gross domestic product, it has not been clear whether investment in telecommunications contributes to economic growth or economic growth leads to investment in telecommunications. That there is a link between the two is however beyond question.

10 When at Stanford University Doctor Andrew Hardy constructed an economic model which suggests that telecommunications contribute to economic development. His model also shows however that economic growth in its turn contributes to the expansion of telecommunications as more resources become available for investment in that sector.

11 An economic model constructed by the Institut pour le Développement et l'Aménagement des Télécommunications et de l'Economie (IDATE) in Montpellier, France, in 1984 indicates that at the early stages of development the primary need is for communication with the principal world centres. The next stage of development entails interaction between the main centres of internal growth and calls for significant investment in transport and communications. The model also shows that, as these major internal centres develop, the use of telecommunications begins to expand rapidly around them until this newly generated local traffic exceeds the traffic between the major centres.

12 A similar conclusion was reached in India where telecommunications have become more important when rural modernisation begins, for instance when improved farming methods are introduced or credit is made available, or when an integrated modernisation plan is put into effect. Other studies, such as the paper presented to the World Communications Year Seminar in San José in August 1983 by

Professor Nicolas Jéquier of the University of Lausanne, suggest that the impact of investment in telecommunications in low income rural areas on the level of employment is far greater than has been supposed hitherto.

13 The impact of telecommunications on the process of development is inevitably influenced by other factors. Other infrastructures and economic or administrative activity obviously have to reach certain levels if the indirect benefits of an efficient system are to be realised. It stands to reason that a well-managed decentralised organisation such as a mining enterprise, a tourist development, or a health service will derive greater benefits than a poorly-managed and under-staffed operation. Similarly, government agencies with clearly defined and well-established administrative procedures will profit from using telecommunications to support their activities.

14 Although telecommunications can be used on occasion as a substitute for transport, their effectiveness in coordinating the movement of goods, in reducing inventories, in finding the best markets for produce and so on depends on the adequacy of the transport system. The same is true of the role telecommunications play in emergencies. The telecommunications link between patient and doctor will not fulfil its purpose unless transport is available to move the patient to hospital or to deliver drugs and other supplies.

15 The economic and social benefits which an efficient telecommunications system confers on a community, or on a whole nation, can be clearly perceived even when they cannot be quantified. The telecommunications system in a developing country can be used not only to disseminate information of immediate importance on a national scale, but also as a channel for education, for strengthening the social fabric, for enriching the national culture. Connections between rural and urban areas for 24 hours a day are important for both social and economic reasons and remote area telephony is an essential element in the development of the national infrastructure. When he received us in Jakarta in November 1984 President Soeharto emphasised the role telecommunications had played in Indonesia in increasing cohesion, the sense of national and regional identity, self-reliance and political stability.

16 These important intangible benefits are available to all developing countries. Distances can be made to shrink. The disparities between urban and rural areas can be diminished and migration to the bright lights reduced in consequence. This in turn can increase productivity and stimulate economic activity generally in rural areas. The quality of life throughout the country can be enhanced.

17 Our study of the role they can play has persuaded us that telecommunications can increase the efficiency of economic, commercial and administrative activities, improve the effectiveness of social and emergency services and distribute the social, cultural and economic benefits of the

process of development more equitably throughout a community and a nation. We have no doubt that any further research in this field will corroborate our view.

18 Dramatic advances in the technology of telecommunications are taking place at a time when the role telecommunications can play in economic and social development throughout the world is more important than ever. It is our considered view that henceforward no development programme of any country should be regarded as balanced, properly integrated or likely to be effective unless it includes a full and appropriate role for telecommunications, and accords a corresponding priority to the improvement and expansion of telecommunications.

(Further information about the examples quoted in this chapter can be found in the studies listed in the Bibliography - Appendix XI)

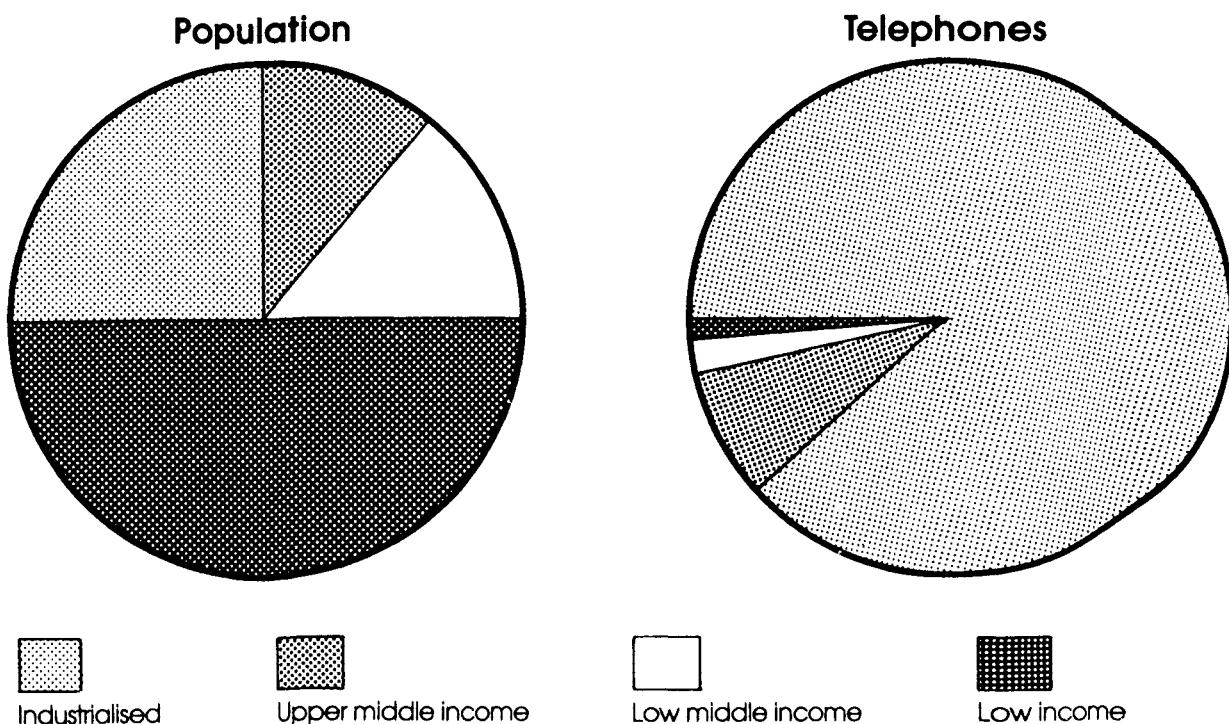
CHAPTER 2

THE SITUATION TODAY

1 The world telecommunications network is one of the great human achievements. It links every country in the world. It serves 600 million telephones and provides telex and data services. According to figures available to the ITU, the combined yearly revenues of the world's telecommunications administrations are currently some US\$250 billion and their combined yearly investment programmes amount to about US\$ 100 billion.

2 There is however an immense disparity in the extent of telecommunications service and in its quality as between industrialised countries and the developing world (Figure 1). More than half the world's population live in countries with fewer than 10 million telephones between them and most of these are in the main cities; two-thirds of the world population have no access to telephone services. Tokyo has more telephones than the whole of the African continent, with its population of 500 million people.

FIG 1. Population and Telephones by country economic groupings



3 The reasons for this disparity are various. They include differences in economic capability, historical experience and the different priority given to investment in telecommunications in the industrialised world and developing countries. This is exemplified by the fact that, while developing countries account for 20% of the world's gross domestic product, they possess only 12% of the telephones. The disparity is even more marked in low-income developing countries. This group accounts for 5% of the world's gross domestic product, but its share of the world's telephones amounts to a mere 1.8%.

4 In industrialised countries the network already extends in one form or another to all but the most sparsely populated areas. The telephone has long been taken for granted as part of both the working and home environment. All businesses and the majority of households are already "on the telephone". In some countries the time is already in sight when every household will have at least one line. Some already have two or more. Customers expect a high quality of service and when faults occur the management of the network is heavily criticised. Telecommunications are recognised as the indispensable arterial system of the information society.

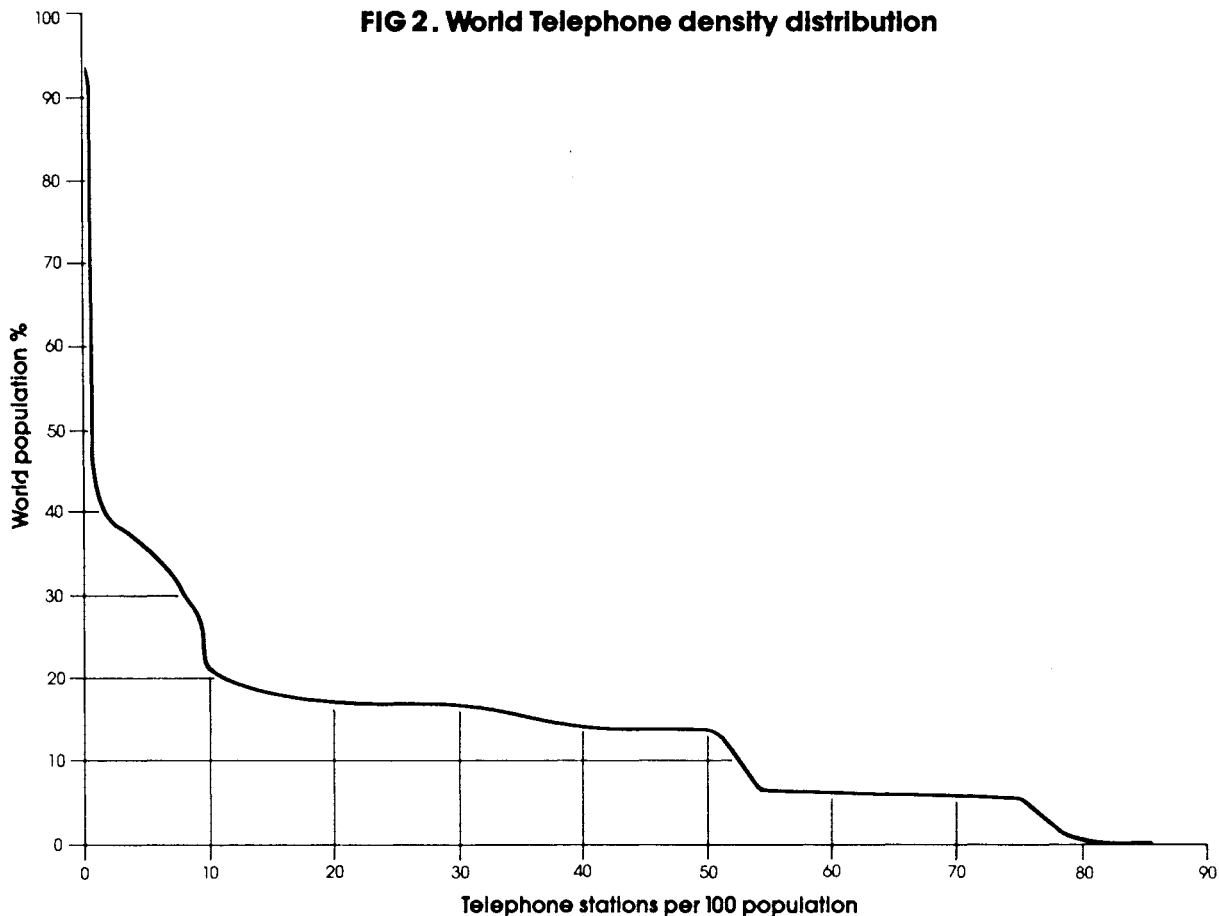
5 In many developing countries successful efforts have been made to create efficient telecommunications networks and to extend these into the more remote areas. Developing countries have come together at regional and sub-regional level to create organisations for mutual cooperation in telecommunications. These include the Pan-African Telecommunications Union (PATU), the African Postal and Telecommunications Union (UAPT), Asia-Pacific Telecommunity (APT), the Arab Telecommunication Union (ATU) and the Inter-American Telecommunications Conference (CITEL). Some important regional telecommunications projects have been mounted with the assistance of the ITU and funding from the United Nations Development Programme (UNDP). Examples are the Panafrican Telecommunications Network (PANAFTEL), and the MEDARABTEL (involving Mediterranean and Arab countries). But in most developing countries telecommunications remain unsatisfactory. In this Chapter we outline the main features of that situation.

The Extent of Service in Developing Countries

6 In most developing countries the telephone service is still far from universal and the more sophisticated forms of telecommunications are almost unknown, except in some of the larger towns and business centres. In many countries there are great tracts of territory with no telecommunications at all.

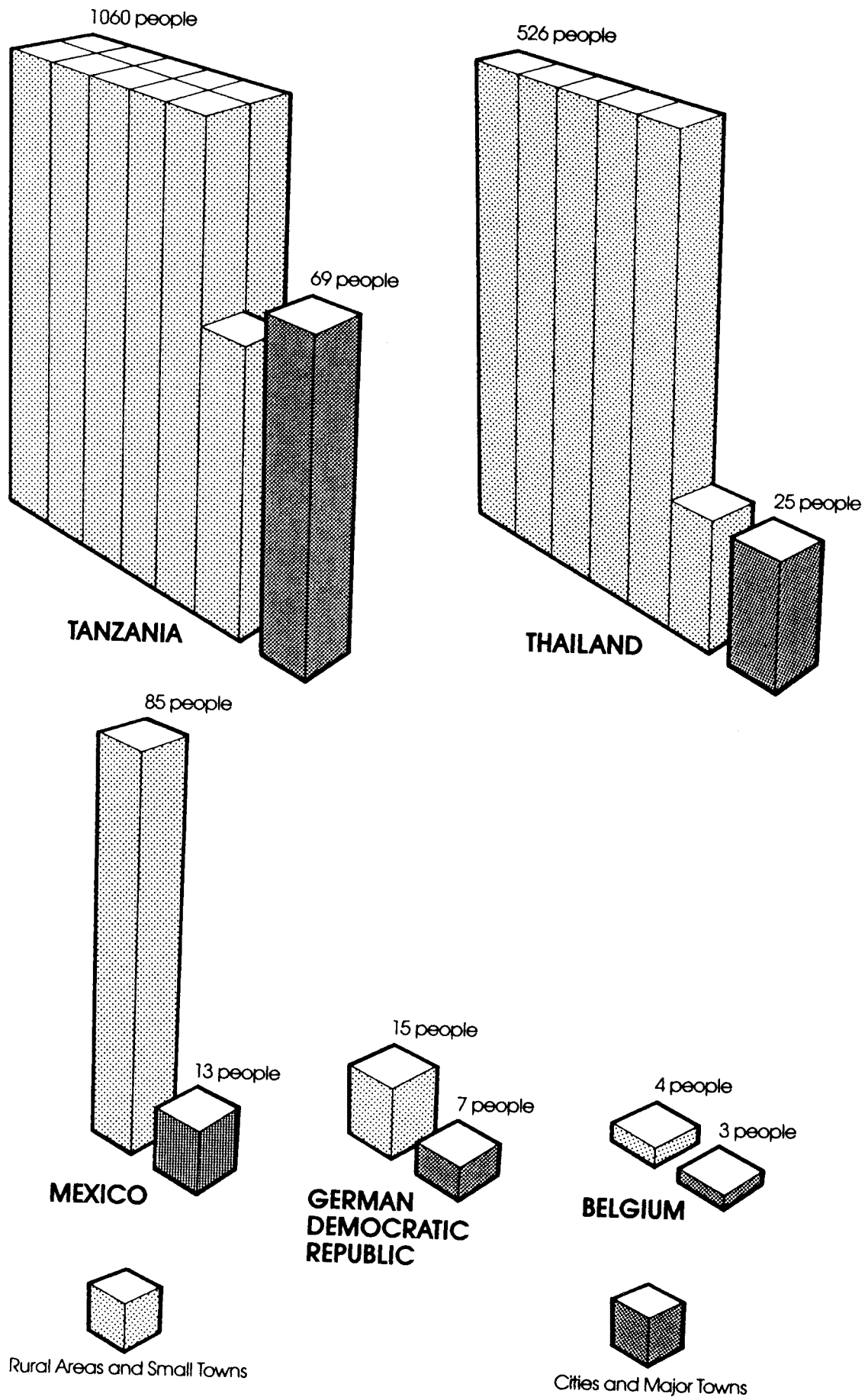
7 The simplest measure of a country's telephone system is the proportion of telephones to the population. This is called "penetration". The penetration of the telephone in developing countries is set out in Appendix III and

illustrated in Figure 2. It will be seen that nearly three-quarters of the world's population live in countries with 10 telephones or fewer for every 100 people, and over half the world's population live in countries with less than one telephone for every 100 people. Penetration varies widely. In oil exporting countries or others with relatively developed economies, it is not unusual to find 10, 20 or even 30 telephones per 100 of the population. On the other hand, where incomes are particularly low, there may be as few as one telephone per 1000 of the population.



8 In many countries low average penetration figures of this kind may still not give a true picture. The telephone service was often provided originally to meet the needs of public administration and of commerce in the capital city and in larger towns. The original network may have been extended and upgraded, for example by replacing manual with automatic exchanges. But the system may still be confined to local networks serving towns and centres of population and their immediate surroundings and linked to one another by long distance transmission systems and to the outside world by satellite earth station, or a submarine cable terminal. Figure 3 illustrates the difference between telephone availability in cities and the rest of the country in typical developing countries compared with industrialised countries (Appendix IV).

FIG 3. Comparative people per telephone in cities and non city locations



Availability and Quality of Service

9 In industrialised countries new applications for telephone service can usually be met on demand, but in many developing countries applicants may often be unable to obtain telephone service even if they are close to an exchange. Shortages of exchange equipment or of local cables or other plant needed to connect subscribers to their local exchange create long waiting lists. The number waiting for service can equal or even exceed the number who have service. Many of the unsatisfied applicants may be businessmen who depend on the service to carry on their business efficiently. Waiting periods can be long; delays of up to three years are not uncommon (Appendix V).

10 Moreover, the real unsatisfied demand is often greater than the official waiting list. Many who want the service can be so discouraged by the length of waiting lists or the size of the deposit required that they do not bother to apply. Furthermore, some operating entities do not record applications in remote areas where there is no foreseeable prospect of giving service.

11 Subscribers in many developing countries can be faced with poor service when trying to use the telephone. Telephones may be out of order and faults may take a long time to remedy especially in more remote areas. When the telephone does work, subscribers attempting to make calls may encounter difficulties. Whatever the time of day many calls may fail because of shortage of equipment or inadequate maintenance. This situation can become worse in busy periods. As many as half the local or trunk calls attempted in peak hours may fail to connect. Under these conditions the network becomes further congested as unsuccessful callers try repeatedly to get through. Such high calling rates can soon wear out electro-mechanical systems. Some subscribers, having achieved a satisfactory connection, keep it open all day, even though they may use it only sporadically. The links in such a case are effectively denied to everyone else. The resultant overloading can strain common control equipment. In some countries it may become impossible to make calls at all during peak periods (Appendix VI).

12 There are several reasons for this situation and they interact. Much of the equipment may be worn out and prone to frequent failure; it is often incapable of giving good service however much is spent on it. Again, there may not be enough trained staff to maintain the equipment properly. At some places equipment may be scarce while at others it stands idle. When the equipment in a key exchange is both inadequate and defective, service suffers. People may be unable to get through because the subscribers they are calling do not have enough lines for all the calls they need to make and receive. A business may have one line where it really needs five.

13 Long waiting lists and poor service handicap government, the economy and society generally. Operating entities lose revenue both from would-be subscribers, who cannot get connected to the system, and from calls which fail to get through. Operators in industrialised countries also lose revenue or incur extra costs as a result of the higher failure rate of international calls to developing countries. When the population becomes disillusioned with the telephone service its growth may be stunted. The standing of telecommunications as an element of national infrastructure and its consequent ability to secure a fair share of national investment may be progressively impaired.

14 These conditions are by no means universal. Many developing countries have made determined efforts to improve matters. Major projects have been initiated to increase capacity, to meet demand, to replace old or defective equipment and to provide an acceptable standard of service. An example is the Senegal Telecommunications National Development Plan 1983-1989 drawn up in cooperation with the ITU. The President of the Republic of Senegal himself underlined the importance he attached to the Plan and to its completion within the time limits set for it. Political support of this kind at the highest level is clearly of great value. Similar initiatives in other countries have led to much more satisfactory systems. But improvements increase customer expectations and waiting lists often remain high or even increase. In many other countries, often despite high capital investment, conditions remain much the same.

15 In trying to overcome these deficiencies operating entities in developing countries face various problems.

Funding

16 The investment needed to expand and improve a country's telecommunications network frequently represents a large proportion of that country's gross domestic product, but usually the investment made is too small to meet demand and reduce waiting lists (Appendix VII).

17 Telecommunications operators often have difficulty in finding investment capital. It is true that existing telecommunications operations in many developing countries are reasonably profitable and show historic returns on capital of 10% to 20%, or even more. This includes providing services in more remote areas where returns are normally lower. But even if surpluses are ploughed back into the telecommunications system and not treated as a contribution to central government funds or used to subsidise postal services, they tend to be inadequate to fund rapid expansion and improvement of the network. It has been estimated, for example, that a developing country with the kind of limited network described earlier could probably raise the number of subscribers connected to the system at a rate of between 4% and 6% per annum by ploughing back its internally generated surpluses. But we believe the rate of growth

required greatly exceeds this. Moreover, many operating entities need to expand capacity for calls and to replace large amounts of plant merely in order to make service acceptable. This requires more capital than they can raise themselves.

18 An additional problem is that with a few exceptions - notably some large countries such as Brazil, China, India, and Indonesia - developing countries do not have indigenous telecommunications manufacturing industries. They have to buy their exchanges, transmission equipment and other technical plant abroad and pay in hard currency. According to World Bank figures, in many countries 60% or more of the cost of a major telecommunications project has to be met in hard currency. Yet only a small part of a telecommunications system's own income and profits - that which arises from international operations - is earned in hard currency.

19 In most developing countries hard currency is scarce and its allocation normally under central control. In recent years hard currency has been made available for telecommunications projects through multilateral and bilateral channels. Between 1978 and 1982 about US \$ 7 billion was provided by the World Bank, as Official Development Aid grants and loans, and through officially supported OECD credits alone. But the predicament facing many developing countries has become worse. The world recession has affected their export earnings. Development assistance from richer countries has been restricted. A number of developing countries with serious problems in servicing their existing hard currency debt cannot take on new commitments. And some of the poorest countries do not have enough resources to obtain even the essentials of life.

20 In many developing countries priority has understandably been given to agriculture, health, education, roads and so on. Difficult choices face those in central government who control national hard currency reserves as well as those responsible for selecting the projects for which aid funds are to be sought (Appendix VIII). However, as has been said, the significance and potential of telecommunications in national infrastructure and its impact on all other sectors is not always understood. The participants in the World Communications Year Seminar for the Americas Region at San Jose (Costa Rica) in August 1983 were unanimous in their view that underinvestment in telecommunications was;

"largely due to the fact that conventional analysis fails to consider the indirect economic and social benefits of telecommunications development".

This aspect is already the subject of separate studies. Moreover, even when the significance and potential of telecommunications has been understood, the poorest countries may still be unable to give it the necessary

priority, so pressing are their other needs. This point was presented to us with vigour by President Nyerere of Tanzania when he received us at Arusha on 6 October 1984. The Minister of Posts and Telecommunications of Morocco put it to us in another way:

"The telephone is still regarded as a luxury in many respects and hardly as a working tool for certain bodies, mainly administrations. Even when senior officials are made to realise that the lack of a telecommunication infrastructure hampers projects promoting economic and social development, this conviction remains limited to narrow circles."

21 There is another side to this question. National policies can deter inward investment, for example by restricting the remittance of profits. We believe there is a case for reviewing policies which relate to the flow of both inward and international finance with the object of encouraging more investment in telecommunications.

22 The major world telecommunications firms have often been active in arranging finance for major projects. Such projects in developing countries represent an important part of their export market. They thus have an incentive to ensure that hard currency finance is available so that projects in which they are interested will go ahead. The firm concerned may arrange financial assistance from its own parent government, or it may set up more complex financing packages involving not only bilateral aid, but also commercial funding. The supplier may himself provide credit or arrange this through commercial banks or similar sources of finance.

23 Such funding mechanisms have enabled many major projects to go ahead in developing countries. But important considerations have to be borne in mind. In the first place credits or loans as distinct from pure aid can add to the total indebtedness of the country concerned. Secondly, equipment may be acquired because the terms of financing are attractive rather than on grounds of suitability, technical merit, price, delivery date and so on. Thirdly, different types of equipment may be installed over a number of years with consequent difficulties over training, compatibility of equipment and plant, maintenance and spare parts. If these issues are not recognised, telecommunications operators may accept less satisfactory or more expensive equipment because it is offered on seemingly favourable terms, with the true "costs" becoming evident only in later years.

24 Competition between suppliers will be keenest for those projects which will be easy to execute and which offer reliable profit margins such as major development or expansion projects in hospitable and densely populated terrain. The limited size and value of the market in the rural and more remote areas have neither encouraged the same competition nor provided the incentive to develop new products to meet these more specialised needs.

Supply of Equipment

25 Except in the largest developing countries, telecommunications operators depend on one or other of the major international firms for much of their equipment.

26 The products of these firms are for the most part designed to meet the largest markets and for use in advanced countries with temperate climates, high density of population, well trained and supported maintenance units and developed and heavily used telecommunications networks. These designs may be less suited to the environments and needs of developing countries. For example, they may not function efficiently in high temperature or humidity without expensive air-conditioning. The procedures to maintain the equipment, to add new subscribers and to change the routing of calls within the network may call for staff with specialised training who are not available in developing countries. The minimum capacity of equipment may be too large.

27 In recent years telecommunications technology has advanced rapidly and major changes have been taking place in the big manufacturers' product ranges. These changes are dictated by the demands of the main world telecommunications markets and may take little if any account of the circumstances of developing countries.

28 A manufacturer may decide to stop making an older system because the market for it has largely disappeared and it would not pay him to continue production even though the system is still used in the network of a developing country. As a result developing countries may be forced to create new exchanges or systems using the latest designs at considerable extra cost when they would have preferred to extend their existing installations with the older equipment. Manufacturers have been known not only to discontinue production of an older system, but also to stop manufacturing the spare parts. We are aware that manufacturers generally attempt to produce sufficient spares to last a number of years. Sometimes however the operator in the developing country may be forced to replace equipment which is still giving adequate service simply because the necessary spare parts cannot be obtained.

29 Problems may also arise in the smaller and poorest countries where only limited quantities of equipment are needed. Small orders, especially for spare parts, customer terminal equipment and even switching and transmission equipment may be expensive because of high transport and support costs. These countries have to import all their equipment and sometimes projects may be completed but not brought into operation because telephone instruments or other simple components cannot be obtained.

30 A telecommunications operating entity depends on the manufacturer for technical information about equipment and for guidance on maintenance procedures. If the manufacturer

fails to meet these needs the operator cannot maintain the equipment, and service suffers. Frequent changes in product technology over recent years have aggravated this problem. Even with support from manufacturers an operator needs time to train staff in a new design. Some developing countries find that the problems associated with acquiring modern equipment, despite the advantages of high reliability, low operating cost, improved facilities and potential for new services, are virtually insurmountable. They may therefore choose to buy equipment of obsolete design which has already seen service in an advanced country and which they can obtain at low prices, though this may lead to difficulties over maintenance and spare parts in later years.

Problems of remote areas

31 In many countries no form of telecommunications service exists at all outside the towns and more densely populated areas. Sometimes the service operates for only part of the day when either the manual exchange is staffed or the radio circuit is available.

32 The main reasons for this are the large distances involved, the difficulty of the terrain, the sparseness of the population and consequent high cost per line, the lack of roads and of public electricity supplies. To extend service to a remote area a microwave or other multi-circuit "back-bone" transmission system may have to be installed over several hundred kilometres. Individual circuits then have to be provided to communities scattered along it, at varying distances from the nearest point at which connexion can be made to the "back-bone" system. What are known as "thin route" satellite facilities and terrestrial radio systems are available and can make a "back-bone" unnecessary; but even when the cheapest technologies are used costs per line in remote areas are on average five times those in densely populated areas (Appendix IX).

33 It may be difficult to project demand for telecommunications in rural and remote areas which have not previously had such services. In some cases use of the system may increase slowly while in others use may greatly exceed forecasts of traffic based on experience in urban areas. Generally speaking however service in remote areas yields lower returns. It may even lose money and have to be subsidised. Commercial profitability alone is an inappropriate criterion for decisions on investment in remote areas. Hence different and more flexible policies are required to account for indirect benefits. Indeed, the World Bank recognises this in its analysis of rural projects.

34 A telecommunications entity's main business and its principal source of profits are its operations in towns and densely settled areas which are already serviced. Pressure to expand and improve the network in such areas is likely to be strong. Administrations therefore have an incentive to concentrate new investment in these areas and may find

it hard to justify substantial investment in remote areas. Indeed, there is little point in providing service in remote areas if the service in the towns is not comprehensive or does not work properly, since the remote areas would be unable to contact anyone. Most town dwellers live in the poorer urban areas which, like rural areas, often lack adequate telecommunications services.

35 In later chapters we examine more closely certain aspects of the situation we have described and suggest practical ways in which this can be improved over time.

CHAPTER 3

INTERNATIONAL COOPERATION

1 We were specifically charged with considering the most cost-effective way in which the International Telecommunication Union (ITU) could stimulate and support the range of activities that might be necessary to achieve a more balanced expansion of telecommunication networks. In addition to its role in harmonising techniques and methods, and in the coordination and utilisation of telecommunications natural resources, the ITU plays an essential role in multilateral technical cooperation. Article 4 of its Convention states that one of the purposes of the ITU is to maintain and extend international cooperation between all members of the Union and promote and offer technical assistance in the field of telecommunications. Further, Resolution No. 34 of the Plenipotentiary Conference at Nairobi in 1982 stated that the ITU should continue to work for the harmonisation, development and enhancement of telecommunications throughout the world.

2 The scope of the ITU's effort depends largely on funds from the United Nations Development Programme (UNDP). Expenditure in 1983 by the ITU as executing agency for UNDP totalled US\$ 21.6 million, or 3.9 per cent of total project expenditures for all sectors, a proportion similar to previous years.

3 The Secretary-General of the ITU described to us certain constraints which prevented the ITU from being fully effective in this field. The ITU acts as a partner with the UNDP in the provision of technical cooperation to developing countries. In recent years the ITU's income from UNDP in support of its activities has been lower than the direct costs incurred. A major difficulty in this respect is the fluctuation in the value of the U.S. dollar against the Swiss Franc, combined with other constraints peculiar to the ITU. These have severely hampered the activities of the ITU in the field of development. We are of the view that steps must be taken to remedy this situation.

4 A pointer to a solution is to be found in the Resolutions of the Nairobi Plenipotentiary Conference relating to the UNDP, Technical Cooperation and Telecommunication Infrastructure and Socio-Economic Development. These are listed in Appendix X. We believe that the role of the ITU can be made more effective if these Resolutions are put into effect as soon as possible, full account being taken of the recommendations we make elsewhere in this Report, and of the ITU's need for funds.

5 In addition to the ITU, a number of other international bodies are concerned with telecommunications. These are:

a) The United Nations Development Programme (UNDP). This is financed by voluntary contributions pledged annually by governments, and funds technical cooperation and pre-investment support for economic and social development. According to General Assembly Resolution 2668 (XXV), responsibility for identification of priority sectors and projects for UNDP support lies primarily with beneficiary governments. Projects are executed on behalf of the UNDP by one or other of 35 executing agencies, mainly from within the UN system. Project expenditure in 1983 for all sectors totalled US\$ 553.8 million. The UNDP's field offices in 114 developing countries play an important coordinating role at the country level.

b) The International Bank for Reconstruction and Development (IBRD) including the International Development Agency (IDA), which assists economic development in the poorest developing regions of the world. It is the largest multilateral source of funds for telecommunications. Between 1962 and 1983, it made 93 loans and credits totalling US\$ 2.7 billion to 42 countries to help finance telecommunications projects costing US\$ 10 billion.

c) The United Nations Educational, Scientific and Cultural Organisation (UNESCO). This operates the International Programme for the Development of Communications (IPDC), whose purpose is to increase cooperation and assistance in developing communications infrastructures and decrease the gap between individual countries in the field of communications. The Inter-Governmental Council of the IPDC has taken decisions on a number of inter-governmental and regional communication development projects in the developing countries.

6 Three organisations provide global commercial communications using satellite systems:

a) The International Telecommunications Satellite Organisation (INTELSAT), an organisation of 109 members, has as its main aim the establishment of a global commercial communications satellite system. Through its Assistance and Development Programme, INTELSAT helps in the design, planning, construction and effective operation of the earth segment of the INTELSAT global system. The Programme has been used by 70 countries, including 17 non-INTELSAT members. By 1983, 77 projects had been completed with some 60 in progress.

b) INTERSPUTNIK, an international space communications organisation open to all was set up to meet the requirements of countries and individual users for the international exchange of radio and television programmes. Some 20 countries use channels for this and for international telephone and telegraph communications. There are two main components of the

INTERSPUTNIK system: the space segment consists of communication satellites and control systems which are the property of INTERSPUTNIK, or which are leased by it from its members; and the ground stations, which are the property of the governments which build them. INTERSPUTNIK collaborates with other international organisations including the ITU, the Council for Mutual Economic Assistance (COMECON), the International Broadcasting and Television Organisation (OIRT), and the International Maritime Satellite Organisation (INMARSAT). The USSR Telecommunication Administration pays for ten channels in the INTERSPUTNIK segment for developing countries.

c) The International Maritime Satellite Organisation (INMARSAT). This 40 member-country organisation provides satellite communications to the world's shipping and offshore industries. The system is used by a growing number of ships and others, totalling 2,600 as of July 1984 from 57 countries, many of them developing countries. The organisation leases satellite capacity for telex, telephone and data communications to users equipped with ship earth stations. Many developing countries depend heavily on their fishing industry and on shipping for imports and exports. INMARSAT has approved access to its system by those concerned with disaster relief. If an earthquake, fire or other catastrophe destroys existing communications, a portable ship earth station could be flown into the stricken area to restore communications immediately.

7 Examples of major inter-regional cooperation activities in developing telecommunication networks are the Panafrican Telecommunication Network (PANAFTEL), which encompasses all 50 countries in Africa; and the Mediterranean and Arab Telecom Network (MEDARABTEL), which links the Arab States and adjoining countries in the Mediterranean basin. These projects were initiated by the ITU and implemented by the countries concerned with ITU/UNDP assistance. These projects, amongst others, led to the proposals for submarine cable links with other regions which are now being implemented. Another example of regional cooperation is the establishment of ARABSAT to provide regional and domestic satellite communications services for the Arab States.

8 Regional arrangements for fostering close relations between telecommunications operating entities and for harmonising and improving administrative and technical services include:

- The Pan African Telecommunication Union (PATU);
- Asia Pacific Telecommunity (APT);
- The Conférence Européenne des Administrations des Postes et des Télécommunications (CEPT);
- The Conferencia Interamericana de Telecomunicaciones (CITEL);
- South Pacific Telecommunication Forum (SPECTEL);

- Union Africaine des Postes et Telecommunications (UAPT);
- Southern African Telecom Conference (SATAC);
- Gulf Cooperation Council;
- Arab Telecommunication Union (ATU);
- SATCC (Southern African Transport and Communication Commission) an organisation of 9 African countries;

and other sub-regional organisations.

9 Other organisations concerned with the development of telecommunications include the OECD (through its Development Advisory Committee) and the European Communities, through the Lome Convention with 64 African, Caribbean and Pacific States, and regional development banks.

10 Bilateral assistance to telecommunications has been a significant element in the development assistance programmes of many industrialised countries. Developing countries see the need to harmonise bilateral and multilateral assistance and also to have access to funds specifically earmarked for telecommunications.

11 While there is some evidence of overlap in the activities of organisations providing assistance, the sector exhibits a high degree of interdependence and mutual support. We suggest no changes in the mandate or structure of any of these organisations or programmes, nor do we wish to recommend any new international organisation. However, we urge existing organisations to redouble their efforts.

12 **WE RECOMMEND** that both contributors to and beneficiaries of the UNDP reconsider the importance they attach to the telecommunications sector, and provide appropriate resources for its growth.

13 **WE FURTHER RECOMMEND** that all concerned with telecommunications give more favourable consideration than hitherto to assistance for the expansion of telecommunications world wide in view of the importance of this sector to the effectiveness of the process of development as a whole; and that regional cooperation, particularly between developing countries, be accorded a high priority.

CHAPTER 4

THE CHOICE OF TECHNOLOGY

1 It is for telecommunications operating entities in each developing country to take their own decisions about the technology in their networks. The consequences of their decisions will be felt for many years and fundamentally affect operations and viability. Telecommunications decision makers should therefore draw on the best possible sources of advice when taking these decisions. The purpose of this chapter is to give some account of the technological options and their characteristics as they stand today.

2 The pace of change in telecommunications technology was relatively slow until the mid 1950s. Since then it has accelerated. The first generation of electronic exchanges appeared in the early 1960s. But within a few years these were superseded by systems which reflected the rapid convergence of telecommunications and computing technology. Over the same period transmission techniques have improved.

3 An exciting future is emerging which promises great benefits. Computer control of exchanges, time-division switching and the transmission of information in digital form are the most important of the new concepts and seem likely to stimulate technical developments for years to come. Advances in the detailed design of equipment, in components and above all in semi-conductor techniques such as Very Large Scale Integration will continue and will reduce costs and improve performance and capability.

4 The unprecedented development of micro-electronic, space and optical fibre technologies make it possible to spread new services around the world. Besides voice and text, huge quantities of visual information will be transmitted. Videotex systems connect the subscriber to databanks and display economic, financial and scientific information as text or graphics on a television screen. In addition, services such as video-conferencing, teletex and electronic mail will undoubtedly become widespread.

5 All these services could be provided over a single global network. This, the Integrated Services Digital Network, would comprise digital switching, computer control and the large transmission capacity of optical fibres and satellite channels. Specialised satellite systems are capable of high quality connections with ships, aircraft and even land vehicles. High powered satellite transmitters with large antennae will open up a new era for space communications by reducing the size and cost of earth stations.

6 With this promise of the future in mind decision makers have to consider the options available today.

The Components of Telecommunications

7 All public telecommunications networks consist of:

- Subscriber terminals
- Subscriber lines
- Local exchanges
- Transit (toll) exchanges; and
- Interexchange circuits.

Subscriber Terminals

8 Subscriber terminals have advanced from the simple telephone instrument designed to provide basic voice telephony. The current trend is towards increasing intelligence in the terminal, enabling subscribers to perform a range of functions which enhance the telephone's utility. The terminals associated with other services such as facsimile and data have also become more versatile and sophisticated. Already the concept is emerging of a single device capable of acting as a terminal for text, data and other "non-voice" services, as well as being used as a telephone. An ordinary telephone line can carry many of these services and devices of this kind could make it easier and cheaper to provide "non-voice" services in rural and remote areas.

Subscriber Lines (Local Distribution)

9 Customer terminals are normally connected to local exchanges by a physical pair of wires. The physical connections are expensive, representing on average 30% of the total capital cost of plant in urban areas. However, in densely populated areas, a suitable local network distribution system can be planned and installed that can be expanded economically. Local networks use overhead or buried cables in various sizes and flexibility points, allowing sufficient spare capacity to add new customer terminal connections. Various electronic means of concentrating traffic are available so that more than one customer can share each physical pair.

10 Local distribution represents the major problem of providing telephone service in rural and remote areas. Individual customers can be a considerable distance from the exchange - over 50 kilometers is not uncommon - and the terrain and environment can be inhospitable. Local network costs can represent as much as 80% of capital plant costs which are themselves normally five times urban costs. Physical conductor connections still predominate with extensive use of open wire systems. Under certain conditions, open wire lines are particularly suitable for servicing rural areas without amplification and small carrier systems can be used to serve several customers from one physical pair. They are, however, inherently liable to electrical interference and to damage and involve high costs for repair and maintenance.

11 An alternative to physical conductors, especially in rural areas, is radio telephony. Very High Frequency (VHF), Ultra High Frequency (UHF) and Super High Frequency (SHF) systems have direct line-of-sight radio paths with distances between transmitter and receiver of 60 to 70 kilometers; in practice the environment and terrain can reduce this. Improving the effective utilisation of the frequency spectrum is possible by using the cellular concept and other methods of dynamic frequency assignment.

12 High Frequency (HF) systems were used only on a limited scale because frequencies in the HF band were scarce and interference high. Even though less HF frequencies are in operation for intercontinental and intercountry services, new national users have been introduced thereby maintaining congestion of the HF band. However, with proper antennae and with the right choice of frequencies HF systems can bridge enormous distances efficiently.

13 Satellite systems are already suitable for large numbers of circuits and are becoming an attractive solution for "thin-route" rural systems, especially when greater distances have to be bridged or where the installation of radio repeater stations is difficult or impossible. The costs of a satellite communications service include investment in a satellite transponder and earth stations. At present earth stations are expensive but their cost is coming down.

Exchange Systems (Local and Transit or Toll)

14 Manual systems with operators setting up connections using key plugs and jacks are still widely used. If attended for twenty-four hours a day these can provide reasonable service with low investment, low consumption of power and simple maintenance. However, in rural areas they are often attended only in daytime and have high operating costs.

15 In all automatic analogue systems speech is converted into an electrical signal with varying frequency and amplitude and calls are connected through separate switches in the system. The oldest automatic system is the step-by-step system with electro-mechanical switches. Although still extensively used, it is obsolescent. Maintenance costs are high, there are many moving parts and its capability is limited, but the system can provide reliable service and many maintenance staff are familiar with its operation. Step-by-step switches can no longer be bought new, but refurbished and fully serviceable equipment of this type is available on the world market. Cross-bar systems operate at higher speeds, are less costly to maintain and give the subscribers greater capabilities. But this system too is obsolescent and is expected to remain in production only to provide for growth of existing systems.

16 The most recent generation of analogue systems have Stored Programme Control (SPC). In these systems the control functions are performed by a computer and the switching matrix can use solid state electronic crosspoints. Advantages include extensive remote operation and maintenance facilities, built-in test and signalling units and practically no open contacts, which make

them less sensitive to dust. Normally SPC exchanges are built in compact form and so require air-conditioning, especially in hot and/or tropical climates. These systems are not yet obsolescent, but most manufacturers are switching production to digital systems.

17 In a digital switching system, telephone speech is converted from the analogue signal to a coded form consisting of high speed ON/OFF pulses. Pulses of different conversations are separated from each other by discrete time intervals and switched in turn by the system (time division switching) so that many calls can be handled by the same switch. Digital exchanges are cheaper to install and maintain than analogue exchanges, particularly in the larger sizes and are likely to become cheaper still. Among the advantages of this type of switching are its compatibility with computer output and potential savings when operated in conjunction with digital transmission systems.

Trunks and Inter-exchange Circuits

18 The links which carry calls between exchanges may be symmetrical pair cable, quad cable, coaxial cable, optical fibre cable, or terrestrial or satellite microwave radio. The choice of medium depends upon the band-width or traffic volumes to be carried, the distances and terrain to be covered, the performance required, the distribution of the traffic and the cost. Inter-exchange transmission systems in the past were analogue but are now being superseded by digital systems.

19 Technological developments are reducing costs and improving the quality of service. Optical fibre cable is particularly suitable for higher capacity routes, leaving longer distances between signal regeneration, further reducing costs and increasing reliability. Optical fibre will be replacing coaxial and quad cable systems as the preferred medium. Microwave systems are particularly suitable for medium-capacity and high-capacity routes in developing countries and inhospitable terrain. Coaxial or optical fibre submarine cables can be an economic solution in numerous cases for long distance or international transmission. Satellite systems, particularly "thin-route" systems, are becoming increasingly competitive when long distances are involved and the terrain is difficult.

The Integrated Digital Network

20 The advantages of digital exchanges and transmission systems have already been noted. Such systems can be fitted piecemeal into an existing analogue network. But their full potential is realised only when they are used to create a wholly digital network, built to an integrated set of standards.

21 Such a network carries data as easily as voice traffic and can therefore be used by many types of service. The result is economies of scale and resilience when traffic on particular services peaks. The computers within exchanges can monitor and control the behaviour of the network as a whole and open up new capabilities and techniques of operation. The flexibility of digital systems also simplifies the physical design of networks - for example, the limitations on serving large areas from a single exchange are reduced.

22 We believe that taken together the advantages of a wholly digital network are overwhelming and that every telecommunications planning decision should now be made with the creation of such a network in mind. This point was underlined in the submission we received from a telecommunications consultant:

"Although data communication or even broadband communications is not that significant at the moment to the Third World as is transmission of telephone signals, it is nevertheless considered highly important that by adopting the digital principle right from the moment a telephone network is installed, the foundations are laid for an expansion in that direction at a later date."

However, when telecommunications networks in the developing world are extended to provide advanced data communication facilities, entities in industrialised countries who would normally operate such facilities may gain advantages with respect to information on trade and world market conditions. To avoid this there needs to be closer cooperation between industrialised and developing countries in the data communications field.

The Choice

23 The accelerated pace of technological advance has widened the range of options and complicated the problems developing countries face when making their choice. The case of each developing country has to be considered on its merits. The latest technology is not always the best solution. But introducing digital systems would make good sense in many networks particularly where existing infrastructures are not advanced. However, conversion of a network from analogue to wholly digital will take many years.

24 Various considerations should guide operating entities when making their choice of technology. A major objective must be to meet present and expected future demand. To do so economically requires careful long-term planning in order to select the most appropriate technology. Existing analogue equipment should be utilised to the end of its economic life rather than replaced prematurely by digital equipment. Digital equipment can be introduced alongside analogue equipment, but the difficulties of operating a network with too many systems must be appreciated.

25 Network planners should also take into account the availability of capital, the impact of network investment on the finances of the telecommunications administration, the implications for staff, the need for building space, and other non-technical problems.

26 Formulating, updating and implementing long-term strategic plans is a demanding process. While prescribing the general lines for the development of the network and providing a basis for financial, personnel and other non-technical decisions, plans should be flexible enough to absorb advances in technology. Skilled network planners are scarce even in industrialised countries. Special efforts are needed to develop such skills,

while exploiting those which already exist. We believe that the Centre for Telecommunications Development whose creation we propose in Chapter 8 can play a valuable part here.

27 Those responsible for planning need to bear in mind advice we were given by a major manufacturer:

"The most appropriate technology for any country is one that makes optimal use of existing resources - human, material and financial. This is true for either industrialised or developing countries."

28 Although suitable equipment is available to provide service in remote and sparsely populated areas, capital and operating costs are high in relation to the number of subscribers served. In urban areas needs and equipment will be closely matched, since both the environment and users' needs correspond more closely with those of industrialised countries, where the equipment is designed and manufactured. But this is not so in rural and remote areas where distances are long and densities low, the terrain and physical conditions are inhospitable and there may be no electric power or roads.

29 Systems need to be developed specifically to enable service to be provided in the more remote areas at lower costs. From the point of view of the manufacturers of telecommunications and satellite systems there is a large potential market here for cost-effective equipment. But developing countries have a role to play in convincing industry that such a market exists and is worth the cost of developing suitable equipment.

30 **WE RECOMMEND** that manufacturers and operators be encouraged to develop systems, using the latest technologies where appropriate, which will enable the needs of the more remote areas of developing countries to be met at lower costs. In many cases this would include satellite systems.

31 We have concentrated in this chapter on the public telecommunications networks. However, vital telecommunications services in support of maritime, aviation, transport, social services and inter-community communications often exist outside these networks and can frequently be technologically self-supporting. These include fixed and mobile radio systems, small satellite terminals and even portable equipment. These technologies are adaptable to remote and rural areas and to mobile or widely dispersed populations.

32 Selection of product can be just as important as choice of technology. Each manufacturer produces equipment which is unique in some respects and offers this at different prices. Competition leads to improvements in technology and service, but buyers must know and be able to appreciate what is available in the market place.

33 To help developing countries in this respect **WE RECOMMEND** that the ITU, in conjunction with manufacturers of telecommunications equipment and components, should consider compiling a comprehensive catalogue of telecommunications

suppliers and systems currently in use. The information in this catalogue would need to be brought up to date at regular intervals.

Frequencies

34 Terrestrial radio and satellite systems are so important to developing countries that the provisions for rational use of the radio frequency spectrum agreed upon by the Plenipotentiaries of the ITU at the Nairobi Convention (1982) call for special attention. These provisions are contained in Article 33 and read:

a) "Members shall endeavour to limit the number of frequencies and the spectrum space used to the minimum essential to provide in a satisfactory manner the necessary services. To that end they shall endeavour to apply the latest technical advances as soon as possible.

b) In using frequency bands for space radio services Members shall bear in mind that radio frequencies and the geostationary satellite orbit are limited natural resources and that they must be used efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to both, taking into account the special needs of the developing countries and the geographical situation of particular countries."

We recognize the importance of equitable sharing of the orbit-frequency resources for the rapid growth of telecommunications services in developing countries. We note that this is the subject matter of the series of World Administrative Radio Conferences (WARCs) being convened by the ITU. We emphasise the need for early and satisfactory decisions, since in our view this would make an important contribution to the achievement of the objective we have set.

CHAPTER 5

INTERNAL ORGANISATION AND MANAGEMENT OF TELECOMMUNICATIONS

1 In Chapter 2 we outlined the present state of telecommunications in the developing world and identified the problems which affect the service given to the public. In this chapter we examine the organisation and management of telecommunications operating entities in the developing world and suggest how these might be improved.

2 Many governments and operators are already fully alive to the shortcomings and much has been done in recent years to improve the situation. Nevertheless problems persist.

Constitutional Position of Telecommunications

3 It is for individual governments to decide whether telecommunications should be wholly state-owned and operated, or wholly or partly privately-owned; whether telecommunications should be operated as a monopoly; or whether competition should be admitted. These constitutional questions should not affect the efficiency with which a telecommunications entity operates. But certain organisational issues do.

4 Most telecommunications systems developed as an activity run by a department of central government, frequently combined with posts and sometimes with transport and tourism. Many countries have already moved in the direction of separating telecommunications both from central government and from posts and other activities. But the extent and character of this separation and the practical autonomy of telecommunications management vary between countries.

5 While the arrangements adopted are a matter for each country to decide, when that decision is being taken weight should be given to the characteristics of telecommunications and the demands these make on its managers. In all developing countries telecommunications already rank as a significant national enterprise. The income from and revenue and capital account expenditure on telecommunications are often an important proportion of a country's total gross domestic product.

6 Again, telecommunications technology is complex and is evolving rapidly; new equipment is constantly coming on to the market. Such changes in technology raise questions not only for the technical side of the business but also in other areas.

7 A decision whether or not to introduce a new technology into a country's network affects almost every facet of operations - finance, procurement, marketing, personnel, training and so on. For example, modern telecommunications equipment requires fewer people to maintain it than older designs it replaces, but maintenance staff will need to develop new skills and be more

highly trained. So the rate at which the new technology is absorbed can be influenced by the size and skills of the existing labour force.

8 These considerations can best be taken into account if telecommunications are run as a separate, self-sustaining enterprise, operated on business lines. The management of its operations and its finances should be separate from those of posts and similar undertakings, and from the structure and financial machinery of central government. Nevertheless, it is for government to define the financial framework within which an enterprise operates - for example whether it should make a profit, and if so how much; whether telecommunications should cross-subsidise postal services; how free the enterprise should be to determine the structure and level of its prices and how often these should be reviewed. If telecommunications are treated financially as a separate enterprise such issues will be addressed in a methodical and informed way. If a complete separation of telecommunications is not immediately feasible, then gradual steps should be taken towards internal autonomy.

9 Governments may find it necessary to prescribe policy and set specific objectives. For macro-economic reasons governments may stipulate the scale of investment, or the rate of growth of the system. For socio-economic reasons governments may want telecommunications to expand outside the main cities and into the more remote districts. Such policies should be clearly stated, quantified where appropriate and publicly recognised as originating from government rather than the enterprise itself. All concerned will then know the extent to which state needs have caused the enterprise to depart from a purely business approach.

Internal Problems

10 If telecommunications are treated as a commercial enterprise operated on business lines, its structure and management need to be considered. In Chapter 2 we noted defects in regard to service to the public. Many of these are symptoms of defective management and internal procedures, rather than of shortage of money for investment; and, in the words of an international operator;

"ensuring that telecommunications investment in the developing world is cost-effective and efficient is actually a question of understanding the management of telecommunications."

11 In a capital intensive business - especially when capital and foreign currency are scarce - investment finance has to be used to the best possible effect. Unnecessary projects, poor project design based on incorrect forecasts, inadequate preparation of specifications, deficiencies or malpractices in procurement procedures, late or defective execution of projects, failure to connect equipment which has been provided or to keep it in serviceable condition - all these waste capital and impair service to the public and the financial performance of the enterprise.

12 Defects in maintenance may not be confined to new projects. Failure to carry out maintenance procedures through poor management and supervision or lack of staff trained in the necessary skills is a major cause of the poor quality of service noted in Chapter 2.

13 Problems can arise in other areas. Commercial procedures are often inadequate - for example for taking and processing orders for new lines, for rendering bills on time, and for ensuring that bills are paid. Poor inventory control can lead to the accumulation of large stocks of uninstalled telephones or engineering stores such as cable, wire and poles, or shortages of components essential to provide service.

14 Deficiencies in the process of matching available staff with requirements can cause shortages of staff with the skills required to maintain the equipment installed in the network, to oversee construction projects and so on. Yet there may be too many staff with the wrong or outdated skills, and often there are more staff on the payroll than are needed to do the work on hand and improvement in labour productivity may be slow.

15 These problems can be remedied by improved internal structures and disciplines.

Requirements for Efficient Operation

Organisation

16 The organisational structure of the enterprise should suit its circumstances, the geography and the layout of its network. The organisational units and the managers in charge should have clearly defined and separate functions.

Financial and Managerial Systems and Controls

17 The financial and management accounting systems should follow sound business practice. Each manager should be set an annual budget and be answerable for his performance against this at the end of the year. Financial reporting systems should be rapid enough to allow top management to control financial performance during the year.

18 Non-financial performance should be subject to similar disciplines. Uniform and simple statistical systems should be introduced for each management unit. These should cover all the main aspects of the enterprise, such as quality of service, staff numbers and productivity. Each manager should be set targets under these heads and his performance monitored against these during the year.

Annual Reports

19 The enterprise should publish an annual report containing a review of events and performance during the year, the financial accounts and statistics dealing with other features of its operations.

Tariff Policy

20 Governments may wish to retain overall control of tariffs to ensure that national policies are followed. This can influence the rate of growth of various groups of users and affect the overall development of the system. From a commercial viewpoint tariff policies must also ensure that costs are covered adequately and sufficient funds generated for further investment. The enterprise should also have a say in the details of tariff structure which can have operational consequences. For example, the level of charges for connection to the system or the rentals charged can affect demand for service. Differential charges for different times of day can influence the network's load factor.

Capital Project Disciplines

21 For operational reasons telecommunications capacity has to be provided in tranches which will meet growth for some years ahead. Demand cannot be forecast precisely. But close attention should be given to forecasting procedures in order to minimise error and consequent waste of money. Control mechanisms are essential to ensure that capital projects are justified, are on a scale relevant to forecast demand, are costed accurately, properly executed and completed on time.

Procurement

22 A telecommunications operator must have effective procedures for procurement and tendering if a balance is to be struck between low initial cost, reliability and running costs. A specialist group should be responsible for procurement. Procurement should generally be by competitive tender when untied financing is available, with proper appraisal carried out by specialists. Major procurement decisions should be taken openly at senior level. Procurement by means of non-competitive procedures should be subject to stringent checks and pre-set profit levels. Each procurement process should be subject to regular independent audit.

23 Even when procurement is effectively organised the telecommunications operators, especially in developing countries with smaller systems, may face problems when buying certain items of equipment or in obtaining spare parts. Small orders for terminals and components may create difficulties for the supplier which may lead to higher prices and delays in delivery.

24 WE RECOMMEND that developing countries consider cooperating on a regional, sub-regional or international basis in order to pool their purchases of appropriate equipment including terminals and components. This would imply unified tendering procedures and adopting common equipment practices.

25 WE ALSO RECOMMEND that, when purchasing equipment, developing countries ensure that the contract includes an effective commitment on the supply of spare parts and training, and on commissioning, post-installation and maintenance obligations.

Personnel Issues

26 Personnel planning and procedures must be effective and cover all categories of employee. Managers should be of high calibre and properly motivated and remunerated. Particular attention should be paid to securing competent and effective first- and second-line supervisors and to providing a sound training and development programme. This is essential to building an efficient organisation capable of providing good telephone service. This issue is dealt with more fully in Chapter 6.

27 Since labour costs constitute most of the operating expenditure, productivity is important and staff levels should be strictly controlled. When a telecommunications system is growing rapidly productivity should also increase, but the number of staff should grow slower than turnover. Where labour costs are relatively low and national unemployment high, it may be more economical to retain labour-intensive plant, so long as people with the necessary skills are available. However, when a telephone exchange grows beyond a certain size automation becomes necessary to achieve satisfactory quality and efficiency of service.

28 Telecommunications operators should seek to maintain good industrial relations, with effective and acceptable procedures for consultation and handling disputes.

Planning

29 Operating entities should prepare a forward plan, say for a five year period, for their entire operation. This is an essential tool in the efficient management of the enterprise as well as a pre-condition for investment. Longer term plans covering up to 20 years are also necessary both for strategic purposes and for planning the procurement of certain items of equipment.

Support from the Industrialised Countries

30 In the previous section we have summarised the most important requirements of structure and of management practice which an operating entity in a developing country should meet if it is to be efficiently run, and hence attract external finance. A number of countries have already made marked progress in this direction.

31 Many developing countries cannot be expected to accomplish the necessary changes without help. They will need the support of industrialised countries in various ways and for varying periods before they can become fully self-reliant. For example, many developing countries find it hard to provide other than basic training within their own borders and are thus dependent on outside help for training in management and supervision, and in higher technology.

32 Help in various fields of activity is already available through different channels. But more is needed.

CHAPTER 6

TRAINING

1 The effectiveness of any telecommunications operation depends on the knowledge and skills of its staff. A major cause of the shortcomings we noted in Chapter 2 is the lack of sufficient trained staff. The importance of this aspect was stressed in a commentary sent to us by a consultancy firm:

"We consider that development aid for telecommunications in the developing countries should aim first and foremost to train manpower. In particular, practical field training in maintenance and operation makes for savings by avoiding costly replacements and ensures that full benefit is gained from investments already made. It should be remembered that equipment is frequently not used to full effect due to the lack of competent staff and that this under-utilization obliges the Administrations to invest more than necessary."

2 Engineering staff must be trained in the equipment they are to install and maintain; operating staff must be trained in efficient switchboard procedures; clerical staff in office and computing procedures; and so on.

3 Engineering supervisory staff must understand the technology with which they are concerned and other supervisors must know the processes they have to oversee. But all supervisors must also be trained in staff management and the techniques of supervision. Competence in basic grade work alone should not qualify an operative to become a supervisor.

4 The effective running of a telecommunications operation requires that its managers should be trained to the highest professional standards. Engineering managers obviously need the appropriate technical qualifications. Middle managers in other disciplines and more senior general managers must have a sufficient grasp of telecommunications technology and other relevant techniques such as computing. But all must be versed in good business practice including how to organise and instruct staff and supervisors, the essentials of financial and statistical systems, and so on. They should be trained to apply their knowledge in the various spheres of activity for which they are responsible.

5 Satisfactory arrangements for training staff at all these levels are therefore essential for any telecommunications operating entity. But the smaller and less-advantaged countries often find it difficult to arrange training in the more complex skills from their own resources. They are unavoidably dependent on outside support and many will continue to be so for the foreseeable future.

Present Facilities

6 It is normal practice for manufacturers in industrialised countries to provide training in the techniques and maintenance particular to the equipment they supply. Developing countries should ensure that adequate numbers of their staff receive this training.

7 Training opportunities representing a major contribution have been provided bilaterally by many industrialised countries, by more advanced developing countries, as well as by multilateral organisations.

8 Universities also make an important contribution. For example, several African universities have faculties of engineering or technology which offer specialisation in electronics and telecommunications. Academic institutions can be expected to continue to play a key role in providing professional staff for telecommunications administrations and industries who, in turn, should remain in close contact with universities.

9 As a main thrust of its technical cooperation activities during the last two decades within the framework of the UNDP the ITU has assisted developing countries in establishing over forty training centres around the world. Most developing countries have their own facilities for training in the more basic skills. In some cases, sub-regional training centres have been established with the assistance of the UNDP. The multinational training centre at Rufisque in Senegal and the training institutes in Saudi Arabia set up in cooperation with ITU are examples.

10 The Technical Cooperation Department of the ITU

- a) provides technical assistance to telecommunications training centres;
- b) develops training techniques and methods;
- c) trains instructors, managers and organisers of training courses;
- d) assists regional and inter-regional coordination of training;
- e) promotes the sharing of resources for telecommunications training;
- f) organises seminars on training.

11 Through cooperative training efforts such as the UNDP/ITU CODEVTEL project, international training standards are established, personnel exchanged and the effectiveness of training within administrations is enhanced. The ITU through its sharing system for training development has so far

trained more than 600 course developers. Some 250 courses have been completed and an equal number is under development.

12 Despite these various efforts much remains to be done. A serious gap persists between developing countries' needs and available training opportunities.

The Future

13 We believe the following considerations should influence future training arrangements in and on behalf of developing countries.

14 In the first place, the primary responsibility for defining training needs and for ensuring that these are met rests with the operating entity concerned. Training programmes should be compiled which will ensure that a staff trained in all the relevant disciplines is built up as rapidly as possible. These plans should allow for some wastage of staff, especially those trained abroad who may be attracted by well paid jobs away from their own country. And they should be closely aligned with the forward plans referred to in paragraph 29 of Chapter 5. We believe that the Centre for Telecommunications Development we propose in Chapter 8 could offer effective support in this field.

15 Since substantial outside help will still be needed, facilities for training organised at sub-regional or regional level (in which the institutes we propose in Chapter 7 can play a role), or provided by industrialised countries, should be expanded systematically to meet the needs of developing countries. However, to encourage self-reliance, attention should be paid to the expansion and upgrading of existing training facilities in developing countries at national and regional levels. Valuable contributions have already been made by many industrialised and advanced developing countries and in this connection, at Bali we were encouraged to hear that the Government of Japan will make a contribution to the CODEVTEL database in Asian countries to show their strong support for the "international sharing system" through which the utilisation of expanded training resources might be achieved.

16 Training in simpler techniques - for example the installation of customer apparatus and the construction of underground cables or overhead wire distribution systems - should in our view be carried out at or close to the place where trainees will have to apply their knowledge.

17 Training in the installation and maintenance of more complex technical equipment - for example exchanges, transmission and radio systems, must clearly be given on the equipment concerned. But instruction should be adapted to the environment in which the equipment will be used and cover special problems arising from terrain, climatic conditions and so on.

- 18 **WE RECOMMEND** that telecommunications entities in developing countries periodically review their training needs and resources, and prepare systematic training plans.
- 19 **WE RECOMMEND** that developing countries use the resources available through the IPDC, such as fellowship programmes.
- 20 **WE RECOMMEND** that industrialised countries organise seminars to improve the qualifications of experts from developing countries in the field of telecommunications.
- 21 **WE RECOMMEND** that the institutes we propose in Chapter 7 be developed as a source of higher technological, supervisory and managerial training and as coordinating agencies for external training opportunities for the countries in their regions or sub-regions.
- 22 **WE RECOMMEND** that the ITU supplement their Catalogue of Training Opportunities with as much information as can be obtained about training opportunities in the private sector and elsewhere.
- 23 **WE ALSO RECOMMEND** that operators and manufacturers consider how they can enhance the training opportunities they offer to developing countries. This might include the provision of training equipment and facilities.

CHAPTER 7

RESEARCH AND DEVELOPMENT AND LOCAL MANUFACTURE

Research and Development

1 The view developing countries take of the issues we discuss in this Chapter was vividly expressed in the memorandum submitted by the Pan African Telecommunication Union:

"Experience in many countries shows that:

- a) Foreign industries are making very little effort to produce equipment geared to the real needs of the African countries;
- b) The prices prevailing in Africa are too high and out of all proportion with the actual production costs of the equipment and the prices charged in the countries of origin;
- c) Spare parts supply contracts are very rarely respected, thereby making brand-new equipment virtually obsolescent several years before the end of its nominal lifetime."

2 At present only a small number of the larger or more advanced developing countries have a research and development (R&D) capability of their own. The majority of developing countries are dependent on R & D undertaken in industrialised countries. In several aspects of telecommunications technology satisfactory solutions to problems particular to developing countries have not yet been found. The assured market for such solutions is relatively small and unstructured and it is doubtful whether sufficient effort will be put into speculative R & D by the major equipment manufacturers in industrialised countries.

3 R & D in industrialised countries is directed to producing equipment geared to conditions and requirements in those countries. As we noted in Chapter 2, this equipment may not be suited to the needs of developing countries, particularly outside urban areas. Probably the most pressing need is for more economic means to provide service to a widely scattered population with no actual community centre. Microwave radio, VHF, UHF, SHF and HF radio, satellites and physical lines are used at present, but these are costly. Even when the equipment is installed there may be added costs to provide dedicated power, and maintenance in remote areas is difficult. Each country or region has its own problems and thus its indigenous solutions.

4 We believe that more R & D needs to be geared specifically to the requirements of developing countries. Such R & D would best be carried out in establishments in the developing world and a deliberate policy of decentralisation from industrialised countries would be helpful. Two main arguments suggest that it could be beneficial for countries to set up institutes, either individually, or in groups on a regional basis.

5 The development of major new systems for use in large high density networks consumes considerable resources. The first objective of R & D establishments in the developing world should therefore be to develop equipment which is not available elsewhere. An example would be equipment capable of providing service at a more reasonable cost in remote areas and which would be suitable for manufacture either on a local or regional basis. There is also a wide range of devices, tools and aids that are not pure telecommunications equipment but whose development and manufacture locally would reduce construction and operating costs. These establishments could adapt designs from the industrialised world to the needs of the countries they serve. In other words, we do not envisage the institutes developing major new telecommunications systems but rather modifying available systems to their own requirements using modules and components available in the world market.

6 Large resources are required to create an effective R & D establishment. However, because of marked differences in local conditions it may still be appropriate for individual countries to make this large investment. Where similar conditions and requirements in regions or sub-regions permit, it might be advantageous for the R & D needs of developing countries to be met by establishments serving such regions or sub-regions. We suggest that wherever possible these establishments should be developed out of an existing entity such as a faculty in a university or an existing research centre; they should however maintain close links with the telecommunications sector in the regions and with the proposed Centre for Telecommunications Development (Chapter 8). Cooperation with manufacturers in the region would also be desirable to ensure that any successful development results in actual production.

7 Manufacturers and operators in industrialised countries should be invited to cooperate in the activities of the R & D institutes, which could then become an important channel for the transfer of technology. Since this consists not only of know-how but also of know-why, we would hope that this information might be given freely through the medium of these institutes by those who are technologically more advanced.

8 The R & D institutes should also communicate between themselves to exchange ideas and avoid duplication of effort. Close contact with manufacturers would also ensure the effective transfer of knowledge and help to keep the institute up-to-date. In return, the institutes could perform certain cooperative functions for the manufacturers, such as developing and producing software programmes.

9 Software is a key ingredient in modern telecommunications systems. The problems this raises were described to us by a major manufacturer in these terms:

"Modern systems rely heavily on sophisticated software, and its maintenance and upgrading is an intellectually difficult task. Where a reservoir of skills in software techniques is not available in a country, it will not be an easy task to establish it quickly, and it may be that the only

practical solution for the medium term is that this capability should be supplied from outside the recipient country".

10 The software for an exchange is provided by the manufacturer along with the hardware. But changes have to be made to it on site for a number of reasons. Some changes may be required at the outset. The manufacturer is likely to notify further changes from time to time, to remove defects or improve performance. We believe that operators in developing countries should be enabled as soon as possible to make as many of these software changes on site themselves as is practicable. While the problems will be less the more software is standardised, it will take time to find people with the ability to carry out these modifications, and to give them the extensive training they need. Moreover, there is a danger that, unless they are well paid, once trained they will be attracted elsewhere; software skills are at a premium world wide. In this situation the institutes have an important part to play, both in arranging training and in maintaining pools of staff able to give direct assistance to operators with their software problems. Generally, the institutes should become foci of software expertise in the developing world, and channels for the transfer of software technology from the industrialised countries.

11 The initiative for establishing such institutes should come from appropriate groups of developing countries, working with and through existing regional cooperation bodies. It is our strong view that the success of these institutes will depend on close cooperation between developing and industrialised countries.

12 We envisage that developing countries would contribute to the funding, either from their own local currency resources or from aid sought for the purpose, for example, from the World Bank, the Regional Banks, or specific bilateral aid. These countries would also provide staff with personal experience of conditions on the ground. The training division of the Technical Cooperation Department of the ITU would have a valuable role to play in support of the institutes. Groupings of industrialised countries or international organisations would also have contributions to make.

13 As they developed, the institutes could progressively take on additional functions:

a) The study in depth of the particular technical and operational problems of the telecommunications administrations in their regions.

b) The development, in cooperation with industrialised countries, of equipment and techniques of installation and maintenance to meet the specific needs of the telecommunications administrations in the region.

c) Sustaining a dialogue with regional or sub-regional manufacturing enterprises which may be established in close association with them, and the submission of designs to these enterprises which they might manufacture.

d) Providing support for training management and higher grade technicians for the telecommunications administrations in their region, and coordinating training provided by industrialised countries.

e) Advice and assistance on manufacturing activities, in close cooperation with the proposed Centre for Telecommunications Development.

14 The ultimate aim of the R & D institutes should be to stimulate self-reliance within the developing world. But the advice of the Minister of Tourism, Posts and Telecommunications of Indonesia should be borne in mind.

"Transfer of technology is inevitably a long and hard process. The building up of a scientific and technological base is essential for such a transfer."

15 WE RECOMMEND that the major regional and sub-regional political and economic organisations in Latin America, West and East Africa, the Middle East and South and South East Asia consider as soon as possible how best such institutes might be established, in consultation as appropriate with the ITU and in cooperation with the Centre we recommend in Chapter 8.

Manufacture in the developing world

16 Indigenous manufacture of telecommunications equipment in the developing world could provide many benefits:

a) Foreign exchange problems could be lessened.

b) Developing countries could become more self-reliant by reducing the dependence of their telecommunications administrations on major international firms.

c) Problems in maintaining older systems could be minimised by manufacturing spare parts which are no longer available from the original manufacturer.

d) Economic activity in the telecommunications sector would increase within developing countries.

17 We recognise that only the larger developing countries could find sufficient capital to establish factories of their own to produce anything but the simplest of equipment, or even have the necessary demand to make such ventures viable. It is well known that the viability of a manufacturing enterprise depends on a sufficient quantity of manufactured units to offer economies of scale. It has been estimated that one would, now or in the short term, require approximately 1 million telephones to support the manufacture under licence of a comprehensive range of

telecommunications equipment. Few developing countries alone have either the necessary resources or the demand and it follows that regional or sub-regional manufacture is appropriate for the majority of the developing world. The Government of India, drawing on its own considerable experience in this field, has described the problem in this way:

"For setting up of facilities for local manufacture of telecommunication equipment in developing countries, the three primary inputs are manpower, material and financial resources. Some of the developing countries have a fairly developed industrial infrastructure as well as adequate skilled manpower and their requirement of telecommunications equipment is also substantial due to the size of their network. These countries can, and some of them already have, set up fairly extensive local manufacturing facilities. However for many of the small countries it may not be economically viable to set up industries. Such countries can set up manufacturing facilities as joint/collective ventures at regional/sub-regional level. The ancillary units can be set up in different member countries to gradually improve their industrial base and also to strengthen the collective effort as well as to provide a local supply source for that particular component for successful maintenance."

18 The manufacturing processes carried out in these factories will depend on the level of cooperation and the size of the market within the region and should be geared to the specific capabilities of the developing countries in which they are located. When we held our fifth meeting in Indonesia in November 1984, we learned at first hand something of the domestic telecommunications industry, which manufactures some small earth satellite equipment, telephone cables, television receiving equipment and other items. It may be appropriate for a developing country to manufacture under licence, or to concentrate on assembly processes and acquire integrated circuits from the international market. The manufacture of integrated circuits involves expensive facilities and sophisticated processes and is viable only in really large quantities.

19 Establishing regional or sub-regional telecommunications industries will require

- a) the will to cooperate;
- b) the removal of intra-regional tariff and customs barriers and possibly the grant of investment incentives;
- c) harmonisation of equipment design and technical standards within the region;
- d) a common procurement policy guaranteeing the industry's continuous operation and full capacity. This implies a commitment by the countries concerned to order sufficient of their needs from the regional industry to ensure it a full work load;

e) agreement on the industry's pricing policy, and definition of its position vis-a-vis competitors from outside the region.

20 Assuming these policy issues can be overcome together with the practical issues related to establishing an industry, methods can be devised for allocating manufacturing within the region to provide each country with an equitable share in the activities.

21 None of these suggestions should deter individual developing countries from taking their own initiatives, however modest, in this field. The Director General of Tanzania Posts and Telecommunications Corporation told us of his Corporation's approach:

"The type of equipment local manufacturers have supplied have been limited by the state of technology available in Tanzania. The electronics industry in Tanzania is almost non-existent and there are thus no manufacturers of electronic telecommunication equipment. On the other hand, local manufacturers have supplied equipment which requires simple technology. Items supplied by local manufacturers include wooden telephone poles, cross arms, PVC conduits, manhole covers etc. Local manufacturers are already making an attempt to manufacture cables and they are starting with drop wires."

22 WE RECOMMEND that developing countries either individually or regionally review their plans for local and regional manufacture to ensure that full account is taken of the potential benefits of domestic manufacture for both the short and long term, especially in relation to a limited or specialised product line and to the problem of spare parts for obsolescent equipment.

23 WE FURTHER RECOMMEND that manufacturers in industrialised countries consider the scope for cooperation in this field with individual, or groups of, developing countries.

CHAPTER 8

A CENTRE FOR TELECOMMUNICATIONS DEVELOPMENT

1 Help for developing countries in the field of telecommunications is already available through different channels. The ITU provides assistance amongst other things with the identification of projects, design and procurement, pre-investment studies and by arranging training. Consultants are employed by the ITU to provide disinterested advice on projects and to help improve internal organisation and management practices. But in our view the scope of this assistance has to be expanded and the machinery for providing it rationalised if the scale of improvement that is needed is to be achieved.

2 In particular, existing mechanisms for aiding the development of telecommunications are loosely structured and seem to us inadequate. The ITU makes a substantial effort. But it combines several functions and serves a variety of interests which are in fact distinct. For example, its work on standards and regulatory activities directed primarily at making possible the conduct of international telecommunications is distinct from its technical assistance to developing countries.

3 As we argue in the Introduction, assistance to developing countries in this field serves not only their interests but also those of industrialised countries. We believe that to make this assistance effective the arrangements through which it is provided need to be revised and strengthened. Indeed it is our view that in present circumstances this would be the most important single step towards achieving the objective of bringing all mankind within easy reach of a telephone by the early part of next century. This step could and should be taken at once.

4 **WE RECOMMEND** that a Centre for Telecommunications Development be established by the Administrative Council at its next meeting scheduled for July 1985.

5 This Centre would have three main elements :

a) The first would be a **DEVELOPMENT POLICY UNIT**. The Unit's main function would be to collect information about telecommunications policies and experience, including experience of the role of telecommunications in economic and social development throughout the world, and to make the results available to developing countries to help them formulate policies for the evolution of their own networks. The Unit would have a staff of no more than 10 who would provide a disinterested intellectual contribution.

b) The second element would be a **TELECOMMUNICATIONS DEVELOPMENT SERVICE**. This would advise developing countries on creating and operating an effective

telecommunications system. It would offer advice at the pre-investment stage on organisation and structure, planning, maintenance, training and personnel policy, procurement policy, tariff policy, integration of telecommunications with general development programmes, financing of investment and so on. The Service might consist of a number of teams, each with up to five highly qualified specialists from the fields of telecommunications management, economics, technology and finance. At the request of the government concerned they would undertake studies lasting, say, three months. The arrangements would need to be such that the full-time staff of the team could be supported on a part-time basis by specialists in particular disciplines. We believe that knowledge that a particular country had made use of this Service would give potential investors and aid agencies greater confidence in the prospects for its telecommunications operation, and so markedly improve its chances of securing outside funds.

c) The third element would be an OPERATIONS SUPPORT GROUP. This would provide specific assistance including preparation of plans; preparation of specifications for projects; assistance with manpower planning and training; management assistance; assistance in research and development and so on. This would complement the work of the Technical Cooperation Department (TCD) as at present.

In addition the Centre would contain a small liaison section to assure coordination with the complementary activities of the TCD.

6 The Centre would operate as a non-profit making organisation under an Advisory Board of between 15 and 20 members representing different regions and interests. These would be selected by the Secretary-General of the ITU in consultation with Members of the Administrative Council of the ITU and other interested parties. Members would be appointed for a period of two years by the Administrative Council which would stipulate the broad objectives and policy guidelines of the Centre. The Chairmanship of the Board would rotate amongst its Members. The Secretary-General would be ex-officio Vice-Chairman.

7 We foresee that eventually the Centre and the TCD could be merged. This matter should be examined further by the Administrative Council and by the Advisory Board of the Centre and, subject to their joint decision, such a merger could be effected progressively in the interval leading up to the Plenipotentiary Conference when any necessary changes to the Convention could be decided.

8 The Centre shall be responsive to the needs and views of its potential financiers and beneficiaries. To ensure this the Advisory Board would give necessary policy direction to the Centre. The Board would determine its own rules of procedure, assure the finances of the Centre and administer its budget.

9 The question of funding the activities of the Centre would require careful study by the Advisory Board. A mechanism would be needed to ensure that the headquarters and other standing

costs of the Centre were met on a regular and reliable basis. We estimate that these could amount to some US\$ 10 million per annum, although a precise figure could be determined only after firm conclusions on the structure and size of the Centre had been reached. Possibilities include setting aside a small proportion of revenues from calls between industrialised and developing countries, or regular contributions.

10 We would hope that operating entities in industrialised countries and other interested parties including manufacturers and suppliers of telecommunications services would also make contributions in kind, for example by loaning staff at no charge to participate in the work of the Centre.

11 The Director and Deputy Director of the Centre should be persons of eminence who would enjoy the confidence of contributors to the Centre. They would be appointed by the Secretary-General on the recommendation of the Advisory Board.

12 The Secretary-General would be responsible for ensuring that the objectives and policy guidelines laid down by the Administrative Council were observed by the Centre.

13 He would also be responsible for ensuring the consistency of the Centre's activities with the general aims of the ITU in the development field as well as effective coordination of effort where the Centre and the TCD are both involved. In the interests of making best use of contributions to the Centre and bearing in mind its foreseen merger with the TCD, the existing facilities of the ITU should be drawn upon as much as possible.

14 The Advisory Board would submit a report annually on the work of the Centre to the Administrative Council through the Secretary-General. The Secretary-General would, in addition, report on the Centre's progress to the Plenipotentiary Conference with recommendations as necessary.

15 **WE ACCORDINGLY INVITE** the Secretary-General to carry out the necessary consultations so that the Centre can be established as soon as possible in the course of 1985.

CHAPTER 9

FINANCING THE DEVELOPMENT OF TELECOMMUNICATIONS

1 In previous chapters we have drawn attention to the consequences of inadequate investment in telecommunications in developing countries. We have also explained why increased investment in this sector is needed if economic and social development programmes are to be fully effective. This higher level of investment needs to be applied both to raising the efficiency of existing telecommunications operations and to expanding their networks.

2 It has been estimated that a total of some US \$ 8 billion* from all sources was invested in new public telecommunications plant in developing countries during 1983. If developing countries are to achieve the improvement and expansion of their networks which in this Report we have shown to be necessary, we estimate that total investment of US \$ 12 billion a year will be needed across the board. The exact scale of investment will vary from country to country according to their circumstances. By any standards this represents a major challenge, which is all the more daunting at a time when the world economy is characterised by indebtedness, high interest rates and low savings - all of which hinder the flow of funds and the transfer of resources.

3 For most developing countries the problem is not simply one of increased investment. Telecommunications require large capital sums. On average 60% of investment in telecommunications in developing countries must be in foreign currency. Foreign exchange is scarce and costly to obtain; and most of the money telecommunications earn is in local currency.

4 In considering this challenge, we have been encouraged by a number of circumstances which are peculiar to the telecommunications sector. First, an effective telecommunications system which meets demand not only is inherently profitable but also generates wealth. As soon as a telephone is installed and comes into use, it begins to earn revenue for the operator of the system and contributes to economic activity.

5 Secondly, the remarkable technological advances of recent years, which still continue, have widened the options for telecommunications administrations and driven down the costs they have to incur.

6 Thirdly, developing countries represent a fast-growing and potentially the largest market for telecommunications equipment and should be highly attractive to manufacturers in industrialised countries. This point was put forcefully to us by the Arab Telecommunication Union:

* In this Report, US \$ 1 billion equals US \$ 1,000,000,000

"Given their current lack of telecommunications services and their sheer size in terms of population and surface area, the developing countries represent a vast market with enormous potential. This should encourage manufacturers to make every effort to open up this market and speed up telecommunications development in these countries."

However, some telecommunications manufacturers and others in industrialised countries have not fully appreciated the potential offered by the telecommunications sector for mutually beneficial relationships with developing countries.

7 We doubt whether this reluctant attitude to the potential market can be sustained. Few markets for telecommunications equipment in the industrialised countries are fully open to international competition. Manufacturers seeking to sell their products outside their domestic markets will be increasingly obliged to turn to developing countries. Moreover, at present many established manufacturers have plants with substantial excess capacity. As a result the telecommunications administrations of developing countries are in a strong position to obtain the benefits of modern technology and to secure lower prices for the equipment they need. Insisting on open tendering by suppliers, or seeking international bids on price and repayment terms for specific projects are methods by which this can be done.

8 Apart from these positive factors we are convinced that if the recommendations we make in this Report are put into good effect the dimensions of the financing problem will be reduced.

9 **ACCORDINGLY, WE RECOMMEND** that developing countries review their development plans to ensure that sufficient priority is given to investment in telecommunications.

10 **WE FURTHER RECOMMEND** that developing countries make appropriate provision for telecommunications in all projects for economic or social advance and include in their submissions a checklist showing that such provision is being made.

11 Against this general background we have based our approach to the financing of investment in telecommunications on two principles. First, drawing on experience in more advanced countries, we have set as our objective an expansion of telecommunications world wide in stages over a period of some twenty years. Secondly, we have accepted that it is impossible to generalise the problem; each country, or region at least, has to be seen as an individual case.

12 Nevertheless, for the purpose of explaining the rationale behind our recommendations, we have assumed four categories of developing country, which correspond broadly with the classification used by the World Bank.

13 First, there are those countries which are so large and have such a long telecommunications history that they must be regarded as special cases. Brazil, China, India and Indonesia are examples of countries in this category.

14 Secondly, there are those such as the oil producers who can largely finance the expansion of their networks from their own resources. But these countries may still encounter problems of organisation and management.

15 Thirdly, there are those countries which are so disadvantaged economically or geographically that they will not find it easy to develop and sustain a telecommunications system which will meet demand, except in the longer term.

16 Finally, there is the main group of developing countries who share many problems - scarcity of foreign currency, low credit rating, comparative neglect of the more remote areas, lack of appropriately trained personnel. Many countries in Africa south of the Sahara and some in South America fall into this category. When we visited Tanzania in October 1984 we learned at first hand how seriously these problems can impede even the most determined efforts to improve and expand the telecommunications network.

17 The situation of the disadvantaged, particularly those in the third category is such that, at least in the early stages of the expansion of their networks, they will require finance on concessionary terms. The same will be true of the more remote areas of some countries in the fourth category.

18 Nonetheless, it is reasonable to suppose that a high proportion of investment in telecommunications in many of the countries in the fourth category can be financed by normal commercial means, provided that the right conditions can be created. This is an important proviso. First, either the actual or the potential commercial viability of the telecommunications system in a given country has to be demonstrated; and we are convinced that the Centre for Telecommunications Development which we propose in Chapter 8 will make a major contribution to this. Secondly, there must exist a climate generally conducive to inward investment, including adequate assurance of creditworthiness. Thirdly, the suppliers of equipment and technology in the industrialised world, together with the finance houses, need to make every effort to enter into mutually beneficial arrangements with developing countries.

19 We recognise that in the present difficult world economic situation any direct call for substantial extra concessionary finance is likely to fall on deaf ears. However, as we have pointed out, investment in telecommunications can be expected to generate significant economic activity in the industrialised as well as in the developing world. Improving and expanding the telecommunications networks of developing countries would make a major contribution to development in such fields as health, the social services and emergency relief, and would stimulate economic growth; and in the process, new or more extensive markets would be opened up for both high technology and traditional telecommunications manufacturing industries. In our

opinion this community of interest between industrialised and developing countries should ensure that the increased telecommunications investment we call for will be financed. Accordingly we urge that the following steps be taken immediately.

- 20 **WE RECOMMEND** that countries and international agencies with development assistance programmes give higher priority to telecommunications in order to increase the flow of resources in this field and, while doing so, bear in mind the wider acceptability of multilateral channels of assistance.
- 21 **WE RECOMMEND FURTHER** that all such countries and agencies ensure that development assistance projects include specific provision for appropriate telecommunications facilities and services.
- 22 **WE RECOMMEND FURTHER** that those who provide international satellite systems study urgently the feasibility of establishing funds to finance earth segment and terrestrial facilities in developing countries.
- 23 We have noted with interest that the seven Governments which participated in the Economic Summit in London in 1984 gave their encouragement to practical measures in developing countries to conserve natural resources and enhance indigenous food and energy production. We believe that it would greatly increase awareness of the essential role telecommunications play in development if, at the next Economic Summit, the participating governments gave similar encouragement to the improvement and expansion of telecommunications. **WE APPEAL** to them to do so.
- 24 Much of the cost of financing large scale projects in developing countries is attributable to the perception by suppliers of equipment, or the financial institutions, of risks of one form or another. Although this problem is well recognised and unavoidable risks arise in most if not all commercial transactions, we believe that there is scope for industrialised countries and international agencies to explore novel methods either of reducing perceived risks in the telecommunications sector or the costs of insuring against them.
- 25 **WE THEREFORE RECOMMEND** that industrialised countries seek to ensure that export/import financing and insurance coverage are extended to their domestic suppliers of telecommunications equipment.
- 26 **WE ALSO RECOMMEND** that the IBRD consider whether investment in telecommunications can qualify for protection under the Multilateral Investment Guarantee Agency which it has recently proposed to guarantee investment by member countries against non-commercial risks.
- 27 **WE FURTHER RECOMMEND** that where projects are financed in part by IBRD loans other contributing finance agencies should consider cross-default arrangements as a form of insurance.

28 International telecommunications traffic is a source of surplus revenue for most operating entities in both industrialised and developing countries. However on some routes between industrialised and developing countries the flow of traffic is unbalanced in that the operating entity in the developing country may have a deficit when the annual traffic account is settled. Moreover, the proportion of successful call attempts to some developing countries is low (less than 30%), compared to success rates of over 50% for industrialised countries. The difference is due in part to the less advanced state of internal networks and to a shortage of international circuits among developing countries. Operating entities in industrialised countries providing international services have a clear interest in improving the ability of their counterparts in developing countries to handle international traffic efficiently.

29 In the light of this there is scope for considering alternative financial arrangements for routes jointly operated by entities in industrialised and developing countries. International services are organised in different ways and within different legal frameworks in different countries and it is therefore impractical to recommend any one scheme. An example is the special preferential adjustments to international accounting arrangements which have been made for some years in the settlement of traffic accounts between developing and industrialised countries of the Commonwealth in order to stimulate the development of international telecommunications.

30 **WE RECOMMEND** that Members States of the ITU consider in the light of their own circumstances a rearrangement of their international traffic accounting procedures with the aim of setting aside a small proportion of revenues from calls between developing countries and industrialised countries. The resources transferred thereby should be devoted to the telecommunications sector in the developing country or countries concerned, or contributed to a fund and used for example to finance pre-investment costs.

31 The recommendations in the preceding paragraphs if adopted should increase funds available for pre-investment studies and other activities and create a more favourable environment for the expansion of telecommunications systems in developing countries. We have considered alternative financial arrangements which would take some time to bring into effect. For example, funds for investment in telecommunications might be raised by a surcharge on domestic traffic, international traffic (including transit traffic), or on expenditure on investment. We recognise however that any such arrangement would have to be universal. We have noted that the patterns of traffic vary and investment levels are matters for sovereign decision. The question of equitable application of a surcharge would also arise. This and other ideas would require further analysis and we hope that industrialised and developing countries alike, as well as international agencies, will contribute to the debate we have initiated.

32 **WE RECOMMEND** that governments of industrialised countries review their long-term financing instruments and institutions with a view to ensuring that they can meet the considerable financing requirements of extending telecommunications networks in developing countries.

33 We have noted suggestions that the economic value of geostationary orbits and of the radio spectrum might be used to finance telecommunications development. In our view, further work is needed to determine whether this idea is practical. We also note alternative proposals for the common use of satellite facilities on a global scale to assist developing countries in the provision of telecommunications services. These ideas are the subject of studies being undertaken in several institutions around the world.

34 Since these studies have not yet reached firm conclusions, we are not in a position to make a positive recommendation which might appear to have prejudged the potentialities of this novel approach. However, we believe that the studies should be pursued actively and their results evaluated by the ITU. If the necessary funds are not available for this further task, other institutions should be invited to finance it.

35 **WE RECOMMEND FURTHER** that the Member states of the ITU, in collaboration with international finance agencies including the Regional Development Banks, study the following proposals with a view to determining, at the earliest possible date and at the latest at the next Plenipotentiary Conference, how best these might be put into effect. The Secretary-General of the ITU is invited to report to the Plenipotentiary Conference on the progress made with these studies:

a) **A revolving fund** could be established to assist in financing the purchase of equipment, the provision of consultancy and training, or as interest relief. The resources of the fund could be built up by contributions by operating entities in industrialised countries, manufacturers of equipment, systems houses and users with an interest in providing such facilities. These entities might undertake to contribute by annual instalments over a period of, say, ten years. The fund could operate by advancing loans to developing countries for specific projects in the telecommunication sector. Repayment of these loans would replenish the resources of the fund. By this means, development assistance could continue in the long term.

b) **Telecommunications investment trusts** could be created for individual developing countries or groups of countries, along the lines of the proposal recently put forward by the International Finance Corporation. The trusts could tap novel sources of funds for investment in telecommunications. For example, in some countries trust status would convey preferential tax treatment for investors. This would encourage manufacturers and others with surplus funds to advance loans to the trusts on favourable terms. The trusts might also be in a position to issue bonds direct to the

public. Matching these hard currency resources, the trusts might issue equity in local currency in order to minimise the burden to developing countries of interest payments in foreign exchange.

36 In future years a need may arise to ensure that such increased activity in the telecommunications sector is properly coordinated. We have examined a proposal for establishing in the longer term an organisation to coordinate the development of telecommunications world wide (WORLDTEL). Such an organisation could initially be intergovernmental in character and in time run on a commercial basis. Its functions could include managing specific development projects in the telecommunications field and administering necessary finance.

37 **WE RECOMMEND** that, in the light of progress made on our other recommendations, the Secretary-General of the ITU study the proposal for a more coordinated approach initially at intergovernmental level and submit his conclusions to the Plenipotentiary Conference.

38 Finally, since it is essential that the momentum which we hope will be generated by our Report be sustained,

WE RECOMMEND that the Secretary-General of the ITU monitor the implementation of all the preceding recommendations in this Chapter, report on progress to the annual meeting of the Administrative Council of the ITU and, where necessary, act to stimulate further progress.

CHAPTER 10

CONCLUSIONS AND SUMMARY OF RECOMMENDATIONS

1 The considerations on which we have based the response to our Mandate have been the subject of previous chapters. In this chapter we set out the conclusions we have drawn.

2 The telecommunications situation across the world has certain notable characteristics. Advanced industrialised societies have virtually comprehensive services. In developing countries, services are mainly concentrated in urban centres. Continuing technological advances offer ever increasing efficiency, reliability, and lower unit costs. The level of investment in telecommunications in developing countries is generally low. With certain notable exceptions, telecommunications services in many developing countries are poor or indifferent. In many remote areas there is no service at all.

3 Given the vital role telecommunications play not only in such obvious fields as emergency, health and other social services, administration and commerce, but also in stimulating economic growth and enhancing the quality of life, creating effective networks world wide will bring immense benefits. An increase in international traffic will generate funds which could be devoted to the further improvement and development of telecommunications services. The increased flow of trade and information will contribute to better international relationships. The process of creating effective networks world wide will provide new markets for the high technology and other industries, some of which are already suffering the effects of surplus productive capacity. The interest industrialised and developing countries share in the world-wide development of telecommunications is as great as in the exploitation of new sources of energy. And yet it is far less appreciated.

4 We look to governments of industrialised and developing countries alike to give fuller recognition to this common interest and to join their efforts to redress the present imbalance in the distribution of telecommunications which the entire international community should deplore.

5 We have identified several key elements in the joint effort for which we appeal.

- First, governments and development assistance agencies must give a higher priority than hitherto to investment in telecommunications.

- Secondly, existing networks in developing countries should be made more effective, with commercial viability the objective, and should become progressively self-reliant. The benefits of the new technologies should be exploited to the full to the extent that these are appropriate and adaptable to the countries' requirements.

- Thirdly, financing arrangements must take account of the scarcity of foreign exchange in many developing countries.

- Fourthly, the ITU should play a more effective role.

6 Our recommendations reflect this analysis of the problem and are aimed at stimulating the actions we consider essential if progress is to be made in creating effective telecommunications networks world wide.

7 First, to ensure that telecommunications are given the priority we believe they deserve, WE RECOMMEND that

a) developing countries review their development plans to ensure that sufficient priority is given to investment in telecommunications (Chapter 9, paragraph 9);

b) developing countries make appropriate provision for telecommunications in all projects for economic or social advance and include in their submissions a checklist showing that such provision is being made (Chapter 9, paragraph 10);

c) countries and international agencies with development assistance programmes ensure that specific provision is made for appropriate telecommunications facilities in development assistance projects (Chapter 9, paragraph 21);

d) contributors to and beneficiaries of the UNDP reconsider the importance they attach to the telecommunications sector, and provide appropriate resources for its growth (Chapter 3, paragraph 12).

In addition to these specific recommendations, WE APPEAL to the governments participating in the next Economic Summit to give encouragement to practical measures to improve and expand telecommunications (Chapter 9, paragraph 23).

8 Secondly, to make existing networks in developing countries more effective and progressively self-reliant and to exploit the benefits of the new technologies, WE RECOMMEND that

a) telecommunications operators in developing countries review their training needs and resources, and prepare systematic training plans (Chapter 6, paragraph 18);

b) developing countries use the resources available through the IPDC (Chapter 6, paragraph 19);

c) industrialised countries organise seminars to improve the qualifications of experts from developing countries (Chapter 6, paragraph 20);

d) the ITU supplement the catalogue of training opportunities with information about training opportunities in the private sector (Chapter 6, paragraph 22);

e) operators and manufacturers consider how they can enhance the training opportunities they offer to developing countries (Chapter 6, paragraph 23);

f) the major regional and sub-regional political and economic organisations consider as soon as possible how best research and development institutes might be established (Chapter 7, paragraph 15);

g) the research and development institutes proposed be developed as a source of higher technological, supervisory and managerial training and as coordinating agencies for external training opportunities (Chapter 6, paragraph 21);

h) developing countries consider pooling their purchases of appropriate equipment including terminals and components (Chapter 5, paragraph 24);

i) when purchasing equipment, developing countries ensure that the contract includes commitments on the supply of spare parts, training, commissioning, post-installation and maintenance (Chapter 5, paragraph 25);

j) manufacturers and operators be encouraged to develop systems which will enable the needs of the more remote areas of developing countries to be met at lower cost (Chapter 4, paragraph 30);

k) the ITU, in conjunction with manufacturers of telecommunications equipment and components, consider compiling a comprehensive catalogue of telecommunications suppliers and systems currently in use (Chapter 4, paragraph 33);

l) developing countries review the possibilities for local or regional manufacture (Chapter 7, paragraph 22);

m) manufacturers in industrialised countries consider the scope for cooperation with developing countries in local or regional manufacture (Chapter 7, paragraph 23).

9 As an immediate step to improve the present arrangements for assisting developing countries WE RECOMMEND that;

a Centre for Telecommunications Development, with its three components of a Development Policy Unit, a Telecommunications Development Service and an Operations Support Group, be established by the Administrative Council of the ITU during 1985 (Chapter 8, paragraph 4).

WE INVITE the Secretary-General of the ITU to carry out the necessary consultations so that the Centre can be established as soon as possible in the course of 1985 (Chapter 8, paragraph 15).

10 Thirdly, to finance the development of telecommunications WE RECOMMEND that

- a) countries and international agencies with development assistance programmes give higher priority to telecommunications (Chapter 9, paragraph 20);
- b) those who provide international satellite systems study urgently the feasibility of establishing funds to finance earth segment and terrestrial facilities in developing countries (Chapter 9, paragraph 22);
- c) industrialised countries extend export/import financing and insurance cover to suppliers of telecommunications equipment (Chapter 9, paragraph 25);
- d) the IBRD consider including telecommunications in its proposal for multilateral guarantees against non-commercial risks (Chapter 9, paragraph 26);
- e) where projects are financed in part by IBRD loans, finance agencies consider cross-default arrangements as a form of insurance (Chapter 9, paragraph 27);
- f) member states of the ITU consider setting aside a small proportion of revenues from calls between developing countries and industrialised countries to be devoted to telecommunications in developing countries, for example to fund pre-investment costs (Chapter 9, paragraph 30).

With the longer term in view, WE ALSO RECOMMEND that

- g) governments of industrialised countries review their financing instruments and institutions to ensure that they can meet the financing requirements of extending telecommunications networks in developing countries (Chapter 9, paragraph 32);
- h) member states of the ITU, in collaboration with international finance agencies, study the proposals for a revolving fund and for telecommunications investment trusts as methods of raising funds for investment in telecommunications with a view to putting these into effect by the next Plenipotentiary Conference at the latest. The Secretary-General is invited to report to the Plenipotentiary Conference on the progress made with these studies (Chapter 9, paragraph 35);
- i) the Secretary-General of the ITU, in the light of progress on our other recommendations, study the proposal for an organisation to coordinate the development of telecommunications world wide (WORLDTEL) and submit his conclusions to the Plenipotentiary Conference (Chapter 9, paragraph 37).

11 Fourthly, to strengthen the role of the ITU, WE RECOMMEND that;

all international organisations concerned with telecommunications give more favourable consideration than hitherto to assistance for the expansion of telecommunications world wide and that regional cooperation be accorded a high priority (Chapter 3, paragraph 13).

12 Finally, WE RECOMMEND that;

the Secretary-General of the ITU monitor the implementation of all the preceding recommendations, report on progress to the Administrative Council and, where necessary, act to stimulate further progress.

13 Our analysis of the problems and the recommendations we have made show that there is no single remedy. A range of actions over a wide front and at different levels is required. Progress will be made only in stages. But, if the effort is sustained, the situation world wide could be transformed in twenty years. All mankind could be brought within easy reach of a telephone by the early part of next century and our objective achieved.

Appendix 1

RESOLUTION No. 20 OF THE PLENIPOTENTIARY CONFERENCE OF THE ITU
(Nairobi, 1982)

The Plenipotentiary Conference of the International
Telecommunication Union (Nairobi, 1982),

recognizing the fundamental importance of communications
infrastructures as an essential element in the economic and
social development of all countries as recalled by United
Nations General Assembly Resolution 36/40;

convinced that the proclamation of 1983 as "World
Communications Year: Development of Communications
Infrastructures" provides the opportunity for all countries to
undertake a comprehensive review and analysis of their policies
on communications development and stimulate the development of
telecommunications infrastructures;

recalling the significant contribution made by the
Independent Brandt Commission on International Development
Questions to the dialogue on world economic issues;

noting the broad consensus of the International Commission
for the Study of Communication Problems (the McBride
Commission) on the common interest in accelerated development
of telecommunications infrastructures;

noting with concern that notwithstanding the importance of
communications and information transfer dependent on
telecommunications infrastructure for social, economic and
cultural development, a relatively low level of resources has
so far been allocated to telecommunications development by
international aid and investment organisations;

resolves

1. that an International Commission for World-Wide
Telecommunications Development shall be established;
2. that this Commission shall be completely independent and
constituted of members of the highest international reputation
serving on a voluntary basis;
3. that the expenses of the Commission shall
be financed from independent non-commercial sources;

instructs the Secretary-General

1. after prior consultation and in cooperation with Member governments to propose a list of 15 to 20 representatives of the highest decision-makers from administrations, operating agencies, and industry in the developing and developed countries as well as the major financial institutions (including the development banks and the UNDP) and other appropriate entities, also seeking as good a representation of all the regions of the world as possible;
2. to report on the action taken to the 1983 session of the Administrative Council;

instructs the Administrative Council

1. to consider the report of the Secretary-General and to take action to constitute the Commission as well as any steps it considers necessary to enable the Commission to discharge its functions;
2. to transmit to the Commission the following mandate:
 - 2.1 to examine the totality of existing and possible future relationships between countries in the field of telecommunications involving technical cooperation and a transfer of resources in order to identify the most successful methods of such transfer;
 - 2.2 to recommend a range of methods including novel ones for stimulating telecommunication development in the developing world using appropriate and proven technologies in ways which:
 - a) serve the mutual interests of governments, operating companies, the public and specialized user groups in the developing world and of the public and private sectors in the developed countries; and
 - b) lead to progressive achievement of self-reliance in the developing world and the narrowing of the gap between the developing and developed countries;
 - 2.3 to consider the most cost-effective way in which the Union could stimulate and support the range of activities that might be necessary to achieve a more balanced expansion of telecommunication networks;
 - 2.4 to complete its work in about a year's time;
 - 2.5 to submit its report to the ITU Secretary-General.

resolves further

that the Administrative Council review the report and, as far as matters necessitating action by the Union are concerned, initiate any action that it considers appropriate.

RESOLUTION No. 900 OF THE ADMINISTRATIVE COUNCIL OF THE ITU
(Geneva, May, 1983)

INDEPENDENT INTERNATIONAL COMMISSION FOR WORLD-WIDE
TELECOMMUNICATIONS DEVELOPMENT

The Administrative Council,

recalling Resolution No. 20 of the Plenipotentiary
Conference of Nairobi (1982);

having considered the Report of the Secretary-General on
the action taken in accordance with the provisions of the said
Resolution;

resolves

1. that the Independent International Commission for World-
Wide Telecommunications Development be consistuted with the
following membership :

Mr. Abdul Rahman K. AL GHUNAIM (Kuwait);

Professor Sukhamoy CHAKRAVARTY (India);

Mr. William M. ELLINGHAUS (United States);

Dr. Koji KOBAYASHI (Japan);

Dr. V. KOEHLER (Federal Republic of Germany);

Mr. Louis-Joseph LIBOIS (France);

Sir Donald MAITLAND, GCMG, OBE (United Kingdom);

His Excellency Mr. J.S. MALECELA (Tanzania);

Mr. PEREZ GUERRERO (Venezuala);

His Excellency Mr. Jean PING (Gabon);

His Excellency Mr. Alioune SENE (Senegal);

Professor Dr. Allexandru SPATARU (Romania);

His Excellency Mr. Achmad TAHIR (Indonesia);

His Excellency Mr. Armando VARGAS ARAYA (Costa Rica);

His Excellency Mr. Faisal ZAIDAN (Saudi Arabia);

His Excellency Mr. Mohand LAENSER (Morocco);

Professor Dr. Leonid E. VARAKIN (USSR);

2. that the following broad mandate be transmitted to the Commission:

2.1 to examine the totality of existing and possible future relationships between countries in the field of telecommunications involving technical cooperation and a transfer of resources in order to identify the most successful methods of such transfer;

2.2 to recommend a range of methods including novel ones for stimulating telecommunication development in the developing world using appropriate and proven technologies in ways which:

a) serve the mutual interest of governments, operating companies, the public and specialized user groups in the developing world and of the public and private sector in the developed countries; and

b) lead to progressive achievement of self-reliance in the developing world and the narrowing of the gap between the developing and developed countries;

2.3 to consider the most cost-effective way in which the Union could stimulate and support the range of activities that might be necessary to achieve a more balanced expansion of telecommunication networks;

2.4 to complete its work in about a year's time;

2.5 to submit its report to the ITU Secretary-General;

3. that the Commission at its first meeting appoint its Chairman and arrange its work programme to fulfil its mandate;

instructs the Secretary-General

1. to provide from within the limits of resources available every assistance to enable the Commission to fulfil its mandate;

2. to continue his endeavours to raise resources for financing the Commission in accordance with Resolution No. 20 of the Nairobi Plenipotentiary Conference;

3. to circulate the Report of the Commission when received, to all administrations for their comments, if any, so as to assist the Council in reviewing the Report.

Appendix II

COMMENTS AND SUGGESTIONS ON THE COMMISSION'S TASK

As stated in the Preface the Commission was helped immeasurably by contributions by individual Members of the Commission and by the responses to letters inviting comments on its task. The following are extracts from some of these responses:

THE ROLE OF TELECOMMUNICATIONS

Office of the Secretary, DEPARTMENT OF COMMUNICATIONS,
AUSTRALIA, July 1984

From its own experience, Australia is aware of the value of good quality communications facilities for successful development. Most of Australia's export income is from products which have been developed in its more remote areas. In earlier years those products were almost entirely agricultural in nature and the extent of that agricultural development was clearly assisted by the provision of good quality communications.

In more recent times Australian resource developments have been concentrated in the minerals area. Revenue from mineral exports has now moved into strong competition with agriculture. Many of Australia's mineral developments are located well away from centres of population and, in some ways, the communications problems which have had to be solved to give those projects good quality services have been the spur which has led to innovation.

The link between telecommunications development and economic development is also obvious today in a developed country such as Australia, where capital expenditure on development of telecommunications infrastructure can create employment opportunity, both directly, in the telecommunications sector public authorities, and indirectly, in the private sector, through significant industry flow-on effects in traditional and high technology industries.

MINISTER OF POST OFFICE AND TELECOMMUNICATIONS, WESTERN
SAMOA, April 1984

The growth of trade and industry is necessary for raising the standard of living of the people. The progress of this growth is linked with better and increased communication facilities.

Fundamentally, telecommunications is recognised as providing a major supporting role to the social and economic development of Western Samoa. It must also eventually evolve to become a catalyst to social and economic development. A reliable and cost effective telecommunications system can help to support other infrastructural development projects in the rural areas of the country such as roads, power, water, to improve public services, such as health and education and to speed up agricultural production and marketing, information flow and business transactions.

Director General, INTERSPUTNIK, USSR, February 1984

Contemporary development of telecommunication is important and at present telecommunications facilities in its development are based on modern basis of latest achievements in the field of electronic technology.

The role of telecommunication in the economic and social development is great. The modern society, nation and its national economy cannot be developed harmoniously and progressively without sufficient and reliable communication links.

Member of the Board, NIXDORF COMPUTER AG, FEDERAL REPUBLIC OF GERMANY, March 1984

Telecommunications is of almost unassessable value for business prosperity. In fact, once telecommunication is available to companies or countries, competing without this tool in its most powerful yet still affordable form is almost totally in vain. Telecommunications is equally important in forming, implementing and administering economic policy. Any lack of telecommunication facilities in this area can have very detrimental effects on the efforts of the business community.

Although telecommunications play a role in social development probably beyond what is known today, we feel that hardly ever has anything been introduced with such powerful wanted effects and so few unwanted side-effects.

Director of Telecommunications, TELECOMMUNICATIONS DEPARTMENT, SRI LANKA, March 1984

Modern telecommunications, providing efficient service continuously adapting and growing to meet the requirements of the economy, have been accepted as an essential infrastructure for accelerated economic development. Increasingly they are amongst the first priorities interested investors consider when assessing potentially new operating Sites/Zones. The increasing cost of energy and resultant effect on transport cost also entails growing importance of good telecommunications. This is supported by the SLTD's

investment programme which is appreciably larger than the programme undertaken in the past in terms of both investment and physical installations.

Director General, Telecommunications Policy Bureau, MINISTRY OF COMMUNICATIONS, REPUBLIC OF KOREA, February 1984

Communications facilities in Korea significantly contributed to economic and social development thanks to the successful implementation of the Four Consecutive Five-Year Communication Development Plans which started in 1962 as part of the national economic development plans.

It is believed that the development of rural telecommunication facilities stimulated the national economic development indirectly by the vivid exchange of information and commercial transmission between urban and rural areas. Isolated villagers who have emergency cases or patients with urgent problems can make immediate connection with relevant organisations through the communications facilities. This improves the well-being as well as community relationships for remote area villagers.

President, AT&T INTERNATIONAL, USA, March 1984

Telecommunications infrastructures in many developing countries are concentrated heavily in urban areas, with rural areas having minimal capabilities. Many of these countries are even now experiencing the early throes of the change from an agrarian economy to one which is being influenced by the industrial revolution. A major portion of the labour force in these countries is still in the agricultural sector. Following the pattern of economic development in the industrial countries, the labour force will have to increasingly move into non-agricultural sectors. Technology, and very importantly, telecommunications technology has played and will play an important role in this shift of labour, and hence, in the pace and level of economic development. It is becoming increasingly important that as each country develops its industrial structure, concentration of industries in urban areas be avoided. Ireland and India are two examples where this is being done by setting up industrial estates away from cities. Here again, telecommunications technology can be a crucial facilitator.

MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO, February 1984

Internally, the telecommunication networks of developing countries continue to suffer from their low place in the pecking order under government programmes. The telephone is still regarded as a luxury in many respects and hardly as a working tool for certain bodies, mainly administrations. Even when senior officials are made to realise that the lack of a telecommunication infrastructure hampers projects

promoting economic and social development; this conviction remains limited to narrow circles. In the case of Morocco, however, a much more general awareness is emerging, in the form of pressure from potential users and local communities, which go as far as to finance projects instead of waiting for the PTT Administration to act. It would therefore seem that information concerning the role of telecommunications and their impact on economic and social development is useful and should be pursued at all levels.

THE SITUATION TODAY

Secretary General, PAN AFRICAN TELECOMMUNICATIONS UNION,
March 1984

Inside individual countries there is also a serious imbalance between the major towns, where the administrative services as well as the secondary and tertiary sectors are located, and the generally agricultural non-urban areas. According to a recent ITU survey, the comparative telephone penetration index shows that the difference between these two sectors of the population ranges from 10 to 100 depending on the country.

A number of reasons have been identified as contributing more or less directly to this situation :

- a) inadequate financial resources, particularly foreign exchange, imposing severe constraints on self-financing capacity and increasing dependence on outside sources of funding;
- b) prohibitive costs of imported equipment and material, reducing the purchasing power of the African administrations' budgets and, as a result, the rate of network growth and modernisation;
- c) very limited choice of types of equipment and technology. The choice is often confined to the country or countries providing the financial assistance, thus making it extremely difficult to plan telecommunication development, particularly with regard to the introduction of digital technologies in African countries' networks;
- d) non-standardised equipment and procedures due partly to the exogenous nature of the equipment, making both interface and operation of the regional network highly complex. The first standardisation exercise resulted in the adoption of the PANAFTTEL R2 signalling code based on the CCITT multifrequency Signalling System R2;
- e) spare-part supply difficulties. European suppliers do not for the most part abide by the terms of their contracts relating to the supply of components and sub-units needed for maintenance and repair over specific periods. They thus lead

administrations to make changes in technology that is highly sophisticated and sometimes still in the process of development;

f) inadequate local training capacity, which is above all unable to keep up with the rapid rate of technological change.

Director General of Posts and Telecommunications, DEPARTMENT OF TOURISM, POSTS AND TELECOMMUNICATIONS, REPUBLIC OF INDONESIA, February 1984

There is a huge gap between supply and demand for all services; the need is even higher including new services. In the cities the waiting lists are exceptionally long, whereby the waiting time is frequently more than one year. The rural is literally unserved.

Executive Director, ASIA PACIFIC TELECOMMUNITY, THAILAND, June 1984

It is also well known that relative demand of the telecommunication sector in developing countries is under provisioned even in urban areas in spite of large unsatisfied demands, high rate of return, falling unit cost and use by a wide spectrum of population. This situation is the result of inadequate resources made available for telecommunication infrastructure in developing countries, disregarding the market signals.

The need for improving the quality of service in the existing national networks of most of the developing countries has a very high priority. For various reasons this aspect got neglected while networks continued to grow and quality of service continued to decline.

The reason for the relatively low level of investment in the telecommunication sectors in many developing countries is not lack of demand for telecommunication services; throughout the developing world the unsatisfied demand for telephone lines far exceeds supply, and it is not unusual for registered un-met service applications to exceed the number of existing telephone lines. New applications frequently wait from two to five years to obtain services, and sometimes even more. In these situations, a large proportion of the potential demand for telecommunication services remains unrecorded and emerges only as the system is perceived to be expanding rapidly.

MINISTER OF POSTS, TELEGRAPHS AND TELEPHONES, KINGDOM OF SAUDI ARABIA, June 1984

Less beneficial can be the "systems" approach offered by manufacturers to a country suffering from a lack of expertise in the telecoms field. In such cases a requirement may be

well identified by a prospective client authority but it may not have the in-house capability to produce detailed specifications of the desired system. Subsequently, manufacturers may offer "turnkey" installations which may, in reality, not provide the client with the most suitable equipment and systems. Such situations offer ideal circumstances for the "dumping" of older "off-the-shelf" equipment, rather than the provision of the latest product lines, which a more versed customer would be identifying. In this context the role of the manufacturer leaves something to be desired.

**MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO,
February 1984**

Mention should be made of the choice of technologies. At the present time the administrations of the developing countries are buyers on the international market, basing their selection on various technical and financial criteria. To take the financial aspect first, when financing is made available, the rules of borrowing have to be obeyed. Where international agencies are concerned (e.g. the World Bank), a type of equipment has to be chosen at each consultation from a range of competing types, bearing in mind the effects of this variety of equipments on training and maintenance. If the financing is bilateral, a country and a type of equipment is chosen, but this too may entail risks since facilities are offered with a view to promoting exports. Apart from the market uncertainties involved in this procedure, it can also result in technically dubious choices.

President, NOKIA ELECTRONICS, FINLAND, February 1984

New technology offers the developing countries many novel and economic alternatives to construct and improve their telecommunications network. On the other hand, more complex systems tend to increase the dependence on the supplier and make the maintenance more intricate in developing countries. These factors threaten to increase the discrepancy of know-how between developed and developing countries.

**MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO,
February 1984**

The telecommunications scene in Morocco may be summarised as follows :

- a network which is technologically adequate but is not geared to requirements;
- a relatively large unsatisfied demand;
- an apparently sound organisation and structure which nevertheless reveals a series of bottlenecks on analysis;

- a practically non-existent mastery of the technology;
- external relations which are essentially reduced to those between suppliers and purchasers.

Secretary General, UNION AFRICAINE DES POSTES ET TELECOMMUNICATIONS (UAPT) February 1984

A way can be found, however, to increase considerably the efficiency of existing installations, namely by improving their effective availability, currently deplorably low. From the telephone set and subscriber line right through to the switching and national and international transmission system, the availability rates are extremely low. There is little maintenance, the environment is difficult and staff are open to criticism with regard to management and implementation. Technical independence has not even been achieved at the level of operation.

THE TECHNOLOGY

Secretary of State, President of Posts and Telecommunications, CENTRAL ADMINISTRATION OF POSTS AND TELECOMMUNICATIONS, HUNGARY, February 1984

It is well-known from the technical literature that the use of modern techniques enables telecommunications to make a great leap, i.e. the countries where the basic wire telecommunication network has not yet been implemented can have equivalent telecommunications means by use of satellites or small cellular radiotelephone systems. One of the essential forms of assistance for the developed countries might be the improvement of the modern radiocommunications technologies in such a direction, taking account of the above aspects.

Head of International Affairs, Telecommunications Directorate General, MINISTRY OF POSTS AND TELECOMMUNICATIONS, FRANCE, March 1984

Thanks to the work done by the International Consultative Committees in the fields of standardisation and innovation, modern and competitive equipment is now available, and the cost of acquiring, maintaining and operating it is constantly decreasing. Such equipment is designed from the outset for the world market. Administrations could assist developing countries by encouraging the manufacture of equipment geared to the specific needs of those countries' networks and environment, particularly in the areas of rural telecommunications and energy.

**MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO,
February 1984**

With regard to the technical aspect of the choice of equipment, the limited freedom of the purchasers must be borne in mind. They have to choose between equipments essentially developed by the industrialised countries to meet their own requirements. An example of this is the case of electronic exchanges, judged according to the wide range of services offered, many of which will not be needed by future subscribers.

**Permanent Secretary for Posts and Telecommunications,
DEPARTMENT OF POSTS AND TELECOMMUNICATIONS, FIJI, February
1984**

With the rapid changes in equipment that take place today, it becomes very difficult for small administrations to standardise on equipment types which increases their costs in spares and training and thus slows down development. Generally speaking manufacturers develop equipment for the mass market and this does not always meet the rather special needs of the small developing countries.

**Permanent Secretary, MINISTRY OF INFORMATION AND CULTURE,
BARBADOS, March 1984**

Manufacturers as well as operators must meet the requirements of the market, either by anticipation or by reaction, but either way they play an important role in telecommunications development.

Frequently, there is collaboration between the manufacturers and the operating companies in developing equipment to meet identified needs. Probably the most outstanding example of this is INTELSAT and the equipment manufacturers they use.

Lacking a local manufacturer in telecommunications equipment, all equipment used locally is imported from developed countries.

As the manufacturers are based in developed countries, their products are usually developed and dimensioned to meet the needs of their large national operating companies. Consequently, developing countries frequently find themselves having to purchase equipment whose size, power, sophistication and cost are greater than that which would reasonably represent their needs.

Director, International Affairs Bureau, NIPPON TELEGRAPH AND TELEPHONE PUBLIC CORPORATION, JAPAN, March 1984

Telecommunications needs of developing countries vary widely from those with large/medium sized cities with relatively concentrated needs to those with sparsely populated rural districts where needs are scattered over extensive areas, and each presents distinct telecommunications requirements and issues.

If we classify these varying needs roughly into two broad categories of urban and rural districts, suitable technologies would be summarised as follows :

a) Large/medium-sized city type... As in the case of developed nations, the most advanced systems designed to meet large-capacity, high speed and high reliability requirements are necessary.

b) Rural district type... Such factors as unique features of local economy, society and life style must be taken into consideration. Compared with the urban area, common characteristics of rural districts are decentralisation of users and low traffic, which, in turn, result in higher costs than urban areas. Therefore, it is vitally important to seek cost reductions through various technological approaches including response to small-sized needs, simplification of basic functions, and pursuit of easy operability/maintainability.

Keeping these in mind, the most appropriate kinds of technology should be explored according to the particular conditions of each city and area.

Under-Secretary, MINISTRY OF COMMUNICATIONS, STATE OF KUWAIT, January 1984

Kuwait has opted to adopt the most up-to-date and modern technology in its path to telecommunication development and found this a most satisfying method.

The latest and up-to-date technology increases the need for a few well-trained specialists and permits a large number of staff with lesser qualifications to carry on routine work. This is quite suitable for a developing country like Kuwait.

Chairman, PLESSEY TELECOMMUNICATIONS (INTERNATIONAL) LIMITED, UNITED KINGDOM, February 1984

Telecommunications development on a worldwide basis is now progressing at a very considerable pace and; it may be argued, in quite distinct steps : the 1960's was the decade for the widespread implementation of analogue microwave radio for backbone networks, and the decade of the 1970's was dedicated to the implementation of stored programme control

switching equipment for urban areas. The decade of the 1980's will be characterised by the introduction of digital switching and transmission equipment, and that of the 1990's by the introduction of integrated services digital networks (ISDN).

MINISTER OF POSTS, TELEGRAPHS AND TELEPHONES, KINGDOM OF SAUDI ARABIA, June 1984

Digital technology has now made its advance into the field of telecommunications, with the present state-of-the-art installations of all-digital switching/transmission clusters taking over from analogue systems. Amongst the benefits to be reaped from the digital advances have been overall financial gains stemming from : reduced equipment size, elimination of multiplex, consequent reductions in building requirements (overall size, land, power, extensions etc.), improved performance and grade of service, and also increased growth flexibility.

President, AEI TELECOMMUNICATIONS (CANADA) LIMITED, February 1984

I have heard it said that advanced electromechanical systems such as crossbar are appropriate to developing countries because (a) they employ more labour and (b) they are easier to maintain with the level of education available. I do not believe this. The newest and latest is appropriate, depending only on the ability to diagnose the faulty area of trouble; usually which PCB to replace, just like our TV repair man. I do not believe we should under-rate the technicians in these countries. Our own experience shows that with appropriate training they can handle the job very well.

Senior Vice President, NORTHERN TELECOM LTD, CANADA, April 1984

The less-developed nations should install digital plant on as complete a basis as possible. They should avoid making telecommunications procurement decisions on a purely first-cost basis, because to do so in today's environment of rapid introduction of wholly-digital systems would guarantee being locked into a situation of poor performance and early obsolescence. The advent of the digital world provides an opportunity for emerging nations to install new telecommunications systems that are both customised to their present needs, and upwardly-compatible for the future.

President, TELEFONAKTIEBOLAGET L M ERICSSON, SWEDEN, March 1984

Following the general trend within telecommunications, the most appropriate technology for telecommunications development in the developing world is digital SPC switching systems and digital transmission systems. By integration of digital SPC switching and transmission systems it is possible to realise the most economical long term solutions to all types of integrated telecommunication networks, rural, metropolitan, national long-distance, as well as international networks.

MINISTER OF TRANSPORTATION AND COMMUNICATIONS, REPUBLIC OF THE PHILIPPINES, April 1984

For the future, all development and planned projects for telecommunications will employ digital technology, based on European standards. The program will seriously consider the use of fibre optics, as recommended in the 20-year telecommunications master plan, prepared jointly by the government, with the assistance of local and foreign consultants and in coordination with ITU experts.

Chairman, HUGHES AIRCRAFT COMPANY, USA, June 1984

Although satellite communications have proven to be cost competitive with established domestic terrestrial systems, the most dramatic benefits are realised in the absence of extensive terrestrial networks. This makes them particularly attractive for developing countries who wish to expand their internal communications rapidly and in the cost-effective way. Examples include Indonesia, Australia and Brazil, all of whom have chosen to solve their long-distance communication needs by satellite. Leased service from Intelsat has frequently been chosen as a short-term solution to developing country communication needs.

Director General of Posts and Telecommunications, DEPARTMENT OF TOURISM, POSTS AND TELECOMMUNICATIONS, REPUBLIC OF INDONESIA, August 1984

New technologies are increasingly adaptive for rural applications, due to the reduced power consumption, increased reliability and easier maintenance. Optical fibre cable systems are also increasingly competitive with satellite systems, even for bridging long distances due to the big capacity (high bit rate capability) and the very long spans without resorting to a regenerative repeater. All islands in Indonesia can be optically interconnected cost effectively.

Some shift in traffic loading is anticipated, leaving the satellite to carry thin route type traffic but with a very large geographical coverage or for broadcasting

purposes, while point-to-point heavy traffic will opt for optical fibre cable and, in the long term, cable is thought to provide redundancy.

President, AT&T AND PHILIPS TELECOMMUNICATIONS BV, THE NETHERLANDS, February 1984

In the rural areas we would recommend the idea of basic need telephony and to install, as a general guideline, community telephones in the population centres since private telephones may be prohibitively expensive. The community telephones would be generally far apart and are therefore most economically connected by means of radio telephony equipment.

Executive Director, ASIA-PACIFIC TELECOMMUNITY, THAILAND, June 1984

Introduction of latest technology in developing countries should be approached with due caution. It is desirable that only proven technologies are introduced in programme stages with due regard for parallel development of manpower resources required, minimum penalty in modifying the equipments, and minimum expenditure involved in the interface during coexistence of old and new systems.

Director General, DEPARTMENT OF TELECOMMUNICATIONS, MALAYSIA, March 1984

Many developing countries often cannot afford to upgrade their networks with more modern equipment where there is still much demand for basic services to be satisfied.

INTERNAL ORGANISATION AND MANAGEMENT OF TELECOMMUNICATIONS

MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO, February 1984

The other obstacle encountered internally is the unsuitability of the organisation and structures. Despite the specialised nature of its activities, the PTT Administration is still run like a traditional administration, or even a social service. The idea of economic return is not stressed and the concept of "real prices" or even the recovery of the cost of services is often absent. State services do not pay or only partly cover the cost of their facilities, which prevents them from exercising any control over the use made of their equipments and does not encourage them to limit their demand, to the detriment of economic sectors. The accounting and administrative regulations governing telecommunications departments are restrictive and often lead to a loss of income because a necessary item of expenditure has been cancelled or has not been authorised in

time. This lack of departmental autonomy can lead to paradoxical situations : a customer who proposes to pay for equipments to be installed for him may meet with a refusal because the administration is unaccustomed to the procedure he proposes. In the case of Morocco, these circumstances have caused activities to be assigned to a public enterprise with legal personality and financial autonomy, conducting its business in accordance with commercial accounting practice. This will certainly not serve to eliminate all bottlenecks, but it can at least reduce them.

Chairman, BELL CANADA INTERNATIONAL INC., March 1984

These values must be translated into corporate, divisional and individual objectives. Each individual and each part of the organisation must know their responsibilities and key interfaces. The coherence of these objectives must be ensured within an organisation both vertically and horizontally.

Plans for achieving these objectives must be laid out and take into account service and cost. Monitoring of actuals versus objectives through control and measurement systems is necessary.

Finally, evaluation and reward systems must be able to recognise individual contributions to the realisation of objectives.

This philosophy of management must be applied effectively in every aspect and every function of the organisation. It must become part of the culture.

The delivery of service in a cost-effective and efficient manner is dependent on the establishment of proven processes that interrelate the development of services, technology choices, customer demands, resource allocation and operational management, and the management of issues and people. The processes must also facilitate the creation of a system of management that leads people to deal with all those elements in a directed and self-correcting way.

President, ITT EUROPE INC., BELGIUM, February 1984

A further priority must be to ensure that the financing is organised from the outset to match the full extent of each telecommunications development programme. Otherwise, the episodic nature of project-by-project financing generally leads to the introduction of a variety of types of systems and equipment within a single country, simply aggravating the problems of training, operation and maintenance.

Chairman, BELL CANADA INTERNATIONAL INC., March 1984

Training, maintenance, the management of networks and planning cannot be looked at in isolation; they are part of a shared philosophy of management which results in all the employees of a telecommunications organisation striving for the goal of the best possible service, at the least possible cost, with equitable treatment of the employee and a fair return to the owner.

Chairman, NEC CORPORATION, JAPAN, March 1984

In consideration of the scarce financial resources available to the telecommunication sector in most developing countries, the importance of a high rate of operation over the installed telecommunication network cannot be overstressed if low returns are to be avoided. Reliable, high-quality telecommunication services should be identified as a goal to be realised through careful planning, construction and O&M (Operation and Maintenance) and pursued through the following strategic policies:

- 1) a well-harmonised overall planning programme;
- 2) successful execution of construction;
- 3) O&M performance enhancement;

The developed nations, where telecommunications infrastructures have been efficiently built up, offer an instructive example to developing countries. By taking account of their example, as well as, and especially by, referring to its own internal conditions, each developing nation may put these strategic policies into effect.

However, mechanically following the developed nations' example in respect of the above mentioned strategic policies remains insufficient to achieve the ultimate goal. Attention has also got to be paid to the morale and consciousness of employees in all areas, by recognising three strategic items:

- 4) promotion of a self-reliant attitude;
- 5) cultivation and fixing a sense of management responsibility;
- 6) international specialisation in technical cooperation activity.

President, ITT EUROPE Inc., BELGIUM, February 1984

An improvement in the management infrastructure is required to enable developing countries to take full advantage of the potential offered by telecommunications. More effective telecommunications planning in third world countries is required to enable them successfully to plan,

implement and procure systems that are in their own best interests. Since each country has different telecommunications problems and requirements, an appropriate telecommunications planning management infrastructure must be put in place. A great increase in educational and training programmes is therefore an important first step in this process, with direct assistance from technologically more advanced countries wherever necessary.

President, KOKUSAI DENSHIN DENWA CO LTD, JAPAN, April 1984

Through our experience in technical cooperation activities, establishment of long-term planning by means of collecting various managerial data and reliable traffic forecast is one of the most important abilities the developing countries presently lack.

Director, International Affairs Bureau, NIPPON TELEPHONE AND TELEGRAPH PUBLIC CORPORATION, JAPAN, March 1984

Development of long-range plans: for increasingly advanced and diversified telecommunications to be firmly rooted in the economy of developing countries it is vital to develop a well-coordinated consistent long-range plan, thereby providing clear directions for future development.

Deputy Chairman, TELEPHONE CABLES LTD, UNITED KINGDOM, February 1984

Based upon our own considerable experience, we have been extremely disturbed at the inability of some administrations in developing countries to obtain anything like the optimum value for money from large capital sums spent on telecommunication development. The problem has been due to the lack of management ability to plan and coordinate all the many aspects of a telecommunication expansion programme. Individual contracts are often awarded for various parts of the network which, in themselves, have been executed efficiently by the contractors involved, but due to certain key elements being incorrectly timed or overlooked altogether, plant and equipment has been installed which it has not been possible to utilise, and which has then been left for months or years with consequent growing deterioration. The potential end user then becomes frustrated and quite rightly is unable to understand why, after vast sums of money have been spent, he is unable to obtain the basic minimum of service.

MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO, February 1984

It is perfectly clear that these internal obstacles must be dismantled by the administrations themselves. This will help to improve the efficiency and performance of services

and increase the administrations' internal resources. But these reforms, though necessary, are not easy to carry out and will take time, during which the gap will widen still further, to the detriment of the developing countries. They will certainly require the assistance of other countries and of international organisations, whose action in this area may appear preferable, being more neutral and not involving large investments, and thus better suited to their role. The agency best fitted for this type of assistance is clearly the International Telecommunication Union (ITU).

**Director General, NORWEGIAN TELECOMMUNICATIONS
ADMINISTRATION, March 1984**

We know that the telecommunications administrations of industrialised nations have one thing in common, namely considerable resources of expertise in the different telecommunication fields. Therefore, we think that one of the most significant contributions these administrations can make to the development of telecommunications in the third world, is to find ways of conveying this expertise to their colleagues in developing countries.

TRAINING

**MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO,
February 1984**

Staff training is an important factor in efficiency, but can meet with a number of obstacles which restrict its scope. In many cases, it can become a mere formality required by the regulations, when the need for manpower in the operational services becomes pressing and has to be met as quickly as possible. In other cases, training remains theoretical for lack of the proper technological environment. That is why the Moroccan Administration prefers to continue to send its State engineers abroad for their training. Retraining is non-existent or rare, while the diversity of the equipments installed continues to increase.

**Director, International Affairs Bureau, NIPPON TELEGRAPH &
TELEPHONE PUBLIC CORPORATION, JAPAN, March 1984**

Developing countries usually suffer from shortages of both field engineers and senior engineers. Therefore, organisational readiness for self-reliant education/training programmes should be developed as soon as possible.

**Joint Wireless Adviser, MINISTRY OF COMMUNICATIONS, INDIA,
April 1984**

In the opinion of the Indian Administration, developing countries can provide training facilities to personnel from other developing countries at more economical cost and in an environment comparable or similar to that obtaining in the latter. This also offers opportunity to share ideas and experiences of different developing countries in finding practical solutions for problems which are peculiar to them.

The developed world, along with the sale/installation of equipment, should ensure training of the local staff. In some cases, especially the smaller developing countries, which may not be able to identify clearly their training needs in the new technology areas while finalising their purchase of such new equipment, it is desirable that ITU provides appropriate consultancy/advisory services in this regard.

**Director General, Telecommunications Policy Bureau, MINISTRY
OF COMMUNICATIONS, REPUBLIC OF KOREA, February 1984**

A telecommunications training center was set up with financial assistance from the ITU. This center provided towards the improvement of manpower quality for maintenance and operation of telecommunication facilities of Korea. The telecommunication training center also played a vital role in increasing the technical manpower for the private telecommunication industries as well as major members of the telecommunications development effort.

**MINISTER OF POST OFFICE AND TELECOMMUNICATIONS, WESTERN
SAMOA, April 1984**

There is an ever increasing demand for trained professional and technical manpower in Western Samoa. The Government has benefitted over the years through the provision of technical expertise under bilateral and multilateral arrangements. Most professional and technical training can only be acquired abroad and the cost of such training is rather high.

To meet the manpower demand in the telecommunication sector, a regional telecommunications training school has been established in Suva, Fiji to provide training at the technical level of telecommunication staff. The Training Project is funded by the United Nations Development Programme, with assistance from bilateral and other multilateral sources. The training programme is presently being reviewed with the intent of strengthening the same to meet manpower needs more effectively.

RESEARCH AND DEVELOPMENT AND LOCAL MANUFACTURE

**Secretary General, PAN AFRICAN TELECOMMUNICATIONS UNION,
March 1984**

As far as the future is concerned, it is becoming more and more obvious that the permanent solutions which must be found can only come from regional programmes covering among other things the creation of regional research and development and manufacturing capacity.

**Chief Engineer, Overseas Communications, PAKISTAN TELEGRAPH
AND TELEPHONE, February 1984**

A transfer of technology with a provision to charge reasonable patent fee for a certain specific period and no proprietary items imposed could, when combined with agreed local R&D effort, really benefit the developing countries. This approach would help the rapid expansion of telecommunication services in a country. The production capacity has of course to be economically viable, and of reasonable size, capable of competing with manufacturers from other countries to a reasonable extent. Some owners of technology remain shy when the question of transfer of technology is involved and charge a high price for their products, many times their possible production cost. Some others put such a price-tag on their technology which is highly excessive.

**Director General of Posts and Telecommunications, DEPARTMENT
OF TOURISM, POSTS AND TELECOMMUNICATIONS, REPUBLIC OF
INDONESIA, August 1984**

The goal of local manufacture is to achieve technological capabilities and to become the main support in the national telecommunications sector. Its role will gradually be increased through assembling and licensing on a progressive manufacturing plan. Indonesia cannot afford to directly embark on component manufacture, but prefers value-added processes for the first stages, in the form of integration of available components in the market to assemble local designed systems. Sub-assembly and sub-system manufacture is under way. The production process takes place at local factories.

**Under-Secretary, MINISTRY OF COMMUNICATIONS, STATE OF KUWAIT,
January 1984**

Kuwait Government encourages the setting up of industries locally. However, the volume of local demand does not adequately justify such industries. A regional approach may encourage local manufacture better.

Transfer of technology has to be negotiated with the company setting up the manufacturing plant or supplying equipment.

Secretary General, UNION AFRICAINE DES POSTES ET TELECOMMUNICATIONS (UAPT) February 1984

Equipment manufacturers are always ready to promote sales and installation whenever the necessary financing is available. They are less willing, however, to invest in activities which will reap returns only in the long term, but which are vital for the future of the countries concerned, and for their technical and economic independence. This independence is only obtainable through the gradual industrialisation of this sector of production which will for a long time yet remain the prerogative of the industrialised countries. A long-term strategy already tested with success elsewhere is to link local industrialisation in telecommunications to telecommunications development in general. To achieve this objective participation of telecommunication managers in the preparation, financing and implementation of industrial projects should be encouraged.

Director General of Posts and Telecommunications, DEPARTMENT OF TOURISM, POSTS AND TELECOMMUNICATIONS, REPUBLIC OF INDONESIA, August 1984

The national policy encourages local manufacture, including in the telecommunication sector, by creating a favourable atmosphere such as foreign investment and tax regulations. Recruitment and training of local staff however is an obligation of foreign investors in manufacturing. Consultant services are restricted to high technologies, or they are to be integrated in a joint effort with local companies.

After two decades of such policies, the role of local manufacture is still relatively small but increasingly significant.

The transfer of technology is a very long process, encountering problems, mainly due to the economic-political interests imposed by foreign partners. Such efforts normally involve intricate negotiations and bargaining.

Joint Wireless Adviser, MINISTRY OF COMMUNICATIONS, INDIA, April 1984

Developing countries are mainly dependent on import of equipment. This further aggravates their general problem of limited resources because of foreign exchange constraints. In any case, developing countries cannot depend entirely on imports for all time to come if network expansion at a fast pace and its continued and efficient operation have to be ensured. For these reasons and for progressive achievement

of self reliance by developing countries with all its attendant connotations, setting up of industries for indigenous manufacture of equipment is considered essential. It is also equally important to build up the capability for absorption of new and high level technology by promoting research and development activity.

President, AT&T INTERNATIONAL, USA, March 1984

Increasing importance of and advances in software.

Software advances will be the key to sustained growth in information products and services. Customised software will be used in conjunction with standard hardware to address specialised customer requirements. As packaged software becomes increasingly available, developing countries will have to consider communication systems which can run such software - since trained programmers often are a scarce indigenous resource. On the other hand, this trend can be relevant to some other developing countries such as India and Taiwan, who have been building up in-country programming skills and can focus on evolving a native software industry since software is not capital intensive.

MINISTER OF TRANSPORTATION AND COMMUNICATIONS, REPUBLIC OF THE PHILIPPINES, April 1984

Part of the 20-year telecommunications program of the country addresses the in-country manufacture of telecommunications equipment. This is intended to reduce the heavy dependence of the sector on the foreign market for equipment and materials. The tight economic situation, presently prevailing, demands this strategy in order that the foreign exchange outflow of a highly intensive capital investment sector may be reduced. The program has also addressed the issue for an integrated local electronics/telecommunications equipment manufacturing program, with a strong software component.

At present, a German-Filipino venture is starting to manufacture digital telephone switching equipment in the country. Two large local companies have the capability of manufacturing cables. There are also some export-oriented electronic companies, producing component parts. The program considers tapping these companies to support the local manufacture program for telecommunications equipment.

FINANCING THE DEVELOPMENT OF TELECOMMUNICATIONS

Manager, Project Analysis Department, INTER AMERICAN
DEVELOPMENT BANK, USA, January 1984

With regard to the application of the Bank's resources, cumulatively less than one per cent of its funds have been lent for telecommunications projects. There are a number of reasons for this low level of investment. First, the telecommunications sector is financially strong compared to other sectors in which the Bank lends its money. For example, schools and roads generate no direct income at all while a telecommunication project generates income and, if properly managed, usually profits as well. As a result, telecommunications projects are frequently financed by internally-generated funds and by commercial loans, while projects in the non-revenue-producing sectors are directed to the multilateral banks. In addition, the international telecommunications equipment market is highly competitive, and the suppliers frequently are willing to assist in obtaining financing. The governments of many of the countries where telecommunication equipment is manufactured are willing to provide financing, either bilaterally or through export banks, in order to foster the export of such equipment. The charter of the IDB prevents it from lending on projects for which adequate financing is available from other sources, and thus it is unable to participate in many projects. It should be mentioned however, that the Bank's investments in telecommunications have increased as our total lending volume has increased.

This brings us to one of the dilemmas of telecommunications in the developing countries. The sector, as previously mentioned, requires large, continuous, capital-intensive investments. If the country is too small to support domestic manufacture of the required equipment, and if it has balance of payments difficulties, investment in telecommunications will tend to make matters worse, since the purchases are made with foreign exchange and the revenue produced is in local currency. Large-scale reliance on foreign currency borrowing can be dangerous, especially in times of recession or when local inflation is excessive, placing a heavy burden on existing subscribers to cover the debt service. This particular problem, we believe, requires serious study leading to new solutions, and is fundamental to growth of the sector.

In many countries the international telecommunications services generate income in foreign exchange, and are highly profitable. The countries with foreign exchange problems should be encouraged to provide superior international service in order to maximize those revenues. They should facilitate international collect and credit-card calling so as to maximize foreign exchange earnings. These earnings can then be used to acquire telecommunication equipment.

With adequate tariffs, efficient management and well thought-out methods of capital mobilization, telecommunications systems in developing countries should be able to grow at very rapid rates without being a burden on the national treasury. The foreign exchange problem, in those countries where it exists, can be minimized by improving the international service and by selective foreign borrowing, including from the multi-lateral banks where that is possible. Other solutions to this particularly difficult problem are urgently needed.

Director of Posts and Telecommunications, DEPARTMENT OF TOURISM, POSTS AND TELECOMMUNICATIONS, REPUBLIC OF INDONESIA, August 1984

Telecommunications operations generally generate surpluses but, not being manufacturers of telecommunications equipment, developing countries must still raise foreign exchange to expand their networks. Notwithstanding the importance of telecommunications in supporting socio-economic development, (international) lending institutions are not found generous in spending loans to this sector.

Indonesia enjoyed World Bank loans, but the telecommunications sector was a low priority in their spending. (See also ITU/OECD Report). Lengthy procedures and the very limited funds available for this sector make developing countries seek other resources.

President, ITT EUROPE INC., BELGIUM, February 1984

The key issue is the provision of initial financing to a developing nation which enables it to obtain a telecommunications network and then provide adequate infrastructure to maintain that system. Once the system is in place and operating, it quickly becomes financially self-supporting, generating adequate resources for expansion and increased sophistication.

Office of the Director of Standards, IBM CORPORATION, USA, May 1984

It is our view that the single most important need in carrying out the work of the Commission and implementing any recommendation is an environment in which industry is encouraged by the developing countries to participate with them in all aspects of telecommunications development from the very initial requirements and planning stages through to actual implementation and evaluation.

This requires developing countries to create an environment which encourages private sector investments. This can be done by preventing or, if necessary, removing trade and manufacturing restrictions, and promoting import

activity. Such an environment will act as a strong motivation for industry participation and assistance in enhancing the development of telecommunications.

**Deputy Chairman, TELEPHONE CABLES LTD, UNITED KINGDOM,
February 1984**

The employment of internationally established operating companies to plan and execute an expansion programme is another alternative. The latter solution would also have the added advantage that such a company would ensure the correct standard of maintenance, certainly if it were also given the franchise for operating the network, even for a limited time. With a reasonably strong indigenous organisation, another possibility is to contract out to locally established major contractor groups the planning and execution of individual large sections of the network to be carried out to an overall central plan.

**Director General, DEPARTMENT OF TELECOMMUNICATIONS, MALAYSIA,
March 1984**

New financial mechanisms (e.g. a World Telecommunications Development Fund) would be necessary to enable the poorer developing countries to speed up the development of their telecommunications infrastructure. The terms of such financial aid may vary with the GDP of the recipients i.e. those countries which are stronger financially may be charged more.

OF GENERAL RELEVANCE TO OUR REPORT

Chairman, NEC CORPORATION, JAPAN, March 1984

In developing countries it is important to improve communications systems gradually, and to establish realistic and useful systems which can later be improved towards an ideal communications system. The systems must be adaptable to future changes in social structure, so that it is possible to expand communications systems as usable infrastructures for developing countries.

**MINISTER OF POSTS AND TELECOMMUNICATIONS, PEOPLE'S REPUBLIC
OF POLAND, March 1984**

The main objective of the assistance should be to help the developing countries achieve autonomy in the organisation, development, modernisation, operation and maintenance of telecommunication networks to enable the administrations to provide the services required under temporary and regional plans and plans for the development of

socially important services such as rural telecommunications, telecommunications relating to safety, and in the event of disasters, medical services, assistance for agriculture, etc.

**Chairman, PLESSEY TELECOMMUNICATIONS (INTERNATIONAL) LIMITED,
UNITED KINGDOM, February 1984**

Perhaps the greatest scope for the wasteful use of limited resources exists in the field of network planning and network management. Highly skilled network planners are in short supply even in the developed countries yet without the application of their skills there is the very real danger of wasteful deployment of the available equipment, and failure to exploit its full capability even after installed. Such shortcomings are not unknown even in the most developed countries. It is perhaps in this area that the scope for assistance to developing countries is greatest. A second area of training which will require further attention is in the field of software. Modern systems rely heavily on sophisticated software and its maintenance and upgrading is an intellectually difficult task. Where a reservoir of skills in software techniques is not available in a country it will not be an easy task to establish it quickly, and it may be that the only practical solution for the medium term is that this capability should be supplied from outside the recipient country.

**Executive Director, ASIA PACIFIC TELECOMMUNITY, THAILAND,
June 1984**

Governments in the region are urged to take appropriate political and economic decisions to accelerate the development of telecommunication infrastructure in rural areas in particular.

- 1) Review of rural service objectives to reflect latest facts on contribution of telecommunication to economic and social development.
- 2) Exclusive development of telecommunication in urban areas should be avoided.
- 3) Increased resources to be allocated to telecommunication sector and certain percentage of this outlay should be utilised for development of rural network.
- 4) In line with rural service objectives, minimum network coverage of rural areas should be obtained at the initial development stage.
- 5) Part of the profits from urban telecommunication network should be used to promote the development of rural networks. This amount should however be below a level that would hamper urban network development.

Secretary General, ARAB TELECOMMUNICATION UNION, February 1984

Given their current lack of telecommunication services and their sheer size in terms of population and surface area, the developing countries represent a vast market with enormous potential. This should encourage manufacturers to make every effort to open up this market and speed up telecommunications development in these countries by :

- a) offering financial assistance to promote the development of telecommunications in the developing countries and providing all the facilities necessary for management of the telecommunication services supplied;
- b) setting aside a portion of their considerable research and development budgets for R & D in the developing countries;
- c) channelling part of their research to meet the developing countries' requirements in telecommunication services and the corresponding technologies, by designing and developing properly adapted telecommunications equipment rather than seeking to market and find outlets for equipment designed essentially for the developed countries;
- d) attempting to improve and expand the training they offer to the developing countries by abandoning the commercial aspect and enabling trainees from the developing countries to master more thoroughly the design, operation and maintenance of equipment and the use and upgrading of technologies.

MINISTER OF POSTS AND TELECOMMUNICATIONS, KINGDOM OF MOROCCO, February 1984

We may well ask why the equipment suppliers do not investigate the conditions of access to this vast potential market constituted by the populations of the developing countries, when administrations and manufacturers might easily pool their efforts in this sphere. It is indeed surprising that manufacturers with colossal research and development budgets do not spend some of the money on stimulating this market and meeting its demand. This might reduce the currency drain on the meagre budgets of the developing nations and at the same time open the way for the products of the industrialised countries.

In our view, this is the greatest obstacle, for even if they are well organised, even if they have adequate internal resources, the telecommunication administrations of these young countries do not have the same appeal for offers of financing. Must we then resign ourselves to shifting the already existing imbalances between industrialised and developing countries to within the group of under-developed nations?

In this context, transfer of technology may be envisaged in the form of genuine international cooperation involving both manufacturers and users. Different approaches might be used, for instance, through recourse to small regional groups. In this way, without suggesting that the developing nations should immediately attain a high technological level - even though some countries have ways and means of doing so - many telecommunication equipments associated with or built into an exchange could be developed locally. But this would be possible only if the transfer were to be effected in a new spirit, implying:

- genuine training provided by the manufacturers and not exclusively sales-oriented, as it is now;
- genuine assistance from the supplier in the manufacturing process; the best test of this assistance would be, for instance, an undertaking by the supplier to use a certain proportion of local manufactures in his products exported to other countries;
- introduction of new developments in locally manufactured products;
- financial assistance to offset the loss of facilities suffered by the developing country as the result of substituting local products for imported products etc.

Director General of Posts and Telecommunications, DEPARTMENT OF TOURISM, POSTS AND TELECOMMUNICATIONS, REPUBLIC OF INDONESIA, August 1984

Transfer of technology is a long and hard process, but inevitable. Building up a scientific and technological base is essential for such transfer.

In addition to those mentioned in the main body of our Report and in this Appendix, and to responses which we received from governments and international agencies, we received substantial commentaries from:

ANT Nachrichtentechnik GmbH, Federal Republic of Germany
ARINC Incorporated, USA
Autophon AG, Switzerland
Bharat Electronics Ltd, India
Burroughs Corporation, USA
Cable and Wireless plc, United Kingdom
Citibank, USA
Codan Pty, Ltd Australia
Communication Workers of America
Computer Maintenance Corporation Ltd, India
Delair Droogtechniek en Luchtbehandeling BV, The Netherlands
Digital Equipment Corporation, Switzerland
Eutelsat, France
Ferranti GTE, United Kingdom
Ferranti plc, United Kingdom
Hermes Electronics Ltd, Canada
The Interpublic Group of Companies Inc., USA
ITAU Tecnologia SA, Brazil
ITEC Inc, USA
ITT Corporation, USA
Merill Lynch & Co Inc, USA
Mobira OY, Finland
RCA Global Communications, USA
Siemens AG, Federal Republic of Germany
Smithsonian Institute, USA
SOFRECOM, France
SR Telecom Inc, Canada
Standard Elektrik Lorenz AG, Federal Republic of Germany
Standard Telephones and Cables plc, United Kingdom
Telease Inc, USA
Telecommunications Radio Electriques et Telephoniques (TRT), France
Telefonaktiebolaget L M Ericsson, Sweden
Teleglobe Canada
Telemalta Corporation, Malta
Texas Instruments Ltd, United Kingdom
TMC Ltd, United Kingdom
Transpac, France
Transtel Communications Ltd, United Kingdom
United Telecommunications Inc, USA
University of Minnesota, USA
The Western Union Corporation, USA

Anyone wishing further access to these contributions should apply to the ITU Secretary-General.

Appendix III

TELEPHONE DENSITY

	YEAR	POPULATION MILLIONS	AREA K Km	GDP/HEAD 1982 US\$	MAIN TELES K	TOTAL TELES K	MAIN TELES PER 100 POPULATION	TOTAL TELES PER 100 POULATION
Low Income Economies								
Chad	77	4.0	1,284	80	2.4	6.5	0.06	0.16
Bangladesh	82*	90.0	144	140	113.7	122.2	0.12	0.13
Ethiopia	82	32.8	1,222	140	77.3	100.8	0.24	0.31
Nepal	82	15.0	141	170	14.3	17.4	0.10	0.12
Mali	82*	7.2	1,240	180	5.2	8.5	0.07	0.12
Burma	79	33.3	677	190	28.2	36.6	0.08	0.11
Zaire	82	29.2	2,345	190	27.2	31.2	0.09	0.11
Malawi	79	5.9	118	210	10.6	29.0	0.18	0.49
Upper Volta	78	5.9	274	210	4.0	8.6	0.07	0.14
Uganda	82	13.4	236	230	22.8	61.6	0.17	0.46
India	82	700.3	3,288	260	2295.5	3019.4	0.33	0.43
Rwanda	80	4.9	26	260	3.3	4.6	0.07	0.09
Burundi	82*	4.0	28	280	5.0	5.6	0.12	0.14
Tanzania	81	19.2	945	280	40.7	96.5	0.21	0.50
Benin	78	3.5	113	310	7.6	16.2	0.22	0.47
Central Af Rep	81	2.5	623	310	2.5	5.0	0.10	0.20
China	83	1,015.4	9,561	310	5072.0	5084.0	0.50	0.50
Guinea	77	5.1	246	310	6.6	9.5	0.13	0.18
Niger	82	5.8	1,267	310	7.0	9.8	0.12	0.17
Madagascar	81	9.9	587	320	19.3	38.2	0.19	0.38
Sri Lanka	82	15.0	66	320	67.0	105.8	0.45	0.71
Togo	80	2.5	57	340	5.8	9.8	0.23	0.39
Ghana	82*	11.5	239	360	37.2	70.7	0.32	0.61
Pakistan	83	86.3	804	380	374.0	384.4	0.43	0.49
Kenya	82	17.4	583	390	88.1	216.7	0.51	1.25
Sierra Leone	80	3.1	72	390	11.5	-	0.37	-
Afghanistan	80	15.1	646	-	25.8	31.7	0.17	0.21
Lao P.D.R.	77	3.5	237	-	5.7	6.5	0.16	0.19
Mozambique	82	12.9	802	-	36.5	57.4	0.28	0.44
Viet Nam	81	55.0	330	-	-	97.4	-	0.18
Lower - Middle Income Economies								
Sudan	82*	19.4	2,506	440	48.7	68.5	0.25	0.35
Senegal	82	5.9	196	490	20.0	-	0.34	-
Bolivia	78	4.7	1,099	570	-	125.3	-	2.64
Indonesia	82	153.0	1,919	580	475.5	669.3	0.31	0.44
Zambia	82	5.6	753	640	35.0	67.2	0.63	1.20
Honduras	82*	4.0	112	660	33.2	33.7	0.84	0.85
Egypt	82	43.7	1,001	690	477.4	-	1.09	-
El Salvador	82	4.9	21	700	79.1	100.0	1.63	2.06
Thailand	82	48.8	514	790	434.3	502.4	0.89	1.03
Papua New Guinea	82	3.1	462	820	25.3	50.5	0.81	1.62
Philippines	82	50.3	300	820	480.7	775.6	0.96	1.54
Zimbabwe	82	7.5	391	850	102.0	236.2	1.35	3.13
Nigeria	82*	100.0	924	860	218.0	708.4	0.22	0.71
Morocco	82	20.7	447	870	191.4	265.7	0.92	1.28
Nicaragua	82*	2.9	130	920	42.2	51.2	1.45	1.76

	YEAR	POPULATION MILLIONS	AREA K Km	GDP/HEAD 1982 US\$	MAIN TELES K	TOTAL TELES K	MAIN TELES PER 100 POULATION	TOTAL TELES PER 100 POULATION
Yemen P.D.R.	82	2.0	333	470	15.2	23.4	0.75	1.15
Ivory Coast	80	8.0	322	950	37.5	87.7	0.47	1.10
Guatamala	82*	7.1	109	1,130	97.7	-	1.37	-
Congo	81	1.6	342	1,180	-	17.3	-	1.10
Costa Rica	82	2.4	51	1,430	188.6	282.8	7.84	11.76
Peru	82	17.5	1,285	1,310	331.5	519.6	1.90	2.97
Dominica Republic	82*	5.8	49	1,330	109.1	175.1	1.88	3.01
Jamaica	82*	2.0	11	1,330	57.4	124.3	2.87	6.21
Ecuador	82	8.1	284	1,350	259.7	311.7	3.22	3.87
Turkey	82	45.4	781	1,370	1,502.0	2,368.0	3.31	5.22
Tunisia	82	6.8	164	1,390	138.6	218.8	2.05	3.24
Colombia	81	27.0	1,139	1,460	1,134.5	1,842.1	4.20	6.82
Paraguay	81	3.3	407	1,610	54.7	64.3	1.65	1.94
Angola	81	5.7	1,247	-	36.7	40.3	0.65	0.71
Cuba	81	9.7	115	-	232.1	406.4	2.39	4.18
Upper Middle Income Economies								
Syria	82	9.5	185	1,680	336.4	471.0	3.54	4.96
Malaysia	82	13.7	330	1,860	585.4	836.6	4.27	6.10
Korea (Rep of)	82	39.6	98	-	4,493.0	5,158.0	11.33	13.01
Panama	82	2.0	77	2,120	150.9	213.0	7.61	10.74
Chile	82	11.3	757	2,210	404.2	584.3	3.58	5.18
Brazil	82*	119.0	8,512	2,240	5,377.7	8,536.0	4.52	7.17
Mexico	82	73.3	1,973	2,270	3,118.2	5,961.4	4.25	8.13
Algeria	82	19.5	2,382	2,350	408.2	606.9	2.09	3.11
Portugal	82	10.1	92	2,450	1,149.3	1,566.9	11.39	15.53
Argentina	82	28.9	2,767	2,520	2,361.4	3,234.8	8.17	11.19
Uruguay	82*	2.9	176	2,650	226.4	294.4	7.74	10.06
South Africa	83	24.5	1,221	2,670	1,936.6	3,208.7	7.89	13.08
Yugoslavia	82*	22.5	256	2,800	1,684.4	2,303.5	7.49	10.24
Venezuela	82	16.7	912	4,140	-	1,036.8	-	6.21
Greece	82	9.8	132	4,290	2,534.4	3,113.0	25.81	31.70
Israel	83	4.1	21	5,090	1,201.3	1,415.0	29.44	34.67
Hong Kong	82	5.2	1	5,340	1,477.0	1,947.5	28.22	37.22
Singapore	82	2.5	1	5,910	630.4	852.0	25.34	34.24
Trinidad and Tobago	82	1.2	5	6,840	46.8	86.9	3.90	7.24
Iran	83	40.4	1,648	-	1,414.3	1,791.8	3.50	4.43
Iraq	82	14.0	435	-	399.6	514.9	2.85	3.68
High Income Oil Exporters								
Oman	82	1.5	300	6,090	19.6	31.4	1.31	2.09
Saudi Arabia	82*	7.0	2,150	16,000	607.3	788.6	8.60	11.24
Kuwait	82	1.6	18	19,870	191.0	243.0	12.20	15.53
United Arab Emirates	82	1.1	84	23,770	165.4	280.8	15.04	25.53
Industrialised Countries								
Market Economies								
Ireland	82	3.5	70	5,150	579.6	779.0	16.56	22.26
Spain	82	38.1	505	5,430	8,017.7	12,820.2	21.05	33.67
Italy	82	56.8	301	6,840	14,697.8	21,679.6	25.89	38.19
New Zealand	83	3.2	269	7,920	1,197.7	1,939.5	37.52	60.76
United Kingdom	83	56.3	245	9,660	19,549.4	29,061.3	34.75	51.66

	YEAR	POPULATION MILLION	AREA K Km	GDP/HEAD 1982 US\$	MAIN TELES K	TOTAL TELES K	MAIN TELES PER 100 POPULATION	TOTAL TELES PER 100 POPULATION
Austria	82	7.6	84	9,880	2,438.7	3,330.2	32.25	44.04
Japan	83	117.8	372	10,080	42,429.0	61,208.0	36.02	51.97
Belgium	82	9.9	31	10,760	2,745.3	3,958.9	27.82	40.12
Finland	82	4.8	337	10,870	1,928.0	2,644.0	39.83	54.62
Netherlands	82	14.3	41	10,930	5,291.0	8,025.0	36.90	55.97
Australia	82	15.3	7,687	11,140	5,480.0	8,241.0	35.87	53.95
Canada	82	24.6	9,976	11,320	10,335.4	16,802.4	46.02	68.30
France	82	54.3	547	11,680	19,327.7	29,373.7	35.62	54.14
Germany Fed Rep	82	61.6	249	12,460	22,712.6	31,370.1	36.87	50.93
Denmark	82	5.1	43	12,470	2,351.0	3,595.0	45.95	70.27
United States	82*	231.0	9,363	13,160	94,457.0	181,893.0	40.84	78.74
Sweden	82	8.3	450	14,040	4,965.9	7,131.9	59.63	85.64
Norway	82	4.1	324	14,280	1,387.9	2,203.7	33.67	53.45
Switzerland	82	6.5	41	17,010	3,021.0	4,977.0	46.71	76.95
East European Nonmarket Economies								
Hungary	82	10.7	93	2,270	655.0	1,338.0	6.12	12.50
Romania	79	22.0	238	-	1,480.0	-	6.71	-
Bulgaria	82	9.0	111	-	1,144.3	1,513.9	12.74	16.86
Czechoslovakia	82	15.4	128	-	1,720.0	3,306.0	11.19	21.51
German Dem Rep	82	16.7	108	-	1,437.3	3,344.3	8.59	19.99
Poland	82*	36.0	313	-	1,970.6	3,505.7	5.46	9.72
USSR	82	271.2	22,402	-	24,540.0	26,667.0	9.05	9.83

Source

1982* figures are from The World's Telephones (AT&T) 1982.

All others are from the Yearbook of Common Carrier Telecommunication Statistics 11th Edition and the World Development Report 1984.

Appendix IV

TELEPHONE DENSITY IN CITY AND NON CITY LOCATIONS IN SELECTED COUNTRIES

		POULATION				MAIN TELEPHONES PER 100 POPULATION			
GDP/HEAD US \$		TOTAL MILLION	LARGEST CITY %	MAIN CITIES %	REST %	OVERALL	LARGEST CITY	MAIN CITIES	REST
Low Income Economies									
Bangladesh	140	90.0	2.9	4.8	95.2	0.13	2.35	1.94	0.035
Ethiopia	140	32.3	3.9	6.6	93.4	0.24	3.44	2.84	0.06
Mali	180	7.2	7.1	10.8	89.2	0.07	0.68	0.55	0.015
India	260	658.1	1.4	7.7	92.3	0.34	1.96	2.38	0.17
Rwanda*	260	4.8	-	17.0	83.0	0.08	-	0.28	0.04
Tanzania	280	17.4	5.9	10.4	89.6	0.23	1.72	1.44	0.09
Ghana	360	11.5	8.7	16.5	83.5	0.32	1.68	1.43	0.10
Kenya	390	16.5	5.8	12.4	87.6	0.55	4.98	3.36	0.15
Lower - Middle Income Economies									
Sudan	440	19.4	8.9	18.5	81.5	0.25	1.71	1.18	0.04
Senegal*	490	5.1	-	44.5	55.5	0.34	-	0.64	0.10
Indonesia	580	152.4	4.4	14.9	85.1	0.28	2.18	1.28	0.11
Zambia	640	6.0	8.9	32.8	67.2	0.46	1.57	1.4	0.006
Honduras	660	4.0	12.7	24.8	75.2	0.84	4.35	3.04	0.11
Egypt*	690	40.0	-	31.5	68.5	0.97	-	2.68	0.15
Thailand	790	47.9	13.8	15.3	84.7	0.77	4.05	3.97	0.19
Morocco	870	22.0	13.6	30.7	69.3	0.81	1.8	1.98	0.28
Guatemala	1130	7.1	10.5	22.0	88.0	1.37	11.13	5.67	0.16
Congo	1180	1.4	21.6	35.4	64.6	0.51	1.52	1.42	0.19
Costa Rica	1430	2.3	25.3	37.9	62.1	6.99	19.7	15.94	1.54
Jamaica	1330	2.9	35.0	-	-	2.87	6.14	-	1.1
Ecuador	1350	8.9	13.4	35.4	64.6	2.7	7.58	7.02	0.3
Turkey	1370	45.2	6.1	19.9	80.1	2.88	13.85	8.4	1.51
Colombia	1460	27.9	15.7	45.9	54.1	5.11	14.64	9.5	1.38
Upper Middle Income Economies									
Syria	1680	9.7	13.0	65.2	65.2	3.49	8.54	7.39	1.4
Korea (Rep of)	1910	37.4	22.3	41.6	58.4	10.9	17.7	16.2	7.1
Panama	2120	2.0	29.3	34.8	65.2	8.12	19.53	19.08	2.26
Chile	2210	11.4	35.1	57.1	42.9	3.41	6.23	5.44	0.72
Brazil	2240	119.1	7.1	24.0	76.0	4.52	11.43	10.08	2.75
Mexico	2270	73.2	19.1	41.0	59.0	3.92	8.23	7.89	1.17
Argentina	2520	28.3	34.8	55.4	44.6	7.55	12.6	10.97	3.29
Uruguay	2650	2.9	44.0	-	-	7.74	12.95	-	9.43
South Africa	2670	24.5	15.7	37.6	62.4	6.8	14.3	14.8	1.98

		POPULATION				MAIN TELEPHONES PER 100 POPULATION			
	GDP/HEAD US \$	TOTAL MILLION	LARGEST CITY %	MAIN CITIES %	REST %	OVERALL	LARGEST CITY	MAIN CITIES	REST
<u>High Income Oil Exporters</u>									
Saudi Arabia	16000	7.0	17.5	65.8	34.2	8.66	11.5	9.5	7.05
<u>Industrialised Countries</u>									
<u>Market Economies</u>									
Ireland	5150	3.47	29.6	35.6	64.4	15.45	24.0	24.43	10.5
Spain	5430	37.7	8.4	19.6	80.4	19.1	35.85	38.14	14.5
New Zealand	7920	3.2	24.4	67.4	32.6	36.8	34.52	36.8	36.7
United Kingdom	9660	55.99	12.2	28.8	71.2	34.1	50.64	42.45	30.7
Austria	9880	7.55	20.0	30.4	69.6	30.74	51.62	49.3	22.63
Belgium	10760	9.88	11.7	40.6	59.4	26.44	38.63	31.41	23.04
Finland	10870	4.81	10.0	32.2	67.8	35.22	62.18	47.49	29.39
Netherlands	10930	14.29	5.0	27.3	72.7	38.05	48.92	43.37	36.06
Germany Fed.Rep	12460	61.71	3.0	27.6	72.4	35.79	54.53	45.01	32.28
Denmark	12470	5.12	24.9	38.8	61.2	45.19	54.32	51.12	41.43
Sweden	14040	8.32	7.7	35.7	64.3	53.6	81.3	65.4	47.06
Switzerland	17010	6.38	5.9	32.7	67.3	45.82	66.33	56.31	40.71
<u>East European Nonmarket Economies</u>									
Hungary	2270	10.71	19.2	27.5	72.5	5.94	17.73	14.95	2.53
Czechoslovakia		15.34	7.7	17.3	82.7	10.97	30.52	24.99	8.03
German Dem Rep		16.73	6.8	25.4	74.6	8.35	21.34	13.52	6.59

- Notes**
- (1) Main cities are those with a population in excess of 50,000.
 - (2) Population data represents the latest available census or estimate, as reported by the respective telephone administration or company at the time of compiling the source documents.
 - (3) All figures except * relate to January 1st 1982.

Source AT&T The World's Telephones, A statistical Compilation as of January 1982 and World Bank data.

Appendix V

SUPPLY, DEMAND AND REGISTERED WAITING LIST
IN SELECTED COUNTRIES

	DATE MONTH YEAR	MAIN LINES WORKING ('000)	UNMET DEMAND ('000)	TOTAL REGISTERED ('000)	REGISTERED DEMAND MET %
<u>Low Income Economies</u>					
Bangladesh	6/81	100	47	147	68
Ethiopia	12/80	64	12	76	84
Malawi	12/79	11	1	12	92
Uganda	12/82	23	22	45	51
India	3/82	2295	594	2889	79
Tanzania	12/81	41	29	70	50
China	12/81	4154	189	4343	96
Sri Lanka	12/82	67	28	95	70
Ghana	12/79	36	16	52	69
Pakistan	6/81	282	200	482	58
Kenya	12/82	88	72	160	55
Mozambique	12/82	36	21	57	63
<u>Lower Middle Income Economies</u>					
Senegal	12/82	20	6	26	77
Indonesia	12/82	475	170	645	74
Zambia	12/82	35	18	53	66
Egypt	12/82	477	629	1106	43
El Salvador	12/82	79	6	85	93
Thailand	12/82	434	387	821	53
Philippines	12/82	481	132	613	78
Zimbabwe	12/82	102	15	117	87
Morocco	12/82	191	115	306	62
Ivory Coast	9/81	42	16	58	72
Guatemala	12/81	88	162	250	35
Costa Rica	12/82	189	11	200	95
Peru	12/82	331	259	590	56
Jamaica	12/79	54	21	75	72
Turkey	12/82	1502	1751	3253	46
Tunisia	12/82	139	67	206	67

	DATE MONTH YEAR	MAIN LINES WORKING ('000)	UNMET DEMAND ('000)	TOTAL REGISTERED ('000)	REGISTERED DEMAND MET %
Syria	12/82	336	785	1121	30
Malaysia	12/82	585	190	775	75
Korea Rep.of	12/82	4493	427	4920	91
Panama	12/82	151	8	159	95
Chile	12/82	404	113	517	78
Mexico	12/82	3118	610	3728	84
Algeria	12/82	408	262	670	61
Portugal	12/82	1149	137	1286	89
Argentina	12/82	2361	952	3313	71
Uruguay	12/81	226	75	301	75
South Africa	3/83	1937	193	2130	91
Greece	12/81	2401	798	3199	75
Israel	3/83	1201	197	1398	86
Hong Kong	12/82	1477	3	1480	100
Singapore	3/82	630	1	631	100
Iran	3/82	988	712	1700	58
<u>High Income Oil Exporters</u>					
Kuwait	12/82	191	2	193	99
United Arab Emirates	12/82	165	3	168	98
<u>Industrialised Countries</u>					
<u>Market Economies</u>					
Ireland	12/82	580	78	658	88
Spain	12/82	8018	309	8327	96
Italy	12/82	14698	632	15330	96
New Zealand	3/83	1198	7	1205	99
United Kingdom	3/83	19549	3	19552	100
Austria	12/82	2439	88	2527	97
Japan	3/83	42429	110	42539	100
Belgium	12/82	2745	26	2771	99
Finland	12/82	1928	1	1929	100
Netherlands	12/82	5291	3	5294	100
Australia	12/82	5480	51	5531	99

	DATE MONTH YEAR	MAIN LINES WORKING ('000)	UNMET DEMAND ('000)	TOTAL REGISTERED ('000)	REGISTERED DEMAND MET %
France	12/82	19328	187	19315	99
Germany Fed Rep	12/82	22713	28	22741	100
Denmark	12/81	2351		2351	100
United States	12/81	94429	57	94486	100
Norway	12/82	1388	41	1429	97
Switzerland	12/82	3021	5	3026	100

East European Nonmarket Economies

Germany Dem Rep	12/81	1397	657	2054	68
Poland	12/81	1971	1014	2985	66

Source : ITU, Yearbook of Common Carrier Telecommunications Statistics
(Geneva 1984), and World Bank data.

Appendix VI

QUALITY OF TELEPHONE SERVICE

This Appendix illustrates the current quality of telephone service in a number of the least well-placed developing countries. It is based on field reports by specialists from an international agency. It should be emphasised that, as indeed the Report makes clear, a number of other countries have already made great improvements in the performance of their networks.

Country A

A low middle income economy with a telephone penetration of about 1 per 100 population.

"... Service is poor. Insufficient investment ... grossly inadequate in relation to demand and usage... Severe peak period traffic congestion in local and long distance networks... Cannot establish connections during peak traffic hours... Worn-out switching equipment and faults on old and defective cables... A businessman tried to call Montreal. He did not get through for a month... Domestic manual long distance... delays from three to six hours."

Country B

A low income economy with a telephone penetration of less than 1 per 200 population.

"...Congested conditions and repeat call attempts result in poor service in most of the main city networks... The local network congestion is now also affecting access to the main long distance and international routes."

Country C

A low income economy with a telephone penetration of less than 1 per 200 population.

"...Frequently out of order for lack of spare parts or inadequate maintenance.

Dial tone (in capital) only after ten or more attempts... direct dialled long distance calls... only completed after hours of trial. Sample (for long distance)... only 5.5% of call attempts are successful... 70% of failures are due to congestion. Manual long distance calls... waiting time of hours or days."

Country D

A low income economy with a telephone penetration of less than 1 per 200 population.

"The number of effective manual trunk calls... is only about 77% of calls attempted and the waiting time... is often over four hours".

Country E

A low income economy with a telephone penetration of about 1 per 1000 population.

"Quality of service is poor... high call traffic congestion... frequently interrupted by faults on the lines... Interruptions in the interurban networks can last for weeks."

Country F

An upper middle income economy with a telephone penetration of less than ten telephones per 100 population.

"5% of local calls, 20% of long distance calls within regional areas and 50% of other long distance calls fail due to equipment congestion at busy hours or malfunctions.

Each direct exchange line experiences one breakdown per year and only 74% of the faults are cleared within two days."

Country G

A low middle income economy with a telephone penetration of just over 1 per 100 population.

"...Considerable local network congestion... repeated attempts to complete calls during peak business hours... causes more congestions.

Long distance service also congested... Shortage of circuits... resulting in a high rate of ineffective calls and repeat call problems when trying to call into congested local networks... Manual long distance service... several hours delay during business hours."

Country H

A low income economy with a telephone penetration of less than 1 per 300 population.

"Service... very poor and under present operating conditions is deteriorating from day to day... Lack of spare parts drastically reduces the traffic capacity... causing bottlenecks and unreliable service... Countrywide, only 49% of manual long distance calls are connected the day they are booked.

... Five minutes to obtain a dial tone in the busy time of day.

... 22% of lines in the country are out of service... 80% of faulty lines... out of operation for more than one month... 50% of faults were due to local cable networks, 45% to subscriber plant and 5% to switching equipment."

Country I

A low income economy with a telephone penetration of just over 1 per 1000 population.

"Telephones are heavily used keeping them busy for long periods... In (the capital)... it is necessary to make four to five call attempts for each successful call during the peak... In the three principal cities... about 50% of calls dialled fail during business hours... about 35% being due to the called number being busy or no answer.

Many inadequacies, also, lead to poor quality long distance services."

Country J

A low middle income economy with a telephone penetration of about 1 per 100 population.

"Appreciable improvement in the quality of service through reduction in call failures due to technical faults and system congestion... Usage of available telephone lines is very high... are kept busy for long periods and unavailable for incoming calls... Overall... only 62% of daily local call attempts are completed".

Country K

A low middle income economy with a telephone penetration of about 1 per 75 population.

"Local service in the main cities is congested, made worse by repeat call attempts. Long distance... are adequate, but congestion at the local level... results in a high proportion of incompleting call attempts".

Country L

A low income economy with a telephone penetration of less than 1 per 100 population.

"Facilities are meagre, generally poor in quality and, in many cases, highly fault-prone... Quality of all domestic services is generally poor... Many long distance and international calls are shown to fail due to the deficient local network... Delays on operator trunk calls average four to six hours and result in many cancellations of booked calls".

Country M

A low middle income economy with a telephone penetration of less than ten telephones per 100 population.

"Local service (in the capital) is significantly congested. During peak traffic hours, only 46% of local call attempts are successful... Congestion is partly caused by telephone over utilisation... and the necessity to make numerous repeat attempts."

Country N

A low income economy with a telephone penetration of about 1 per 1000 population.

"Local telephone service is poor... during business hours telephones are in use a high proportion of the time due primarily to the low penetration. Hence party busy conditions and repeat call attempts seriously overload central exchanges... Long distance service is deficient with delays of as much as 12 to 18 hours on some routes... The quality of speech is in most cases unsatisfactory."

Country O

A low income economy with a telephone penetration of about 1 per 1000 population.

"The quality of... telephone service is poor... Due to cable related inadequacies, the network is presently saturated, although the exchanges themselves operate at only slightly more than 50% capacity."

Country P

An upper middle income economy with a telephone penetration of about ten telephones per 100 population.

"In (the capital) local telephone service is generally unreliable and of poor quality, making it often easier to conduct business by traveling to meetings rather than telephone. Local service is severely congested, on average, probably only about one half of local call attempts are successful, and during peak business hours, congestion is worse... Delay on manual long distance traffic is about 1½ hours."

Country Q

A low income economy with a telephone penetration of about 1 per 300 population.

"Test call samples gave completion rates of :

Local call, busy hour	65% - 85%
Local call, slack hour	80% - 100%
Long distance call, busy hour	50%
Long distance call, slack hour	65%

This is caused by a large excess demand, which congests the circuits and prevents call completion due to insufficient capacity.

INVESTMENT LEVELS AND GROWTH RATES IN SELECTED COUNTRIES

	ETHIOPIA	MALAWI	TANZANIA	KENYA	INDONESIA	PAPUA- NEW GUINEA
1. YEARS COVERED	75-79	75-79	76-78	75-78	75-79	75-80
2. AVERAGE INVESTMENT (\$M)	108.6	8.4	7.7	22.3	418.7	18.7
3. AVERAGE INVESTMENT % GDP	3.6	-	0.15	0.35	0.68	0.7
4. AVERAGE MAIN LINE ANNUAL GROWTH CONNEXIONS (K)	3	0.54	2.74	3.8	23.9	1.47
5. AVERAGE INVESTMENT PER ADDED MAIN LINE WORKING (US\$)	36,400	15,500	2,800	5,800	17,500	12,700
6. AVERAGE ANNUAL GROWTH RATE ACHIEVED	6	5	10	7	10	7
7. WAITING LIST % OF WORKING AT START OF PERIOD	-	12.5	43.3	30.6	15.6	4.2
8. WAITING LIST % OF WORKING AT END OF PERIOD	19	11.5	41.7	40.1	35.6	5.5
	PHILIPPINES	COSTA RICA	ECUADOR	TURKEY	TUNISIA	PARAGUAY
1. YEARS COVERED	75-80	75-81	75-79	76-79	75-82	75-81
2. AVERAGE INVESTMENT (\$M)	797.0	33.9	28.6	246.0	31.1	30.0
3. AVERAGE INVESTMENT % GDP	2.6	0.86	0.29	0.55	0.43	0.8
4. AVERAGE MAIN LINE ANNUAL GROWTH CONNEXIONS (K)	25.8	15.0	15.0	102.8	10.0	3.9
5. AVERAGE INVESTMENT PER ADDED MAIN LINE WORKING (US\$)	30,900	2,300	1,900	2,400	3,100	7,700
6. AVERAGE ANNUAL GROWTH RATE ACHIEVED	8	15	9	13	11	10
7. WAITING LIST % OF WORKING AT START OF PERIOD	11.4	27.5	-	139.7	23.7	-
8. WAITING LIST % OF WORKING AT END OF PERIOD	27.5	5.6	-	140.6	48.1	-

INVESTMENT LEVELS AND GROWTH RATES IN SELECTED COUNTRIES

	SYRIA	MALAYSIA	KOREA	BRAZIL	ARGENTINA	URUGUAY
1. YEARS COVERED	75-79	75-82	75-79	75-82	75-79	75-81
2. AVERAGE INVESTMENT (\$M)	41.4	1157.0	479.0	1,700.0	172.8	42.13
3. AVERAGE INVESTMENT % GDP	0.38	5.2	1.8	0.8	0.32	0.61
4. AVERAGE MAIN LINE ANNUAL GROWTH CONNEXIONS (K)	14.8	54.5	293.0	485.3	37.8	6.58
5. AVERAGE INVESTMENT PER ADDED MAIN LINE WORKING (US\$)	2,800	21,200	1,600	3,500	4,600	640
6. AVERAGE ANNUAL GROWTH RATE ACHIEVED	10	19	21	16	2	3
7. WAITING LIST % OF WORKING AT START OF PERIOD	104	23.8	8.8	-	34	14.4
8. WAITING LIST % OF WORKING AT END OF PERIOD	221	32.4	26.5	-	48	33
	SOUTH AFRICA	YUGOSLAVIA	GREECE	ISRAEL	SINGAPORE	KUWAIT
1. YEARS COVERED	75-82	75-81	75-81	75-82	75-81	77-82
2. AVERAGE INVESTMENT (\$M)	396.7	302.5	247.9	120.0	102.5	85.7
3. AVERAGE INVESTMENT % GDP	0.6	0.2	0.67	0.43	0.95	0.33
4. AVERAGE MAIN LINE ANNUAL GROWTH CONNEXIONS (K)	95.0	127.7	118.3	60.8	57.0	14.7
5. AVERAGE INVESTMENT PER ADDED MAIN LINE WORKING (US\$)	4,200	2,400	2,100	2,000	1,800	5,800
6. AVERAGE ANNUAL GROWTH RATE ACHIEVED	7	11	6	9	18	11
7. WAITING LIST % OF WORKING AT START OF PERIOD	10	-	16	25.7	12.3	-
8. WAITING LIST % OF WORKING AT END OF PERIOD	7.9	-	36.4	17.5	0.5	1.04

Notes

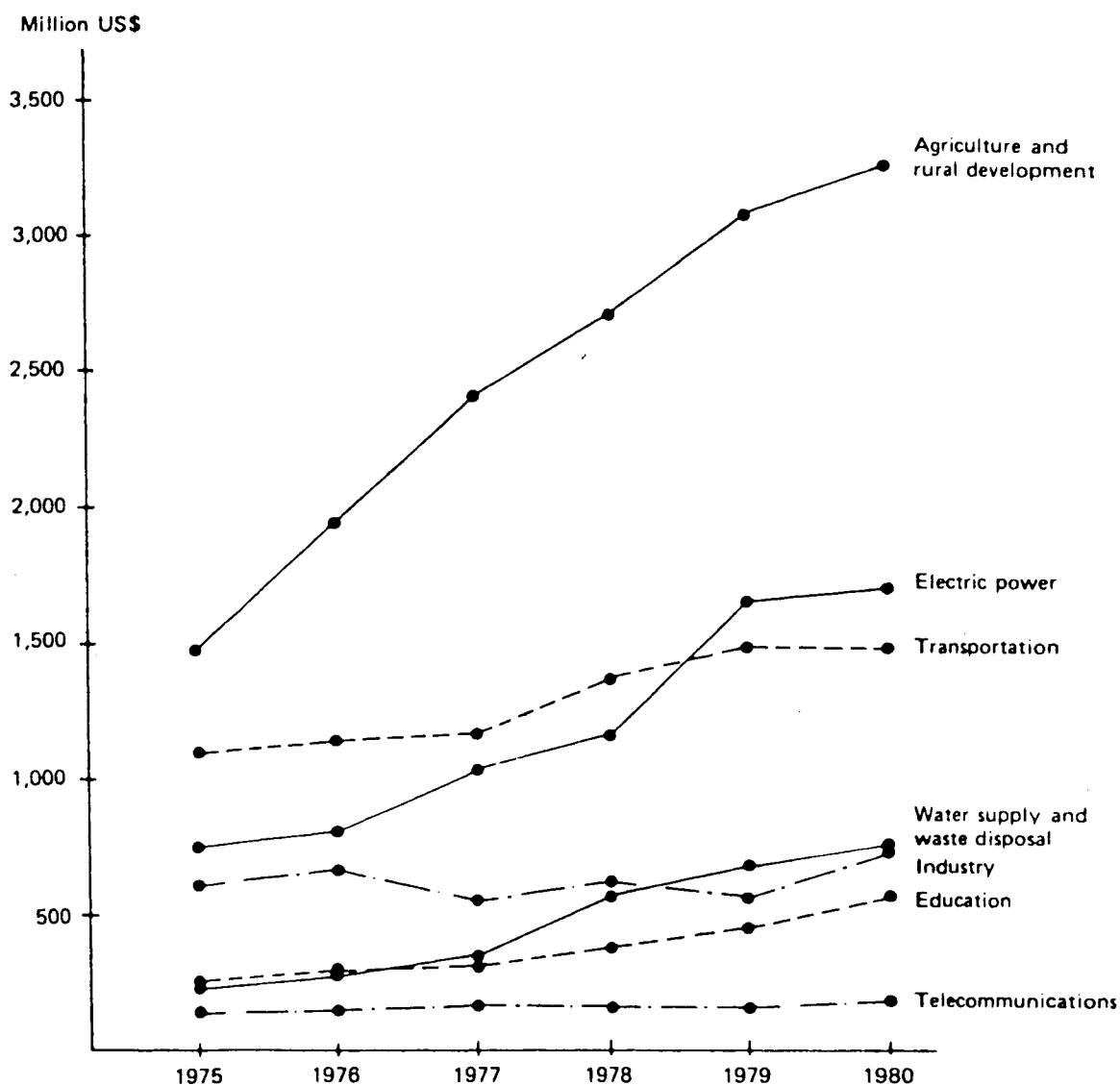
- 1) Investment and cost figures related to 1982 US\$ equivalents.
- 2) System growth is for working connections and not necessarily related to investment in the same year and so a time period is taken to indicate the improvements achieved.
- 3) Investment includes land and buildings in the whole telecommunications sector (except for Indonesia) whereas growth is for telephones only - investment cost per added connection may therefore be unrepresentative for some countries for example with major satellite investment.
- 4) Investment figures for Indonesia are for telephone services only.

Source

Yearbook of Common Carrier Telecommunications Statistics (1973-1982)

Appendix VIII

SECTORAL DISTRIBUTION OF WORLD BANK GROUP LOANS, 1975-1980



Source: World Bank Annual Reports.

Notes: The data used here are three-year averages.

The seven sectors presented in this figure amount on an average to 80 per cent of the total loans of the World Bank Group.

In the 1969-73 period, telecommunications accounted for 5.4 per cent of the World Bank Group loans. In 1974-78, for 2.3 per cent, and in 1979-81 for 1.7 per cent.

Reproduced from ITU/OECD Telecommunications for Development, (June, 1983)

Appendix IX

INDICATIVE COST PER LINE OF URBAN AND RURAL
TELECOMMUNICATIONS

(Index 100 = cost per line in urban areas)

	Cost per line in urban areas	Cost per line in rural areas
Subscriber connection	40	400
Investment in exchanges	30	60
Investment in transmission equipment	20	20
Investment in land and buildings	10	20
Total cost per line	100	500

Note: It should be noted that these figures do not take into account the cost of connecting the rural network to the trunk service of the national network.

Source

The figures are based on the experience of a manufacturing firm working in a number of developing countries, are essentially indicative, and can vary quite substantially from one location to another. For this reason, they should be used with caution, but the conclusion they suggest is obvious: the big economic and technical challenge facing telecommunications planners and hardware manufacturers is to reduce the very high cost of connecting subscribers in the low-density, sparsely populated rural areas.

Reproduced from ITU/OECD Telecommunications for Development, (June 1983).

Appendix X

The following are the Resolutions of the ITU Plenipotentiary Conference, Nairobi, 1982, referred to in Chapter 3.

- Resolution No. 16: Participation of the Union in the United Nations Development Programme (UNDP) and in Other Programmes of the United Nations System.
- Resolution No. 17: Inter-Country Projects Financed by the United Nations Development Programme (UNDP) in the Field of Telecommunications.
- Resolution No. 18: Budgetary and Organizational Aspects of Technical Cooperation and Assistance of the Union.
- Resolution No. 19: Special Voluntary Programme for Technical Cooperation.
- Resolution No. 21: Review of the Overall Management and Operation of Technical Cooperation and Assistance Activities.
- Resolution No. 24: Telecommunication Infrastructure and Socio-Economic Development.
- Resolution No. 27: Special Measures for the Least Developed Countries.

Appendix XI

BIBLIOGRAPHY

American Telephone and Telegraph: The World's Telephones, 1982

Arthur D. Little: World Telecommunications, 1980-1990

International Bank for Reconstruction and Development:
World Development Reports, 1983 and 1984

ITU: Forum 83, One World, One Network, 1983

ITU/OECD: Telecommunications for Development, 1983

ITU: Yearbook of Common Carrier Telecommunications Statistics,
1984

IDATE (Institut pour de Developpement et l'Amenagement des
Telecommunications et de l'Economie): Growth and
Telecommunications: A summary of Research, 1984

Saunders, Robert J., Jeremy J. Warford, and Bjorn Wellenius:
Telecommunications and Economic Development, Johns Hopkins
University Press, 1983

UNDP/ITU: Maintenance of Telecommunications in Africa, 1983

CHAPTER I

African Medical and Research Foundation: Annual Report, 1982,
1983

Clarke, D. G., and Laufenberg, W: "The Role of
Telecommunications in Economic Development, with Special
Reference to Rural Sub-Saharan Africa", ITU, 1983*

Hardy, Andrew P: "The Role of the Telephone in Economic
Development." Telecommunications Policy, vol. 4, no. 4, December
1980. Also Ph.D. dissertation, Institute for Communication
Research, Stanford University, 1980*

Hudson, Heather E: When Telephones Reach the Village: The Role
of Telecommunications in Rural Development, Ablex, 1984

Hudson, Heather E: "Three Case Studies on the Benefits of
Telecommunications in Socio-Economic Development", ITU, 1983*

Hudson, Heather E., Douglas Goldschmidt, Edwin B. Parker, and
Andrew P. Hardy: The Role of Telecommunications in
Socio-Economic Development: A Review of the Literature with
Guidelines for Further Investigations, ITU, 1979*

Hudson, Heather E., Victor Forsythe, and Stanley Burns: "Keeping in touch by Two-Way Radio", World Health Forum, vol. 4, no. 2, 1983

Hudson, Heather E., and Edwin B. Parker: "Medical Communication in Alaska by Satellite", New England Journal of Medicine, December 20, 1973

Hudson, Heather E., Andrew P. Hardy, and Edwin B Parker: "Projections of the Installation of Satellite Earth Stations on National Development", Telecommunications Policy, vol. 7, no. 4, December 1983*

Kamal, A A: "A Cost-Benefit Analysis of Rural Telephone Service in Egypt", ITU, 1983*

Kaul, S N: "India's Rural Telephone Network", ITU, 1983*

Parker, Edwin B: "Economic and Social Benefits of the Rural Electrification Administration (REA) Telephone Loan Program", ITU, 1983*

Pelton, Joseph N., Marcel Perras, and Ashok Sinha: INTELSAT: The Global Telecommunications Network, Pacific Telecommunications Conference, 1983

Pierce, William B., and Nicolas Jequier: Telecommunications for Development, ITU, 1983

Tyler, Michael et al: "The Impact of Telecommunications on the Performance of a Sample of Business Enterprises in Kenya", ITU, 1983*

Tyler, Michael, Morgan, R., and Clarke, A: "Telecommunications and Energy Policy", ITU, 1983*

* These studies were prepared as part of a research project sponsored by the ITU and the OECD Development Centre. They are briefly summarised in Pierce, William B and Nicolas Jequier, Telecommunications for Development.

CHAPTER 4

CCITT: Rural Telecommunications, 1979

Commonwealth Telecommunications Organisation: Digital Technology Seminar, 1983

ITU: Appropriate Modern Telecommunications Technology for Integrated Rural Development in Africa, 1981

CHAPTER 7

CCITT/GAS 5: Conditions required for the establishment of a national industry for the manufacture of telecommunications equipment (especially switching equipment), 1983

Appendix XII

LIST OF ADVISERS TO THE COMMISSION

Mr S Abdulrachman, Indonesia
Mr N Abji, Tanzania
Mr Anouar, Morocco
Mr Aroko, Tanzania
Mr H Banham, United Kingdom
Mr E L Barinov, USSR
Mr H Bartlett, United Kingdom
Mr J P Basgallop, United Kingdom
Mr R Beaird, USA
Mr A Cañas, Costa Rica
Mr G Corré, France
Mr J C Deniaud, France
Mr A P Djiwatampu, Indonesia
Mrs N Dolmatovskaja, USSR
Mr L Forrester, USA
Mr T Goto, Japan
Mr Hamdoun, Morocco
Mr H Hara, Japan
Mr J M Harper, United Kingdom
Mr N Hasegawa, Japan
Mr G Hausmann, Federal Republic of Germany
Dr H Hudson, USA
Mr Y Inoue, Japan
Mr G Issembe, Gabon
Hon G Itatiro, Tanzania
Mr G Johnen, Federal Republic of Germany
Mr F C Kasambala, Tanzania
Mr Y Kawasumi, Japan
Mr P Kirby, United Kingdom
Mr G F Knapp, USA
Mr Y Kotaka, Japan
Mr T Kuriki, Japan
Mr B Laidlaw, United Kingdom
Mr A D D Leimena, Indonesia
Mr J W J Maeda, Tanzania

Mr W Manda, East African Development Bank
Mr J F R Martin, United Kingdom
Mr F Mchauru, Tanzania
Mr A Miyazawa, Japan
Mr F B Moerwanto, Indonesia
Mr J Msambichaka, Tanzania
Mr N Ngaruhia, Kenya
Mr A Ng'eny, Kenya
Mr E N Olekambainei, Tanzania
Mr O Ongara, Tanzania
Mr A Philips, INRUTEL
Dr A Rathenbuecher, Federal Republic of Germany
Mr H Richardot, France
Mr G Risakotta, Indonesia
Mr M Samoura, Senegal
Mr B Santoso, Indonesia
Mr I Shinohara, Japan
Mr R Stern, World Bank
Mr T V Srirangan, India
Mr A Surjade, Indonesia
Mr S Suzuki, Japan
Mr Tanaka, Japan
Mr A Viehbeck, Federal Republic of Germany
Miss J Williams, United Kingdom
Mr J Wilson, United Kingdom
Mr M Yamaguchi, Japan
Mr N Yamamura, Japan
Mr R Yusuf, PATU