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WORKSHOP ON SPECIAL ASPECTS OF TELECOMMUNICATIONS DEVELOPMENT IN ISOLATED AND UNDERPRIVILEGED AREAS OF COUNTRIES

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ATELIER DE TRAVAIL VISANT L'ETUDE DES ASPECTS PARTICULIERS DU DEVELOPPEMENT DES TELECOMMUNICATIONS DANS LES REGIONS ISOLEES ET DEFAVORISEES DES PAYS

ATELIER DE TRAVAIL PARRAINE PAR

LE MINISTERE DES COMMUNICATIONS
GOUVERNEMENT DU CANADA

DU 26 AU 28 JUIN, 1978
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REUNION SOBRE LOS ASPECTOS PARTICULARES DEL DESARROLLO DE LAS TELECOMUNICACIONES EN LAS REGIONES AISLADAS Y DESFAVORECIDAS DE LOS PAISES

PATROCINADA POR EL

MINISTERIO DE COMUNICACIONES
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Workshop on Special Aspects of Telecommunications Development in Isolated and Underprivileged Areas of Countries.

Sponsored by Department of Communications, Government of Canada, June 26-28, 1978, Ottawa, Canada.

The Workshop was held in association with a meeting of the International Telecommunications Union CCITT GAS/5 Subject no. 1 Sub-Group.

This document presents invited papers, as submitted to the Workshop.

Atelier de travail visant l'étude des aspects particuliers du développement des télécommunications dans les régions isolées et défavorisées des pays.

Atelier de travail parrainé par le ministère des Communications, gouvernement du Canada, du 26 au 28 juin, 1978, Ottawa, Canada.

L'atelier a été suivi d'une réunion d'un Sous-groupe traitant de la même question du GAS/5, CCITT de l'Union international des télécommunications.

Ce dossier comprend les documents qui, à invitation du ministère des Communications du Canada, ont été présentés a l'atelier.

Reunión sobre los Aspectos Particulares del Desarrollo de las Telecomunicaciones en las Regiones Aisladas y Desfavorecidas de los Países.

Patrocinada por el Ministerio de Comunicaciones, Gobierno de Canadá, 26 al 28 de junio, 1978, Ottawa, Canadá.

La Reunión fué organizada con motivo de la reunión del Sub-grupo encargado del Tema No. 1 del GAS/5, CCITT, Unión Internacional de Telecomunicaciones.

Esta documentación incluye las ponencias que, a invitación del Ministerio de Comunicaciones de Canadá, fueron presentadas durante la Reunión.

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I. General Comments

The workshop papers, drawing as they do largely on the experience of a relatively few countries, must be interpreted merely as examples. It is not possible, on the evidence presented in these papers alone, to draw conclusions or suggest solutions which would be applicable globally. The fact that the countries reported on are at varied stages of economic and telecommunications development further compounds the difficulty of drawing general conclusions.

Some common themes do, however, emerge; this summary will highlight these themes and the major issues discussed at the workshop.

II. Perceived Benefits

A number of papers suggest that improved telecommunication services could facilitate a range of benefits:

1. Greater decentralization of economic activity and improved efficiency of the market signal mechanism would benefit both producers and consumers and could facilitate creation of cottage industries in rural areas.

2. Better access to a variety of services, including education, health care, police, emergency services.

3. Some papers suggest telecommunications development as a means for political, cultural and economic integration.

4. Social benefits: increased contact with family and friends, and the general enhancing of the social fabric of a nation.

5. As a component in the development of an adequate infrastructure in rural areas, the provision of telecommunication services may help stem the tide of rural-urban migration.

6. Improved agricultural production, through better access to information, including weather forecasts.

7. Improved institutional communication can permit increased productivity, better management and administration, and greater structural and locational flexibility.

8. Telecommunications may be the least-cost way of responding to a society's communication needs.

III Constraints

The papers identify several constraints on the development of telecommunication services in isolated and underprivileged areas:

1. Physical characteristics, or geographical and climatic barriers.

2. Settlement patterns - often a low population density results in great distances between settlements.

3. Financial constraints, including overall shortage of capital and foreign exchange constraints.

4. Lack of supporting infrastructure, which together with equipment maintenance problems leads to poor quality of service and, in turn, low credibility from the viewpoint of the users.

5. Lack of user awareness of the system's availability and/or understanding of how to use it.

6. Lack of adequately trained manpower, of adequate data on rural areas which are needed to accurately forecast demand, and of adequate land surveys, all of which results in inadequate planning.

IV. Solutions

Several papers refer to a growing awareness of the importance of telecommunications in the development of rural areas, and describe various methods and plans undertaken by different countries to deal with the telecommunications aspect: rural telecommunications commissions, central coordinating agencies, and the like.

The identification of problems and constraints leads to discussion of possible solutions:

1. Equipment should be carefully selected to allow for flexibility, reliability, ease of maintenance, compatibility, and appropriateness in relation to users' lifestyle.

2. Training and hiring policies should be adopted that would ensure availability of qualified personnel, particularly in the areas of planning and equipment maintenance.

3. There must be recognition of the need to consult with user groups in planning telecommunication services and systems, in order to ensure relevance, and to respect the social and cultural identity of the users.

4. There is general agreement that telecommunication service to remote and/or underprivileged areas should not have to be self-financing. Many papers recommend some form of cross-subsidy scheme within the telecommunications sector; the point is also made, however, that such schemes may force the telecommunications authority to assume a policy responsibility which may not be in its mandate and for which it may not be equipped.

   Other financial aspects discussed in the papers include the influence of tariff levels on system utilization; the suggestion of relating prices to users' income level; and the approach of raising prices to ration available supply.

5. There must be a deeper study of the role of telecommunications in the development of isolated and underprivileged areas, with particular emphasis on the measurement of benefits.

This last point is made in several papers, and indeed may be considered as the main recurrent theme of the workshop; if governments and planners are to be convinced of the virtues of investment in telecommunications, they must be shown evidence of its positive effects.

ANALYSE SOMMAIRE

I Observations générales

Les documents présentés au cours de l'atelier, ne portant dans l'ensemble que sur l'expérience de quelques pays, doivent être considérés à titre d'exemples seulement. En effet, il est impossible en se basant uniquement sur les faits qui y sont contenus, de tirer des conclusions ou de proposer des solutions applicables de façon universelle. En outre, comme les pays qui font l'objet de ces rapports ne sont pas tous au même stade de développement sur les plans de l'économie et des télécommunications, il est encore plus difficile d'en tirer des conclusions générales.

Toutefois, un certain nombre de constatations communes se dégagent de la plupart des travaux présentés. L'analyse qui suit les mettra en lumière et traitera également des principaux thèmes étudiés dans le cadre de l'atelier.

II Avantages perçus

Un certain nombre de documents laissent entendre que l'amélioration des services de télécommunication pourrait donner lieu aux avantages énumérés ci-après:

1. Une plus grande décentralisation de l'activité économique et une efficacité accrue du mécanisme d'indicateur de marché qui seraient avantageuses pour les producteurs et les consommateurs et pourraient faciliter la création d'industries artisanales dans les régions rurales.

2. Meilleur accès à différents services, y compris les services d'enseignement, de santé, de police et d'urgence.

3. Moyen d'intégration politique, culturelle et économique, comme le laissent entendre certains documents.

4. Avantages sociaux: contacts plus nombreux avec la famille et les amis et amélioration générale de l'identité sociale d'un peuple.

5. La prestation de services de télécommunication étant un facteur susceptible de favoriser le développement d'une infrastructure suffisante dans les régions rurales, ralentissement de la vague de migration des populations rurales vers les centres urbains.

6. Production agricole améliorée, grâce à un meilleur accès à l'information, y compris les prévisions météorologiques.

7. Amélioration des communications institutionelles, ce qui peut permettre un accroissement de la productivité, de meilleurs services de gestion et d'administration et une plus grande liberté de choix quant à la structure et à l'emplacement.

8. Moyen le moins coûteux de répondre aux besoins de communications d'une société.

III Restrictions

Les documents identifient plusieurs obstacles au développement des services de télécommunication dans les régions isolées et défavorisées:

1. Caractéristiques physiques ou barrières géographiques et climatiques.

2. Schémas de peuplement - souvent, dans les régions à faible densité de population, les zones de peuplement sont séparées par de grandes distances.

3. Restrictions financières, y compris le manque général de capitaux et de devises étrangères.

4. Absence d'une infrastructure de soutien qui, jointe aux problèmes d'entretien du matériel, entraîne une mauvaise qualité de service, et détruit la crédibilité aux yeux des usagers.

5. L'usager n'est pas au courant du système offert et(ou) ne sait pas comment s'en servir.

6. Une planification insuffisante résultant d'un manque de main-d'oeuvre ayant reçu une formation appropriée, de la carence de données nécessaires pour mieux prévoir la demande dans les régions rurales et de levés de terrain suffisants.

IV Solutions

Plusieurs documents font état de l'importance croissante des télécommunications dans le développement des régions rurales et décrivent différentes méthodes et différents plans mis en oeuvre par divers pays pour s'occuper de l'aspect des télécommunications: commissions sur les télécommunications rurales, agences centrales de coordination, etc.

L'identification des problèmes et des obstacles rencontrés donne lieu à des discussions sur les solutions possibles:

1. Le matériel devrait être soigneusement choisi pour permettre la flexibilité, la fiabilité, la facilité d'entretien, la comptabilité et l'adaptation voulue au genre de vie des usagers.

2. Il faudrait adopter en matière de formation et d'embaûche des politiques assurant la présence d'un personnel qualifié, particulièrement dans les domaines de la planification et de l'entretien du matériel.

3. Il faudrait reconnaître la nécessité de consulter des groupes d'usagers au moment de planifier les systèmes et les services de télécommunication pour s'assurer que ces systèmes et services répondent bien au besoin et pour respecter l'identité sociale et culturelle des usagers.

4. Tous conviennent que les services de télécommunication offerts aux régions éloignées et(ou) défavorisées ne devraient pas être obligés de s'autofinancer. Bon nombre de documents déposés recommandent l'adoption d'une certaine forme d'interfinancement au sein du secteur des télécommunications. Cependant, il est reconnu également

qu'une telle méthode de financement pourrait obliger les autorités en matière de télécommunications à se charger de la formulation de politiques, responsabilité qui pourrait ne pas faire partie de leur mandat et pour laquelle elles ne sont peut-être pas préparées. Parmi les autres aspects financiers qui sont abordés dans les documents, mentionnons l'influence des niveaux de tarif sur l'utilisation des systèmes, la possibilité de fixer les prix en fonction du revenu des usagers et l'idée d'augmenter les prix afin de rationner les ressources disponibles.

5. Il faudrait effectuer une étude plus approfondie du rôle joué par les télécommunications dans le développement des régions isolées et défavorisées, en insistant particulièrement sur l'évaluation des avantages retirés.

Cette dernière question est soulevée dans plusieurs documents et peut, en fait, être considérée comme le thème principal de l'atelier. Si l'on veut convaincre les gouvernements et les agents de planification qu'il est important d'investir dans le secteur des télécommunications, on doit d'abord leur démontrer les avantages d'un tel investissement.

BREVE ANALISIS

I Comentarios Generales

Los documentos del seminario, que se fundamentan mayormente en la experiencia de un número relativamente pequeño de países, deben interpretarse simplemente como ejemplos. La evidencia presentada en estas ponencias no es suficiente para sacar conclusiones o sugerir soluciones de aplicación general. Además los países objeto de las ponencias se encuentran en fases distintas de desarrollo económico y de telecomunicaciones, lo que hace aún más difícil la formulación de conclusiones generales.

No obstante, es posible dicernir algunos temas comunes; este resumen subrayará dichos temas y los problemas más importantes discutidos en el seminario.

II Beneficios aparentes

Cierto número de ponencias sugieren que la mejora de los servicios de telecomunicaciones podría dar lugar a una gran variedad de beneficios.

1. Una mayor descentralización de la actividad económica, conjuntamente con un mecanismo más eficiente para determinar la condición del mercado, beneficiaría tanto a productores como a consumidores y podría facilitar la creación de pequeñas industrias artesanales en áreas rurales.

2. Mejor acceso a los servicios públicos, tales como educación, medicina, orden público y servicios de emergencia.

3. Algunas ponencias sugieren el desarrollo de las telecomunicaciones como medio para fomentar la integración económica, cultural y política.

4. Beneficios sociales: contactos más frecuentes con la familia y amigos, y una mejoría general de la fibra social de la nación.

5. Como componente para el desarrollo de una infraestructura adecuada en zonas rurales, la introducción de servicios de telecomunicaciones puede ayudar a detener el flujo migratorio del medio rural al medio urbano.

6. Mejor producción agrícola debido a un mejor acceso a fuentes de información, incluso pronósticos meteorológicos.

7. La mejora en les comunicaciones institucionales pueden permitir un aumento de la productividad, mejor gestión y administración, así como una mayor flexibilidad de estructura y emplazamiento.

8. Las telecomunicaciones pueden ser el modo menos costoso para responder a las necesidades de comunicación de la sociedad.

III Limitaciones

Las ponencias también identifican varios factores que limitan el desarrollo de los servicios de telecomunicaciones en zonas aisladas y económicamente subdesarrolladas:

1. Características físicas del terreno o barreras geográficas y climatológicas.

2. Naturaleza de los asentamientos humanos - frecuentemente une pequena densidad de población resulta en grandes distancias entre asentamientos.

3. Limitaciones financieras, que comprenden escasez global de capital y limitaciones en divisas extranjeras.

4. Falta de infraestructura de apoyo, lo que conjuntamente con problemas en el mantenimiento del equipo da lugar a un servicio de baja calidad y, a su vez, a un bajo coeficiente de credibilidad desde el punto de vista de los usuarios.

5. Falta de percepción por parte de los usuarios, sobre la disponibilidad del sistema y/o conocimiento de cómo usarlo.

6. Falta de mano de obra debidamente capacitada; de datos adecuados sobre las zonas rurales necesarios para predecir su demanda con exactitud; y de estudios topográficos adecuados, todo lo cual resulta en una planificación incompleta.

IV Soluciones

Varias ponencias se refieren a la creciente realización de la importancia de las telecomunicaciones en el desarrollo de las zonas rurales, y describen varios métodos y planes puestos en ejecución por diferentes países para tratar el aspecto de las telecomunicaciones; por ejemplo, comisiones rurales de telecomunicaciones, organismos centrales de coordinación y otros similares.

La identificación de los problemas y las limitaciones nos lleva a la discusión de soluciones posibles:

1. El equipo debería ser cuidadosamente seleccionado para que sea flexible, fiable, de fácil mantenimiento, compatible y apropiado en relación con el modo de vida de los usuarios.

2. Se deberían adopter políticas de empleo y capacitación que aseguren la disponibilidad de personas calificadas, especialemente en las esferas de mantenimiento de equipo y planificación.

3. Deberá reconocerse la necesidad de consultar con grupos de usuarios al planear sistemas y servicios de telecomunicaciones, con objeto de asegurar su pertinencia y el respeto a la identidad social y cultural de los usarios.

4. Los ponentes están generalmente de acuerdo en que el servicio de telecomunicaciones a zonas remotas y/o subdesarrolladas no tiene necesariamente que ser económicamente autosuficiente. Muchas ponencias recomiendan alguna forma especial de subvención dentro del sector de telecomunicaciones; no obstante también se subraya el hecho que tales planes podrían obligar a las autoridades de telecomunicaciones a asumir responsibilidades en el terreno de la formulación de políticas para las que no tengan mandato específico y para las que pudieran no estar equipadas.

Otros aspectos financieros discutidos en las ponencias comprenden la influencia de niveles de tarifas sobre la utilización del sistema; la sugerencia de relacionar los precios con los ingresos de los usuarios respectivos; y la posibilidad de aumentar los precios para racionar la disponibilidad de la oferta.

5. Se necesita un estudio más profundo del papel de las telecomunicaciones en el desarrollo de zonas aisladas y subdesarrolladas, con enfoque particular en la medición de beneficios.

Este último punto se subraya en varias ponencias, y sin duda puede considerarse como el tópico principal sobre el que se vuelve una y otra vez en el curso del taller; si de lo que se trata es de convencer a los gobiernos y a los planificadores de las virtudes y beneficios de la inversión en el sector de telecomunicaciones, se les deberá demostrar la evidencia de sus efectos positivos.

WELCOMING ADDRESS

BERNARD OSTRY
CANADA

Thank you Mr. Chairman. On behalf of the Department of Communications, the Government of Canada, and the Canadian Telecommunications family, I would like to welcome to Ottawa all participants in the Workshop and the important CCITT GAS/5 Working Group which will follow it. The fact that so many knowledgeable people have come to Ottawa from all parts of the world is evidence of the priority we all attach to extending the benefits, which telecommunications bring, to isolated and underprivileged areas of our countries.

I realize that in this type of Workshop I am, for the most part, preaching to the converted when I say that a basic telecommunications infrastructure, tailored to the real requirements of specific countries or regions, is essential to the process of development. I have, however, become sensitive to the fact that there is not enough hard socio-economic data to document what I consider to be this unchallengeable assertion.

Policy planners at the international level and in each of our countries must base policy decisions establishing development priorities on data which clearly demonstrate the dynamic impact of telecommunications. It is my expectation that this week's Workshop and Working Group will represent an important contribution to the international dialogue which is currently taking place on this crucial question.

For this reason, I am particularly looking forward to Professor Wellenius' keynote address which will set the theme for the Workshop even if it will be delivered by proxy since his arrival has been delayed by conditions which neither he nor we could control - the weather. I am sure that the subsequent detailed analysis of and exchange of views on experience in Latin America, Africa, Asia and Canada will permit us to take an overview and reach some conclusions by the end of the Workshop and Working Group session which will follow it.

I trust that the Wednesday morning session on the Canadian experience will be of interest by demonstrating how our country is proceeding to implement its priority goal of extending the benefits of telecommunications to its rural and remote areas. Although Canada is technologically advanced in the field of telecommunications, it will become apparent to you that, in bringing telecommunications to our rural and remote areas, we have a lot of problems in common with many developing countries, the solution of which will prove of benefit to us all.

I believe, however, that this week we should try to place our national preoccupations in a wider international framework. We should view our activities this week as part of an international effort to facilitate the broader process of development. Many organizations and agencies are participating in this effort - the ITU, the international lending agencies, the private sector, the Organization for Economic Cooperation and Development (OECD), the United Nations Development Program (UNDP), national planning agencies, and national development agencies such as CIDA. In my personal capacity, I am a member of the Board of Governors of UNESCO's International Fund for Cultural Development and at our next meeting in Paris in September I hope we will be looking at some communications projects that might assist the cultural interests of the developing world.

Indeed, during the discussions which the President of CIDA and the Minister of Communications had in Ottawa last autumn with the Secretary-General of the ITU, Mr. Mili, there was a recognition of the importance of ensuring that all such activities as yours today form part of a well-integrated attack on the problems of development. There was also agreement that in this strategy the real development priorities of each country and region must prevail. I can assure you that Canada is ready and willing to cooperate with other countries in the search for appropriate solutions to the telecommunication problems that face us.

It is in this spirit that I welcome you to what I know will be a week of searching, committed, informal and free-wheeling discussion. My Minister, Madame Sauvé, her Parliamentary Secretary, Mr. Crawford Douglas, M.P., and I hope to have the opportunity to speak personally with many of you during the more informal, social parts of your agenda. By the end of this week's meetings, I am confident that we shall have benefited from each other's experiences, and that the conclusions we reach will contribute to our common goals.

THE ROLE OF TELECOMMUNICATION SERVICES IN DEVELOPING COUNTRIES

BJORN WELLENIUS
CHILE

INTRODUCTION

By kind invitation of the Canadian Department of Communications, we are here to use three days in looking into telecommunications in the context of the world's least privileged areas, from economic, social, technical and institutional viewpoints.

The Workshop's agenda, and the very fact that it has been convened by a major industrial nation, are expressions of the fact that there is no firm dividing line between so-called developed and developing countries. Consequently, it is entirely appropriate that both will be considered in scheduled papers and discussions.

However, since the focus is on the underprivileged, we should look especially at the developing countries. And, within these, to the least affluent of their people.

Thus, it is probably useful that I organize this introductory address along a line of thought that leads from concepts of underdevelopment and poverty, through telecommunication services' organization and performance in developing countries, to a discussion of the roles of telecommmunications in relation to the objectives of development, giving more than average attention to the rural areas.

DEVELOPMENT, UNDERDEVELOPMENT AND POVERTY [1-5]

Economic growth, defined as a sustained increase in total national income or in national income per inhabitant, is a relatively recent phenomenon in world history. It is closely related to the industrial revolution which took shape first in Britain in the 18th and early 19th centuries, subsequently followed in Belgium, France, Germany and other European countries, and by their overseas descendants mainly in North America and Australia.

With industrialization, the average individual for the first time saw his income rise substantially during life. Long-term growth of gross domestic product increased from less than 0.5% *per annum* (a doubling in 140 years or more) to 2.0% *per annum* or more (a doubling in 35 years or less). The advent of industrial economies was accompanied by rapid changes in social structure and organization and by increased awareness of the role of individual decisions in economic processes.

The emergence of an industrial nucleus in 18th-century Europe has deeply influenced the evolution of the world's economy and ways of life, mainly in three directions.

First, in Western Europe, industrialization resulted in substantial increases of productivity, initially liberating a large supply of labor. Rapid economic growth followed, sustained by continued technological innovation, well beyond the full utilization of this surplus.

Second, away from Western Europe, labor, capital and technology moved towards sparsely occupied land with abundance of natural resources. In this phase, the American, Canadian and Australian economies were mainly extensions of the European economy, and high standards of living were soon achieved.

And third, the industrial economies moved into places already occupied, some very densely populated but all with pre-capitalistic economies. The clash between expanding industrialism and ancient structures developed in a variety of ways, depending on specific circumstances. In some case, interaction was limited to opening up new lines of trade, supported by the great expansion of maritime transportation facilities. In others, it was addressed to develop the production of raw materials, the demand for which rose enormously in the industrial countries. In general, this interaction resulted in the emergence of dual economies, in which modern enclaves developed in the context of otherwise traditional societies. It is essentially this dual type of economy which constitutes the phenomenon of contemporary development.

One outcome of this unique historical process is that sustained economic growth in the 19th and 20th centuries has been confined mainly to countries which had already achieved a certain measure of industrialization, or are peopled by communities which had an industrial revolution passed on to them as a heritage from their European ancestors. Thus, in 1974, 30% of the world's population, mainly Western Europe, its overseas descendants in America and Australasia, the USSR and Japan, earned 82% of the world's income with an annual average US $ 4,000 per capita. In contrast, the remaining 18% of the world's income was earned by 70% of its population, averaging only US $ 360 per capita.

The low average income tends to be associated with low levels of technology, high illiteracy rates, low standards of education, health, food and housing, low saving ratios, high population growth rates, and often inefficient public administration and political instability. Hence the broad distinction between so-called "developed" countries, which are relatively few, industrial, wealthy and enjoy high average standards of life, and "developing" countries, numerous, typically with relatively primitive economies, poor, often with unacceptably low average quality of life. Under the category of developing countries, normally more than 100 are counted. Although there is no neat division between developed and developing nations, most of the countries in Africa, Asia and Latin America are separated from most of those in Europe, North America and Oceania by a wide gulf, whether one considers income per head, social conditions, demographic characteristics, or the structure of production.

However large may be the differences between developed and developing countries, the diversity among the latter is even more impressive. Population varies from over 500 million (India) to about half a million (Gabon). Average population density in Bangladesh is almost 50 times as high as in Brazil. The private sector is heavily relied upon in some countries and the public sector in others; the majority of the economies lie between these extremes, but public utilities and heavy industries tend to be state-owned. Some developing countries are heirs to long-established and sophisticated cultures, while others contain the world's most primitive peoples. Many have only recently become free of colonialism, while others reached that stage almost two centuries ago. The capacity to absorb political and economic change varies widely. There are enormous differences in incomes: in 1972, Argentina's gross national product was US$ 1,300, about 20 times that of Upper Volta, Rwanda or Burundi; whereas in some countries most of the people live on the brink of subsistence, in others minimum acceptable conditions are - or could be - enjoyed by all. Likewise, there are large differences in product composition; the great majority, however, depend heavily on agricultural production, which though increasingly directed towards commmercial forms is still predominantly a subsistence activity. There are huge differences in economic potential: whereas some developing countries seem to have the physical resources to build a great power, others have virtually no base for sustained growth in the foreseeable future.

Development problems, then, vary greatly from country to country, and there is a wide range of national development objectives and strategies. Despite this diversity, however, common purposes are found across almost all developing countries: to eradicate extreme poverty and ensure minimum levels of food, housing, health and education to every person, to increase average income at a rapid and sustained pace, to attain greater equity in the participation in the development effort and in the distribution of its benefits, to broaden the opportunity for choice.

Let us look more closely at the least well-off within these countries.

Poverty can be perceived from two points of view. On the one hand there is absolute poverty, defined by income levels below which even minimum standards of nutrition, shelter and personal amenities cannot be maintained. On the other hand there is relative poverty, reflecting extreme differences in standard of living between the most and least affluent groups of society.

There is no uniquely correct way to measure the extent of poverty, but setting arbitrary limits serves the purpose of providing orders of magnitude. The World Bank estimated that in the mid-1970s, 750 million people or 40% of the developing countries' population are poor. These comprise about 550 million absolute poor, with annual incomes equivalent to US $50 or less (1969 dollars), and some 200 million relative poor, with incomes below one-third of the national average income of the countries they live in.

Of the total 750 million poor in the developing countries, 600 million (80%), including virtually all the absolute poor, live in rural areas. 40% of all people in these countries' rural areas are poor. Improving the lot of rural areas is thus central in any development effort.

Rural poverty is more severe and intractable in some countries than in others.

The most difficult circumstances are those in which extensive rural poverty is combined with low levels of mobilizable resources. Countries in this situation include all the South Asian nations, many of the larger African countries such as Ethiopia, Sudan and Tanzania, and a few Latin American and Caribbean countries such as Bolivia and Haiti. Rural development is the major development problem faced by these nations.

At the other end of the scale are countries with pockets of rural poverty, varying in extent and intensity, but with resources adequate to deal with the problem, provided the political commitment is made. In this group are Iran, Argentina, Malaysia and Yugoslavia, among others.

In an intermediate category are countries with relatively extensive rural poverty but no inconsiderable resources to deal with it. This group includes petroleum exporters such as Indonesia, Nigeria and Algeria, middle-income countries such as Brazil, Colombia and Mexico, and moderately poor countries such as Thailand, Korea and the Philippines.

TELECOMMUNICATIONS IN THE DEVELOPING COUNTRIES[6]

The telecommunication sector in developing countries mainly consists in one, two or occasionally more operating companies that provide public and leased services; a small number of networks meeting specialized communication requirements of the armed forces, police, railways, power utilities and some other large organizations; and one or more bodies performing technical and economic regulatory functions. Several countries have some manufacturing of telecommunications equipment and materials, but only a few have achieved significant degrees of self-reliance.

The developing countries' share of the world's telephones is even lower than that of its income. In 1972, Latin America, Africa (excluding South Africa) and Asia (excluding Japan), which consists mainly of developing countries, had an average telephone density of 0.8%. In contrast, North America, Europe and Oceania, where most countries are industrial, averaged 27.1%, 34 times as high. The differences among developing countries are even greater. The ratio of telephone density in the better-off countries (e.g. Argentina, 8.1%) to that in the poorest (e.g. Upper Volta, 0.03%) is a staggering 270:1.

Starting from such modest levels of penetration, and typically with substantial unmet market demands, telecommunication services in developing countries expand at very high rates. Compared with the usual 5-7% found in Europe and North America, developing countries commonly grow at 8% or more and several are capable of sustaining 18 or 20%. However, despite high growth rates, telecommunication companies are seldom able to catch up with demand. Although in exceptional countries most new applications for telephones can be met within a few months or less, waiting lists are typically equivalent to 2-10 or more years of past net new lines added to service.

One of the effects of this large gap between supply and demand is that important proportions of potential subscribers do not care to apply, although they are willing to pay the applicable connection and rental charges. The waiting lists thus do not reflect fully the magnitude of unmet demand, and a large part of it tends to remain hidden.

Partly the result of shortages of telephone connections (which lead to many users per main telephone), and in some countries also due to flat-rate pricing and to peculiar speech habits, traffic offered per subscriber tends to be exceptionally high. This results, among other effects, in high proportions of call attempts failing because the other telephone is engaged. Repeated call attempts aggravate the situation. As a consequence, in a number of developing countries the probability of a call attempt being successful is very low, sometimes 20% or less.

Although difficult technical problems are often present, the limitations on the rate at which the developing countries can expand and improve their telecommunication services are mainly institutional and financial in nature.

On the one hand, the relationships between the operating companies and the various government agencies that have legitimate interest in influencing them, are often too involved and cumbersome. Besides, the companies' capability to undertake large expansion projects while ensuring adequate maintenance and operation is often constrained by availability of experienced top- and middle-level engineering and management staff and by inadequate organization structures.

On the other hand, developing countries typically have little telecommunication manufacturing and persistent balance of payments deficits. Telecommunication programs, always intensive in highly industrialized equipment and materials, thus have to compete fiercely with all other sectors of the economy for the country's limited foreign exchange resources. Therefore, although surpluses from telecommunication operation can be quite large (since the broad gap between supply and demand gives considerable freedom in setting tariff levels), they often cannot be reinvested within the sector as needed, and are transferred to other parts of the economy, less intensive in imports. Long term international financing of telecommunications' foreign exchange requirements is often the only viable solution, but sources are very limited.

THE ROLE OF TELECOMMUNICATION IN DEVELOPMENT

The Communication Pattern

The introduction of telecommunication services in a region alters considerably its patterns of communication. Three types of phenomena take place: some substitution of alternative means, when these exist (mainly transportation, post and telegraph); some generation of new communications, which would not have developed in the absence of telecommunication facilities; and some new requirements on other communication means (notably transportation) as a consequence of the overall increase in the intensity and variety of interaction brought about by telecommunication.

For example, a survey of urban Chilean households in 1970 showed that, regarding communication among members of the family and with friends and kin, availability of the residential telephone tends to result in a partial substitution of the use of letters and telegrams by long distance telephone calls, a considerable number of telephone calls that constitute new communication events, and a net increase in visiting frequency. On average, families with telephone had more than three times as many of these communications per unit as those without telephone.

<u>The Benefits from Telecommunication</u>

What are the likely benefits arising from the introduction of telecommunication service?

With telecommunications, some of the physical constraints on organizational communication can be removed in all sectors of the economy, permitting increased productivity through better management and administration, making it possible to adopt different structures and locations, and contributing to the evolution of increasingly complex and large organizations.

Markets gain in effectiveness with improved communication, fast responses to market signals become possible, and coverage can be extended at city, regional, national and worldwide levels.

The efficiency of household operation rises as telecommunication allows improved access to goods and services. Forms of work are supported in which complete segregation of workplace and residence is not desirable. The well-being of the family is assisted by telecommunications, with the provision of rapid access to services needed for the preservation of life, health and property, and with enhanced contact with kin, friendship and special interest groups.

Telecommunication contributes to the development of a shared communication environment reaching the country's remotest spots, and is a means for political, cultural and economic integration.

Thus, <u>benefits arise from telecommunication services' contribution to the country's infrastructure, numerous production and distribution functions, and quality of human life.</u>

Surprisingly enough, very little has been done to obtain quantitative information on the relative intensity and importance of these uses and effects of telecommunications in developing countries. The little there is, however, tends to support the preceding expectation.

For example, the Chilean survey of urban households to which I have already referred, shows that the family uses the residential telephone to a considerable extent to participate in the community's economy. This is mainly through calls related to a profession or occupation normally conducted away from the home (e.g. doctors, nurses and midwives being reached during night by patients or hospitals); calls to identify, search, select or order goods or services necessary for the household's day-to-day operation (e.g. order fuel, book theatre seats); and emergency calls (e.g. ask for medical assistance, police or fire brigade). However, the residential telephone is dominantly used to communicate with members of the family out at work and with kin and friends: more than two-thirds of the subscribers identified these social uses as the most frequent objectives of their residential calls. The pre-eminence of social uses, and the lower but very significant frequency of economic uses, are characteristic of residential subscribers found in Chile across a wide range of city sizes, economic activities and telephone densities.

Likewise, preliminary results from a pilot study of rural public long distance telephones in Chile indicate that calls divide into roughly equal proportions of economic and social uses, both in a prosperous, commercial fruit-growing area and in a depressed, drought-prone zone of subsistence agriculture and small-scale mining.

<u>Telecommunications and Development</u>

How important are these effects of telecommunications, in relation to development?

Development is closely related, historically and functionally, to the growth of urban centres and the diffusion of typically urban forms of political structure, business and government, public services, technology, attitudes and ideas. Abundance of formal organizations, occupational and spatial specialization and mobility, competition as a basis of economic and social behavior, families reduced in size and function to their essentials, reliance on voluntary association in the pursuit of individual interests, and the need for indirect communication and decision-making, are characteristics closely related to communication behavior that are found at the roots of both development and urbanism.

As a region or country develops, it is increasingly held together as a functional whole by relationships that reflect independence of individual ends, product-orientation, impersonality, fragmentation and formality. These relationships typically take place across large distances, among many potential participants, and in short and/or infrequent episodes.

Telecommunication services are an effective means to realize a large proportion of the communication events that tend to arise under these conditions. Often they are also less costly than alternative communication means in terms of time, energy, materials and quality of the environment.

Hence the proposition that telecommununication services are an effective and efficient means for development. Given certain performance standards of the economy and the society as a whole, it may further be claimed that <u>telecommunications are a necessary condition for development.</u>

This, which is intuitively obvious to many, especially to those who spend their lives working in telecommunications in the developing countries, is by no means a generally accepted proposition. For example, national development strategies, which normally refer to other infrastucture such as roads, ports, electric power and water, very rarely mention telecommunications.

RURAL TELECOMMUNICATIONS

In the mid-1970s, roughly 70% of the developing nations' population was rural. However, the rural areas' share of telecommunication services is typically well below national averages.

For example, in Chile (a country with relatively widespread services), all cities with more than 50,000 inhabitants have telephone exchanges, with average main telephone density of 6.4%. In contrast, only one-fourth of the settlements with 500 inhabitants or less have telephones (mostly limited to a single public long distance station) and density averages 0.6%, only one-tenth of that in the cities.*

The slower than average progress of telecommunication services in the rural areas reflects a preference to concentrate the scarce resources available for telecommunication investment in the big cities and in the interurban and international routes. Whereas this probably results in the greatest economies of scale and highest financial returns, the services are available to only a small proportion of the country's population, benefiting mainly the modern sectors of the economy and the more affluent strata of society, while often failing to meet even the most basic development requirements of the rural areas, which includes most of the country's poor.

This classical pattern of telecommunication development stems in part from difficulty in installing and maintaining conventional equipment in places with limited road access and no reliable or permanent electric power supply, and from the virtual impossibility of meeting modern national service standards in outposts that are far from the established urban and interurban main networks. To a considerable extent, however, slow development of rural telecommunications can be traced to the fact that it is often financially unattractive: whereas average annual return on telecommunication investment may typically be 10 to 20%, with international services yielding over 100% and interurban services somewhere in between, the revenues from rural projects often fail to even meet operating expenses.

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* Although classifying settlements as rural on the basis of population size alone is arbitrary, large numbers of inhabitants is so pre-eminent a characteristic of urbanism that it may be taken as a rough classification criterion. This is also convenient in practice, since censuses generally draw the line between urban and rural in terms of population size, adding administrative and other criteria to handle special categories of places and to define the boundaries of the settlements.

There is, however, some awareness of the need to invest in rural telecommunications, even if at a loss.

For example, in India, rural public long distance telephones are installed, provided revenues from them are forecasted to cover at least 25% of operating expenses. Further, this threshold is reduced to 10-15% for places of importance in specific economic and social development projects, with administrative, pilgrimage or tourist significance, with large population or difficult access, or far away from served areas. In the last decade, roughly 10% of India's telecommunication investment has been in rural areas, in recognition of telecommunication's importance as part of development infrastructure, and partly also under the expectation that traffic will gradually build up to levels at which some stations may be replaced by profitable small-exchange service.

How much of a developing country's telecommunication investment should go to rural services? This is part of the more general problem of defining adequate program composition and balance, with economic efficiency in the use of scarce resources being a prime consideration, but also including income redistribution and other non-economic objectives of development, whenever possible.

Resource allocation within the telecommunication sector partly relies on market forces, to some extent corrected for wrong or insufficient signals. Wrong signals, from the viewpoint of economic efficiency, result for instance from large distortions in the general price system (mainly in the prices of labor, capital and foreign exchange). Insufficient signals occur, for example, when telecommunication tariffs are regulated well below market equilibrium levels, resulting in large and persistent gaps between supply and demand. In recent times, theoretical and practical arguments have developed in favour of increasing the role of market forces in the allocation of scarce telecommunication growth capability. Essentially this means passing the allocation problem down from the operating company to the users, as far as possible.[7]

The use of market forces to direct rural telecommunication investment requires a clear answer to the question: who must pay for telecommunication service in these areas? This is a question to be answered by national or regional development planners, not telecommunication company managers.

Some rural users may be expected to pay for the full cost of service. This category could include, for instance, medium and large agroindustries, large farms, and resorts for affluent urban dwellers.

Other users may have to be subsidized in order that specific development programs may succeed. This could be the case, for example, of farmers cooperatives participating in a government program to transform agriculture from subsistence to commercial forms, which requires telecommunication with wholesale markets, with supplies of seeds, fertilizer and insecticides, and with financial and technical assistance organizations.

Finally, some service may have to be provided free. For example, governments tend to undertake the responsibility of giving every inhabitant at least minimum access to emergency services and government authorities, and to some other facilities, irrespective of the individual's income and thus of his or her willingness to pay for the associated communication means.

The key point, then, is this: who provides for these subsidies? In practice, subsidies are generally financed internally in each telecommunication operating company by surpluses from the more profitable services (e.g. interurban and international). This has the disadvantage of imposing economic development, social and political responsibilities on a public utility, which conflicts with its essential task of providing service efficiently. It also tends to dilute the government's control on development and welfare, or leads to interference with the telecommunication companies' management.

Therefore, if allocation problems are to be kept within manageable proportions by relying substantially on market forces across the whole range of telecommunication services, rural included, it may be best to leave to the operating companies only the task of providing service on a commercial basis, and let subsidies be financed directly by the programs that give rise to their need. This places the allocation responsibility on those who, by policy or practice, are expected to take the decision on whether and with what intensity telecommunication services should be used.

This removes allocation problems from the telecommunication companies to the variety of users of its services. It still does not tell the latter, when they are organizations or programs rather than individual homo economicus, what telecommunications they should have, although judgement is likely to be more accurate at this level than when performed by essentially unrelated telecommunication company staff.

CONCLUSION

Underdevelopment is a historically specific situation, jointly comprising industrial and preindustrial countries, and not a stage in the process of modernization and growth of traditional economies. Today's industrial nations never were underdeveloped, in the contemporary sense of the word. Likewise, telecommunications in the developing countries have characteristics and pose problems of their own, which bear little resemblance to the industrial nations' early or present experience in this sector.

Telecommunications are necessary for development. However, the developing nations' share in the world's telecommunication services is disproportionately low. Despite exceptionally high telecommunication growth rates, developing countries typically are unable to meet large outstanding demands in the near future. Limitations to faster progress in this sector, mainly financial and institutional, can only be overcome in the long term.

Under consequently large pressures from the modern sectors of the economy and the parts of society that participate in them, the rural areas, typically containing most of the country's people and an even larger proportion of its poor, obtain a far lower than average share in telecommunication investment.

The usual procedures followed to allocate limited telecommunication growth capability are unlikely to result in efficient use of these resources. Further, telecommunication utilities are given social and other responsibilities for which they are not the most suitable agents and which conflict with their prime function of providing service efficiently.

Obtaining a right balance in telecommunication's contribution to the various economic, social and other objectives of development as seen by each country would probably benefit from clearer separation of responsibilities between the telecommunication operating companies and other entities; from moving closer to market forces by, among other things, having the individuals and organizations who are expected to decide on the use of telecommunication pay the full cost of these services; and from getting to know considerably more than we do today, about the relative importance of telecommunication uses and impacts. The latter requires some further effort towards consolidating a suitable interdisciplinary framework, and above all a growing body of organized experience, including empirical economic studies preferably carried out against such a backdrop.

We are still rather far from mastering well the use of telecommunication as a means for development.

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CONSIDERACIONES SOCIALES EN LA PLANIFICACION DEL DESARROLLO DE LAS TELECOMUNICACIONES EN LAS REGIONES DISTANTES Y DESFAVORECIDAS

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Las implicaciones sociales que involucran la planificación de Telecomunicaciones son de alta importancia, en especial en países en desarrollo y cuando ellas se establecen en áreas distantes y desfavorecidas.

La realidad que vivimos es la de no tener experiencia suficiente en este aspecto, precisamente porque el desarrollo de las Telecomunicaciones ha llegado en una mínima expresión a dichas áreas.

Por ejemplo, México es un país con una población de 65.9 millones de habitantes, con una extensión de 2 millones de kilómetros cuadrados y con un total de asentamientos humanos del orden de 104,000.

Presenta un alto crecimiento de población (3.2% anual), una gran concentración urbana y una marcada dispersión rural. Existen más ó menos 90,000 localidades (± 86%) con una población inferior a 500 habitantes; unas 12,000 (± 12%) localidades con población fluctuando entre 500 y 2,500 habitantes y como 2,000 (± 2%) con más de 2,500 habitantes. Se distinguen dos medios: el urbano (2,000 localidades) y el rural (102,000).

Sin embargo, el 60% de la población se localiza en el medio urbano y el 40% de ella en el medio rural.

Cabe hacer aquí la aclaración de que no existe una bien definida frontera para el medio rural. En México en general se ha formado por las poblaciones de menos de 2,500 habitantes, idéntico al de la ONU, pero otros organismos sugieren diferentes valores.

De los servicios de telecomunicación que pueden ponerse a disposición del usuario final, el telefónico es el más conveniente para auxiliar al medio rural como elemento fundamental para la productividad, así como la integración económica y social de ese medio, debido a su fácil manejo, su privacía, su inversión relativa, su universidad y la flexibilidad de su estructura tarifaria. Por ello se mencionarán algunos aspectos inherentes.

De las 104,000 localidades que existen en México, sólo alrededor de 4,000 disponen del servicio telefónico, aunque es cierto que el 55% de la población vive en ciudades con este servicio (figura 1), lo que permite tener una densidad telefónica de 5.6, resultante de los casi 4 millones de aparatos existentes en el país, de los cuales el 97.3% tienen servicio automático.

Esta situación, aunada a otras de diversa índole, ha influído en la creación de varios fenómenos, el principal de los cuales es el de la marcada migración de las áreas rurales a las urbanas, propiciando que el campo pierda fuerza de trabajo que se translada a las ciudades buscando mejores condiciones de vida.

Por ello el Medio Rural, que equivale a las Regiones Distantes y Desfavorecidas, se encuentra en una situación delicada; su productividad ha disminuído debido al éxodo de su población productiva y además aquélla que se ha aferrado a su lugar de origen, carece de los servicios públicos en general.

Por lo anterior es que se sostiene la tesis de que el desarrollo de las Telecomunicaciones en esas Regiones tiene un fuerte contenido social, aunado al apoyo que significa a las actividades de producción.

Al llegar la telefonía, el usuario rural tendrá la posibilidad de comunicarse en forma inmediata para la consecusión de servicios de salud, de seguridad, de relación familiar; no tendrá que desplazarse para enterarse de las situaciones que le interesen y sumado a esto, se valdrá de este medio para transacciones comerciales más justas y oportunas al conocer el mercado y tener la posibilidad de negociar a distancia la venta de sus productos. Permitirá, asimismo, el aviso oportuno sobre catástrofes.

Será en consecuencia un incentivo para el arraigo del habitante de Regiones Distantes y Desfavorecidas, permitiendo que también se eviten ó minimicen los hacinamientos humanos que se detectan en las grandes urbes. Es decir, será una herramienta para que la planeación de los países sea más equilibrada demográfica y productivamente.

No debe pensarse, sin embargo, que el desarrollo será utópico y una panacea para todos los males. Por el contrario, es necesario manejarlo con suma cautela, en especial cuando el desarrollo se enfoque a medios masivos de comunicación como son la radio y la televisión.

En México se han tenido experiencias amargas cuando la televisión alcanzó regiones que no conocían ni la electricidad, originando comportamientos deformados y negativos de la población. Se debe evitar que la programación no transtorne la mentalidad original del auditorio, rompa moldes o choque con las costumbres.

Bien dirigida la programación de la televisión, vuelve a ser una herramienta sensacional que educa, lleva cultura, información y diversión. Para que llegue a los núcleos seleccionados, no debe depender únicamente del cubrimiento de la infraestructura básica de Telecomunicaciones, sino que se deben diseñar aquellos ramales que tengan la configuración apropiada a las necesidades de las Regiones Distantes y Desfavorecidas.

Una actividad que será relevante al aprovechar los medios de comunicación, será la de aleccionar a la población para que cuide su salud, su alimentación y se le prepare en conocimientos de métodos modernos para su actividad productiva, sea ésta la agricultura, la agropecuaria, la explotación maderera u otras.

El actual gobierno mexicano, consciente de estos principios está dando un apoyo decidido a las Regiones Distantes y Desfavorecidas, por lo que la Administración de Telecomunicaciones se ha echado a cuestas la tarea de elaborar un Plan Nacional de Telefonía Rural con un horizonte a 10 años y contemplando la posibilidad de comunicar a 12,000 localidades que tengan una población de 500 a 2,500 habitantes, que estén electrificadas y que algún camino permita el acceso a ellas.

Como es natural, se ha tropezado con el fenómeno repetitivo en varios de los países, en el sentido de no disponerse de la información completa, adecuada y actualizada. Las carencias en este renglón se han subsanado en parte a través de encuestas en áreas en las que la falta de datos es mayor.

Los estudios que se realizan, culminarán en breve con el Plan mencionado, una vez que se optimice el medio de enlace para cada localidad.

Así como seguramente se tratará en la discusión de este tema, desde el enfoque económico que mencionará la evaluación cuantitativa de sus resultados, se presenta obligada la urgencia de aportar datos que establezcan un método que ilustre los beneficios sociales desde el punto de vista tanto cualitativo como cuantitativo.

Se estima indispensable el establecimiento de un sistema tarifario conveniente, para que no impacte la economía, por lo regular raquítica de los pobladores de las Regiones Distantes y Desfavorecidas.

Esto apoya una vez más el principio de que el desarrollo del tipo de redes que nos ocupa, obedece más a razones de tipo social que de tipo económico ó comercial. Es obligación de los gobiernos llevar la comunicación a estas unidades de población carentes de algunos privilegios modernos de bienestar social. Este servicio sin duda será un apoyo para el establecimiento de otros servicios públicos que conformarán mejores condiciones de vida en el medio rural y a la larga acabarán con la imagen distorsionada del supuesto encuentro de comodidades en el medio urbano, que por lo regular para los emigrantes resultan en condiciones de vida infrahumana en los "cinturones de miseria", como consecuencia lógica de su preparación inferior. Esto, por otra parte, origina el problema de suministro de servicios en las urbes que así experimentan un crecimiento incontrolable.

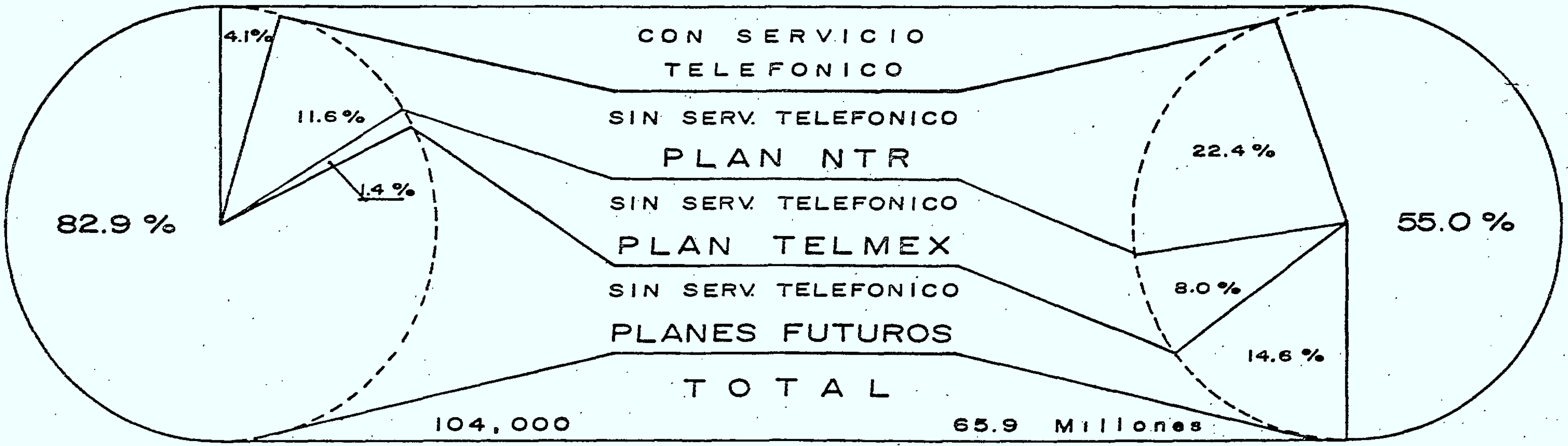
Este problema es una preocupación mundial y, por ello, receintemente se adoptaron las políticas de Asentamientos Humanos en la reunión HABITAT, celebrada por coincidencia feliz, en Canadá en 1976.

Figura 1

PANORAMA GENERAL DEL SERVICIO TELEFONICO EN MEXICO

LOCALIDADES

POBLACION



TELECOMMUNICATIONS DEVELOPMENT IN
ISOLATED AND UNDERPRIVILEGED AREAS
BRAZILIAN EXPERIENCE

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1. Introduction

Some Brazilian regions could be defined, in a larger or lesser scale, as isolated and underprivileged areas, whether viewed through the angle of their physical, geographic and climatic characteristics, or through the angle of their economic and social development.

Therefore, with the purpose to present this subject as objectively as possible, this paper will emphasize the description of the Amazonic characteristics and the Brazilian experience in the installation of telecommunication systems in that area. Some economic aspects involved with the planning development of these systems will also be shown.

It is also necessary to mention that, in order to smooth the effort of collecting data and information to produce this document, Amazonia was considered restricted to the geographic area defined (politically) as the "northern region" (figure 1), formed by the States of Pará, Amazonas, Acre and the Territories of Roraima, Rondonia and Amapá. The official Amazonia would include part of the States of Mato Grosso, Goiás and Maranhao as well (figure 2).

2. Geo-physical Characteristics of Amazonia

The classic Amazonia coincides with the Brazilian northern region. It presents an approximate area of 3.5 million square kilometers (table 1), which represents 42% of the Brazilian territory (figure 2) and bears a population of about 4.5 million inhabitants.

The Amazon River, its tributaries and sub-tributaries dominate almost the whole landscape, forcing peculiar forms of social and economic organization to the people who live in urban and rural areas near the rivers, lakes and bays. This net of rivers represents a fundamental and important element to the folk of said region. The Amazon River, navigable through 2/3 of its length of 3,300 Km in Brazilian ground, forms together with plenty of other rivers, a huge hydrographic basin, an enormous hydrowaynet, which is used by thousands of boats of the most varied kinds: from the simplest ones to the great international vessels.

Concerning the region's relief, same presents itself with varied irregularities of ground, with a predominance of plains and low plateaus. A contrast may be observed in the Amazonic regions: from one hand, we can detect the existence of large mountains, at the north end, where there stands the noticeable "Pico de Neblina", 3.014 meters high, being the highest peak of Brazil; at the other hand, we have huge surfaces of low lands, where heights are no bigger than 10 m above sea-level.

The prevailing weather in this region is warm with a great deal of moisture. Its average temperature is 25 degrees Celcius. Precipitation is about 2,000 mm. Rains occur throughout the year, being more intensive from December to June. The average humidity is 82%.

The Amazonian region is covered, up to our days, by a primeval tropical forest, which extends over 70% of its territory, (about 30% of Brazil's surface). The Amazonic forest formations constitute the biggest moist forestal area of the world.

3. Brief History of the Region's Development

Between 1850 and 1910, Amazonia experienced a glorious time, on account of the top intensity occurred with rubber affairs. At the last century's end, it reached the position of the highest contributor of exchange income to the Nation.

Trading directly with the more important European centers, this region began to enjoy a privileged situation due to the wealth generated by rubber extraction of native rubber trees. The surge of rubber produced in the East was really ruinous to the Amazonic economy: rubber put into the international market by the Britons was far cheaper and of better quality as compared with Amazonic rubber. Without conditions to compete, the region merged into an economic depression process, owing to the collapse of its major exportation product.

In 1912, the Federal Government issued a series of measures destined to defend the rubber economy as well as to promote the colonization of the Amazon River Valley. These measures were: elimination of customs barriers to the importation of equipment and materials suitable to the rubber exploration, incentives for a more rational exploration of this culture and the institution of a substructure of transportation in the Amazonic hinterland.

Notwithstanding the fact that these measures didn't reach their targets, perhaps because of limited financial resources or due to difficulties presented by the environment to an exploration which was made on an empiric basis, the region was favoured with hopes to restore its economy, only in the period of 1940-45, with the Second World War, when the demand for rubber increased enormously.

Nevertheless, this wasn't enough to ensure the region's development run. Finishing the war, a reduction of rubber needs in the whole world was felt. With the decay of the rubber international market, new plantations were not made and so Amazonia had to face again a depressive situation, which remained for about half a century (1910-1960). We must add that the national economy began to be seriously biased by the industrial center, concentrated in Sao Paulo, Rio de Janeiro and Minas Gerais, leaving Amazonia in a peripheral zone, outside of this pole.

However, starting in the early 60s, Amazonia beheld a hope of obtaining conditions to redeem its economic and social situtation, by the beginning of the interiorization of Brazilian development.

Brasilia's birth (at the beginning of the 60s) and its connection with the northern region through the road "Belém-Brasilia" (figure 3), the creation of SUDAM in 1966 (SUDAM is a government department liable for the Amazonic development) and the new organization given to the "free-zone" (restricted area where the import taxes are lower) of Manaus in 1967, together with some new programs for economic and social development of the area, brought solid grounds for the enlargement of Amazonia and for its decisive integration to the rest of the country.

4. Present Situation

Making more concentrated and dynamic its action in the area the Federal Government put into practice, in the second half of the decade of the 60s, plans for Amazonia's development, more important of which are: to increase the regional growth, based on the exploration of the advantages of some sectors or selected products; to intensify Amazonia's integration to the national economy; to improve the exchange incomes; to raise the level of incomes and social status of the people, through the expansion of job opportunities and by the raising of productivity, as well as by the buying power of the inhabitants of that region; and finally, to promote the occupation of the ground and the lifting of the level of security in this area, by means of the enlargement of economic borders.

In a region so large as Amazonia (table 1) but with a rather low population rate (tables 1 and 2), it became fundamental to define the areas of priority, for the forwarding of financial support.

Many programs, therefore, were implanted in the region to complement the space strategy of the Government in this area and guided to the occupation of the empty spaces and to the use of the transport axis, linked to development projects of preferential areas.

These preferential areas are called POLES (figure 4). These poles can be defined as of agromineral nature, agro-industrial, agro-cattle, timber and urban. There are being implemented research and development programs, as well as support to the industrial fields, to the human being, energetics, transport, telecommunications, urban, agriculture, mineral sectors and to the search in natural resources.

Due to the physical and demographic characteristics of Amazonia, the regional economy's growth tends to be realized based upon its relationship with other areas. The internal market of the region is relatively small and still doesn't admit a large scale industrial program to be put into action.

It should be carried out with priority, keeping in sight, however, the national and the foreign market supplies.

Amazonia's contribution to the building up of the exchange incomes (between 90 and 100 million dollars) is already noticeable in view of the reduced size of its regional population. In the future, this share will be considerably increased, with the mineral and timber complexes in operation, besides a great number of varied industrial, agricultural and cattle projects being pushed forward.

The Federal Government's budget level, concerning investments of varied applications in the region, presents a magnitude of about 400 million dollars, within the period of 1975-80. If we consider the multiplicative effects of these investments, we may estimate that the circulating currency in the region in said period might reach the value of 2 billion dollars, a figure never reanhed before in the development of that region, in any phase of its economic life.

However, such applications are being made in mechanism's structures which will give the basic conditions to allow that this region may take rational and economic advantages, of its potentiality, so as to improve the people's life conditions. Consequently, these will be the foundation on which, in the future, this region will settle on an auto-supporting development.

In fact, at this very moment, many difficulties are still to be won. The income level of the people is low in comparison with the rest of the nation (table 3) and there are also several social (education, health and sanitation) and economic problems to be solved.

5. Potentialities

The big potentialities already extant in Amazonia are being exploited recently, and they will be of great relevancy to the national wealth.

Their natural resources will help the workability of important national projects, as, for instance, the National Siderurgical Plan, establishment which could hardly be fulfilled, taking into consideration the iron or exportation rise, without the exploration of the Carajá mine, in the State of Pará.

Another example is the increase of cocoa culture, adequate to this region, and that can aid the nation to rewin the first place among the product's exporters.

In the mineral sector, we include seven mineral goods, whose economic importance has been proved. Exploitation projects concerning these goods are at the pre or at the exploration phases: iron, manganese, bauxite, cassiterite, kaoline, rocksalt and limestones.

The main iron mine is in the Carajá mountain (south of Pará) which possesses an estimated reserve of 18×10^9 tons of ore.

As regards manganese, the main mine is the one called "Serra do Navio" in Amapá, in full operation now, exporting about 1 million tons per year.

Bauxite is found in wide mines at the left shore of the Amazon River, north of Pará, with a global potentiality of about 2.6×10^9 tons.

Cassiterite is spread over Rondônia, nowadays, the biggest Brazilian producer.

Great reserves of kaoline, rocksalt and limestone have been detected in Pará. Limestone is being already processed commercially.

Surely enough, when these resources are fully explored (we foresee this peak during the 80-85 period), they will contribute expressively to the exchange balance of the country.

The agriculture and cattle activities are being largely stimulated in the region. Concerning agriculture cultures, there are wonderful prospects for cocoa, rice, ooffee, sugar cane, rubber; as regards cattle, the prospects are that the region will have the biggest cattle herd of the nation, about 1980, due to the disponibility it has of empty spaces of low cost (compared with the rest of the country).

The timber sector is the third in size to attract investments in Amazonia and will have a distinguished role to play, in the future supplies of both internal and foreign markets. In this field, several measures are being taken, in order to transform the timber business into a planned and rational activity, allowing the permanent exploration of the forest with continued re-plantations.

Maritime and fresh-water fishings deserve to be put in a distinct place, inasmuch as for the regional wealth, they constitute a source of dollars coming from USA and Japan, in addition to representing an important activity for the people.

The secondary sector (industrial) has been progressing in the region since 1965; it's concentrated mainly in Manaus (Industrial Sector in the "free-zone") and in Belém.

The extant industries are linked to varied interests, like shipyards, electronic products manufacturers, optic devices, chemical products, textile products, timber, metallurgy, cement, plastics and engines.

Tourism is a remarkable item too, because of its importance in the integration process of Amazonia to the social economic context of the country. The tourist industry growth in Amazonia is being proved by many aspects: from the considerable increase of the hotel net and from the quantity of tourism agencies which popped up in the region, up to the enlargement of about 200% (1968-75) of the number of air travellers in their airports.

The region's basic substructure is also being developed, as the primordial element of support to the region's growth.

The transport system, either roads or hydroways, began its expansion in 1970. The road system (figure 5), comprising at present, a net of 25,000 KM of good and dirt roads, connects the region with every spot of the nation and even with the exterior. It has, as main roads, the Transamazonica, Cuiabá-Porto Velho, Cuiabá-Santarém, Perimetral Norte, Manaus-Porto Velho and, at last, Belém-Brasília, considered as the mother road of the transport system of Amazonia, playing an important role in the regional development of the hinterland.

The transport over water predominates in the whole Amazonic territory and is being enlarged with the modernization and building of many ports. The ports of Manaus, Belém, Macapá and Santarém are the principal of them.

In the energy sector, despite that hydro-electric potentiality of Amazonia, which one believes reaches 62 million KW, almost all the electric energy employed there, at present, comes from thermo-electric generators, either propelled by steam or diesel oil, generating about 350000 KW.

However, due to the needs that the growth of the region brought to itself and to the projects relative to the use of their natural resources, the present generating capability must increase tenfold within the next 8 years, when their newly build hydro-electric plants will be operating at full speed. These plants were built near Santarém (Pará) and Macapá (Amapá). Another five ones are being constructed, the more important is Tucurui which will supply essentially the siderurgical complex of Carajás and the city of Belém.

Finally, sometimes acting as a motivating element, sometimes being influenced by all the context of growth and integration, there appears the telecommunication sector, the development of which will be described in the following chapters.

6. Telecommunication Development in Amazonia

The telecommunication development in Amazonia presents three distinct phases up to now.

First Phase (...1967)

Through the passing time, we may consider the end of the first phase as around 1967. Up to that date, the telecommunication situation in Amazonia was a reflection of a combination of factors which kept said situation in a state of almost nothing.

One of these factors was represented by the lack of a governmental policy addressed to the expansion and modernization of the telecommunication system throughout the country. The other factors were represented exactly by the stagnation of the whole development of the region and by the low economic and social importance given to them by the whole country.

Amazonia had 1% of the total of telephones installed in Brazil, it had only their major cities connected to the rest of Brazil, by few and bad HP circuits, centralized in Belém and connected to Rio de Janeiro.

The telecommunication systems throughout the country were precarious and unstable. At that time we had:

a) in the urban service:

-we had approximately 1.5 million telephones, 90% concentrated in the south of Brazil; they were operated and maintained by 800 private and state companies.

b) in the long distance service:

-a microwave system connecting Rio de Janeiro to Sao Paulo, with 486 voice channels;

-a microwave system connecting Rio de Janeiro to Belo Horizonte, with 120 voice channels;

-a microwave system connecting Rio de Janeiro to Brasilia, with 132 voice channels;

-an open line system, connecting Rio de Janeiro to Sao Paulo, with about 80 voice channels;

-some low capacity circuits, (open line or UHF and other radio circuits, in short waves, with a reduced number of channels), connecting many States with telephone and telegraphic communications.

Second Phase (1967-1972)

The second phase might be situated between 1967 and 1972. In this phase, not only Amazonia, but all the nation began to emerge out of that stagnation condition in which they lingered, with respect to telecommunications matters.

This phase was preceded, some years before, by the introduction of a new mentality about telecommunications, owed to the Brazilian awareness of the importance of this sector to the social economic development of the country, as well as to the inter-regional integration. In this preliminary phase (1962-1967) many measures were adopted which had as objectives to build the sector administratively, regarding the implantation of a sub-structure concerning telecommunications, which could furnish basic support for the development of all systems to be installed in the future. These measures began to be put in force as far back as the birth of EMBRATEL (1965) and of the Communications Ministry (1967).

EMBRATEL was created having the following delegation:

a) First part: to give the country a substructure with a capability to attend in full, in the telecommunications field, connections inter-states, with large possibilities to be enlarged;

b) Second part: to allow to run telecommunications services of high grade and high reliability, including telephony, telegraphy, telex, facsimile, transmission of data and program transmissions, either sound or television;

c) Third part: to introduce the DDD system in the inter-state circuits and to put forward the automatic ticketing;

d) Fourth part: to build an international system, of high quality and high reliability, through the country's share in the international satellite communications system and in the world system of submarine cables, with adequate quantity of channels, not only in number but in quality as well, this country needs to be able to communicate with the rest of the world nations.

The Communication Ministry was created with the responsibility to issue, to orient and to control the general policy of the Government considering communications, being of its duty the supervision of all federal administrative cells, directly and indirectly, embodied in its influential borders.

It has been since then that the important realizations in the telecommunications area began to flow in Brazil. The predominance of these worka was made by EMBRATEL at the beginning.

Within EMBRATEL's programs to the creation of a Basic Telecommunication System (figure 6), there was one concerning the attendance to the Amazonia region. This was part of a general plan of the Government which intended to provide basic substructure conditions for its development and integration to the rest of the Brazilian land.

The first studies made about implantation of telecommunication systems in Amazonia were started in 1968. At that time it was not very difficult to obtain financial support for the undertaking. It was the main objective to give adequate and reliable means to connect Amazonia to the rest of the country. More than that, there had been created the National Telecommunication Fund which could dispose of for that purpose at 1962. This financial source was made of over-tariff imposed in all toll-ticketing of the country. This fund was created to help the construction of telecommunication systems in Brazil, including the systems of Amazonia.

The cost-benefits of these investments were deeply analyzed. In an area as Amazonia, where the occupation and integration were the main objectives, the economic possibilities of investments analysis couldn't be based upon the traditional standards of comparison between cost and direct benefits for the subscriber. It was thought as correct, in this situation of extreme privation of telecommunication services, the relations concerning benefits/costs would be rather high in contribution for total development of the region.

The investments realized to build up the telecommunication systems in Amazonia were not considered as a specific application of funds, but as a parcel of global investments which were made regarding the occupation and integration of the region with the rest of the country.

For this reason, the installation of telecommunication systems in this region, could be only analyzed together with other important decisions taken in diversified sectors regarding the development of that area.

The basic limitations found in that period were related to the peculiar physical characteristics of that region, especially in view of the lack of roads for the access to the places where the equipment of telecommunications would be installed.

The conditional factors were pre-established and there were no other options to be analysed. Where permanent access conditions were possible (roads), like the case of the Belém-Brasilia road, it was decided to adopt microwave systems in line-of-sight (figure 6). Disposing of Belém-Brasilia road, it was possible to implant that system, presenting a length of 2,200 KM with repeater stations each 50 KM in average. Beside the access facility, the following factors have conditioned the choice of a microwave system in line-of-sight which had to link Belém to the rest of the country:

a) the traffic forecast from Belém taking into account the high interest to the Center-South of the country could justify the installation of a high capacity system;

b) the need to have a high capacity system in the interior of the country would result in an alternative circuit for the microwave system already extant, running along the Brazilian Atlantic shores, from Belém to Salvador and from there up to Belo Horizonte, Rio de Janeiro and Sao Paulo;

c) the limitation which had to be faced, as regards the traffic's flow from Belém, if said city should be linked with the others only through the litoranean circuits and a specific link of troposcatter microwave system between Belém-Sao Luis.

In all the remaining Amazonia the option adopted was a troposcatter microwave system with some links in line-of-sight.

The basic factors conditioning this choice against the line-of-sight systems were:

a) the satellite techniques were not fully developed at that time;

b) lack of road facilities;

c) the impossibility to use the rivers as means of access because many large areas at their sides are frequently damped during long periods of the year. This would demand great distances from the river's shores for the installation of the repeater stations;

d) the fact previously cited would bring serious problems of reflexion and would compel the erection of too high towers;

e) with the troposcatter system, the quantity of repeater stations would be quite small, which would imply an economy in the system's installation and reduction of difficulties in obtaining the necessary labourers.

More detailed studies were tied to choice alternatives, more economic for the installation of repeater stations of the troposcatter microwave system in Amazonia. These are the partial systems installed:

- Belém-Manaus system;
- Manaus-Boa Vista system;
- Campo Grande-Rio Branco system;
- Porto Velho-Manaus system, and
- Belém-Sao Luis system.

Belém-Manaus System

This system was bought in July 1969 and activated in March 1972. It has 6 radio links, using the troposcatter microwave technique and 2 radio links in line-of-sight.

It extends itself along 1,500 Km and has seven repeater stations (Mosqueiro, Macapá, Almerim, Santarém, Parintins, Itacoatiara and Ponta de Lajes) and two terminal stations (Belém and Manaus); 12 Km of access roads had to be opened; 14 towers were erected.

The longer distance with 318 Km of extension lies between the Mosqueiro and Macapá stations.

All the repeater stations are equipped with three electric generators. The antennas installed vary from 1.8 to 12.0 m in diameter, being fixed on 15 to 85 m towers.

Between Mosqueiro and Macapá, four billboard antennas were used, area of which reaches $800m^2$.

Mosqueiro and Ponta de Lajes stations are connected to the terminal stations in Belém and Manaus, respectively, through microwave links in line-of-sight with medium capacity.

Manaus and Belém stations are equipped with automatic exchanges, which operate the automatic long distance telephonic traffic to all capital towns of Brazil besides other lesser cities.

Manaus-Boa Vista System

Its contract was signed in the beginning of 1971 and activated in October 1972.

In those days it was used as a short wave system, in a single link, between Manaus and Boa Vista, 660 Km apart, one to the other. This system could make, simultaneously, 4 voice channels transmissions, using LINCOMPLEX terminals for telephony and telegraphic services.

Campo Grande-Rio Branco and Porto Velho-Manaus Systems

Their contracts were celebrated in December 1969 and activated in October 1972.

Along a 3,400 Km length, these systems crossed almost the whole of the Mato Grosso State and the Rondonia Territory, reaching at last Rio Branco (Acre). They had branches coming from Porto Velho to the north, crossing the State of Amazonas to be connected, in Manaus, to the Belém-Manaus trunk.

These systems were constituted of 12 troposcatter stations installed along its route, and of 6 terminal stations in the cities of Campo Grande, Corumbá, Cuiabá, Porto Velho, Rio Branco and Manaus.

Transmitting in the 900 MHz band, they had equipment operating with tetra-diversity technique, using 20 billboard antennas besides another 24 parabolic antennas of large diameter.

In order to have manual and semi-automatic telephone services, telegraphy, telex, facsimile, transmission of data and high fidelity programs, these systems utilize 120 voice channels from Campo Grande to Corumbá and Cuiabá. They use 60 channels in the other links they have.

Belém-Sao Luis System

Its contract was signed in 1970 and the system was activated in 1972.

It was composed of a dual system, presenting links in line-of-sight and troposcatter. Its length is 400 Km, having 6 repeater stations and two terminal stations built in Belém and Sao Luis.

This system had one troposcatter link in Bacanga, Maranhao, and in Cachoeira, Pará; it has other links using microwaves in line-of-sight linking the Bacanga station with Sao Luis and Cachoeira with Santa Maria, Pará, where they join the Belém-Brasilia system.

In the Bacanga-Cachoeira connection the system consists of one RF channel, with 120 voice channels. In the Bacanga-Sao Luis and Cachoeira-Santa Maria connections, the systems consist of (1+1) RF voice channels, with a final capacity of 960 voice channels.

These long distance systems were implanted in the region in this second period as a part of the basic national system making up the base upon which the enlargement of all telecommunication services in Amazonia stood, during the next phase.

From 1967 to 1972, there has been about 1 million dollars spent in the telecommunications sector in the whole country; 20% destined to building up the Amazonia systems.

We may say that the realizations in the telecommunication sector in Amazonia, together with investments in other sectors represented one of the basic substructure factors which made possible to the region, to start to go out of the isolation and begin its process of development.

Third Phase (after 1973)

The third phase is characterized by the TELEBRAS activities since it was created in November 1972. The objective was to solidify the telecommunication sector structure in Brazil in accordance with the policy established by the Government.

Linked with the Ministry of Communications, TELEBRAS was created as a holding of telephone companies, its obligations being:

a) to plan public telecommunications services in Brazil, in accordance with the rules issued by the Ministry of Communications;

b) to manage the Federal Government investments meant to the public telecommunications services;

c) to coordinate and to provide for techno-administrative assistance to the public telecommunication companies and to those concerned with industrial production, seeking for a reduction of the operating costs and ensuring better returns for the investments made;

d) to get internal and foreign financial sources to be sent to the public telecommunication companies for the execution of the plans and projects approved by the Ministry of Communications;

e) to promote, by means of their subsidiary/or associated companies, the enlargement and exploration of local, and long distance services;

f) to promote and to push the training of qualified persons, for the telecommunication sector;

g) to promote and to push activities about research and technological development of the sector.

With these great objectives in mind, TELEBRAS tried, since the beginning, to emphasize the technical and administrative structure of the telecommunication services, especially in the more needed areas of the country.

Amazonia, of course, was included in this situation. During 1973-74, it has been the object of detailed studies made by TELEBRAS: the expansion and modernization plans for the already extant systems.

The region was, even at that time, already integrated through the systems built by EMBRATEL. However, it didn't have, in all its own area, local and long distance equipment compatible with its necessities, nor companies capable to build and operate them.

Tallying with the administrative rationalization's policy of the telecommunication services in Brazil, first measures taken by TELEBRAS in the region were the creation of "pole-companies" in each State or Territory, the planning of the regional systems so as to integrate them into the national system already in operation and the destination of the necessary funds to have the plannéd systems duly installed.

While the second phase was flowing, the long distance facilities created by the work of EMBRATEL increased very swiftly owingto the inclusion of the microwave systems. In this present third phase, the effort concentration is being pushed toward the local urban net expansions (table 4) and the long distance systems of each State or Territory of that region, so as to offer available means of telecommunications to the biggest possible amount of people.

In this third phase, the need to enlarge substantially the regional systems can be characterized as a consequence of the global development of the area. With many projects put in practice by the Federal Government in the region, its economic growth and the increasing interest in the traffic to/from the rest of the country imposed the expansion of the extant systems, in order to satisfy its telecommunication services increasing demand.

The start of the expansion of the State systems together with the expected and verified traffic boom (table 5) brought, as a consequence, the need to go on with the amplification of part of the national system installed in Amazonia, in such ways as to allow the flow of both the present traffic and the one foreseen.

Moreover, in spite of the expansions which were being made, a great quantity of places of the region would still lack the proper means for long distance calls.

The need to extend the long distance facilities to the biggest possible amount of localities in Amazonia, together with other factors, such as the governmental program of integration of this region into the rest of the country, the inadequacy of the system using the troposcatter technique to transmit TV signals and their high maintenance and operating costs, the difficulties imposed by the physical characteristics of the region and the national security requirements, conducted to the choice of a domestic satellite system, which, within a short time, could furnish good quality services and high reliability to the Amazonic region.

Many studies were made to precisely determine under which conditions the system could be economically practicable. Two types of possibilities were considered.

The first tried to establish how many K circuits could produce enough income to cover all operational, maintenance and depreciation costs of the system, taking into consideration the use of a satellite system comprising K stations. There was also estimated the generation of an investment return tax. This proposition was developed employing a formula of the kind $N \geqslant AK+B$, where $\underline{N}$ and $\underline{K}$ were defined previously, and $\underline{A}$ and $\underline{B}$ are coefficients which were calculated taking into account the following parameters:

- the capital recovery factor;
- operating, maintaining and system's administrative yearly costs;
- interconnection cost referring to the linkage of earth stations with the existing systems;
- the basic costs of an earth station with all its requirements;
- part of the total income which should be retained for supporting the system;
- the average tax of income per circuit;
- the cost per channel;
- the adaptation to MFC signalling cost;
- the present value of the investments concerning the spacial segment and control system.

The second possibility aimed to compare the present value of investments in spacial system and in conventional techniques employing microwave systems in line-of-sight and troposcatter, intending to serve the same place in both cases.

The comparison conclusion was that the satellite system would offer a significant advantage when compared with conventional earth techniques in the region.

The result of all these studies made for the implantation of the Brazilian satellite telecommunication system was duly examined, leading to the conclusion that this system would be technically and economically favourable.

Nevertheless, owing to some political, economic and financial factors, the Government has decided to postpone the implementation of the domestic satellite telecommunication system to a more favourable date in the future.

Within the factors which were more prominent there were:

- the total investment volume which would be spent with the system: about 200 million dollars (prices of 1975) 55% referred to the spacial segment of the system;

- the big volume of disbursements which should be made in foreign currency, having in mind the difficulties that the country faces now in order to keep properly its payment balance;

- the need to develop other economic and social projects with higher priority;

- the limitation of financial sources which the telecommunication sector had to face, due to the severe economical policy which involved the whole country since the petroleum crisis.

Because of the postponed decision and, at the same time, the need to expand the telecommunication facilities in the region in a short time, there's an alternative plan being elaborated (figure 7), meant for the five years ahead, of which the principal characteristics are:

- utilization of the INTELSAT satellite, through rental of transponders;

- building of earth stations to attend the increase in places at present, by the troposcatter system, trying to enlarge it up to its full capability;

- increase of attendance to other cities through the installation of earth stations of small size, as soon as the more adequate time arrives for such events.

The definition of this alternative system takes into consideration the following factors:

- it stays in force, as soon as the proper opportunity arises, the fulfillment of the domestic satellite project;

- at the moment it is more interesting, from the economical and financial viewpoint to use the INTELSAT satellite as the main means of transmission to Amazonia and the improved beyond the horizon system;

- it becomes easier to satisfy the region's services in function of the available economic financial resources.

- the initial foresight regarding investments to the building up of the whole alternative system (34 places) is far less - circa 50 million dollars, of which 9 million are represented by foreign currency - which means a huge reduction of the first disbursements.

A part of this alternative system to serve Amazonia, corresponds to the earth segment and is being built. In this year an earth station has already been built in Macapá (Amapá) and many others will be constructed in 1979 in Altamira and Santarém (Pará) and, in 1980, in Cruzeiro do Sul (Acre) and Tabatinga/Benjamin Constant, Coari and Tefé (Amazonas) (figure 8).

At present, in the installation of this system, the Brazilian industry is being quite active in order to supply the needs of the project. A parabolic antenna, for instance, was completely developed, manufactured and installed in Brazil, with our own technology, having a diameter of 10m, and meant for satellite communications. One of them was installed in Macapá.

With such alternative system, the most urgent needs of the region will be satisfied. Services of telephony, telex, TV and others will be offered. There remains the flexibility of decision as regards the future, whether concerning the carrying on of the domestic satellite project or concerning the building up of earth systems in line-of-sight. All depends on the conjunctural aspects of the country and of the socio-economic evolution of that region.

Conclusion

The Amazonic telecommunication services are the most typical example of the Brazilian experience as regards the planning of telecommunication systems in isolated and underprivileged areas.

In all phases of the telecommunication's development in Amazonia the geo-physical conditions factors were always present forcing in a prominent way its technical and economic planning. Other factors, especially those of political and economic kinds, are also present, acting with varied intensity in the system implantation projects of the region.

The systems which were and will be installed in Amazonia sometimes acting as a cause of its development, sometimes being the consequence of said development, represent a factor of major importance for the improvement of the social and economic conditions of the region. We may assert that while looking for solutions for the technical, operating and economic drawbacks which are faced by the Amazonic attendance, the telecommunication sector has been favoured through the improvement of the human resources and of their own development of new technologies.

The Brazilian experience in this area serves as a distinguished example of the telecommunication's action as an integrating, economic and social developing factor of isolated and underprivileged areas.

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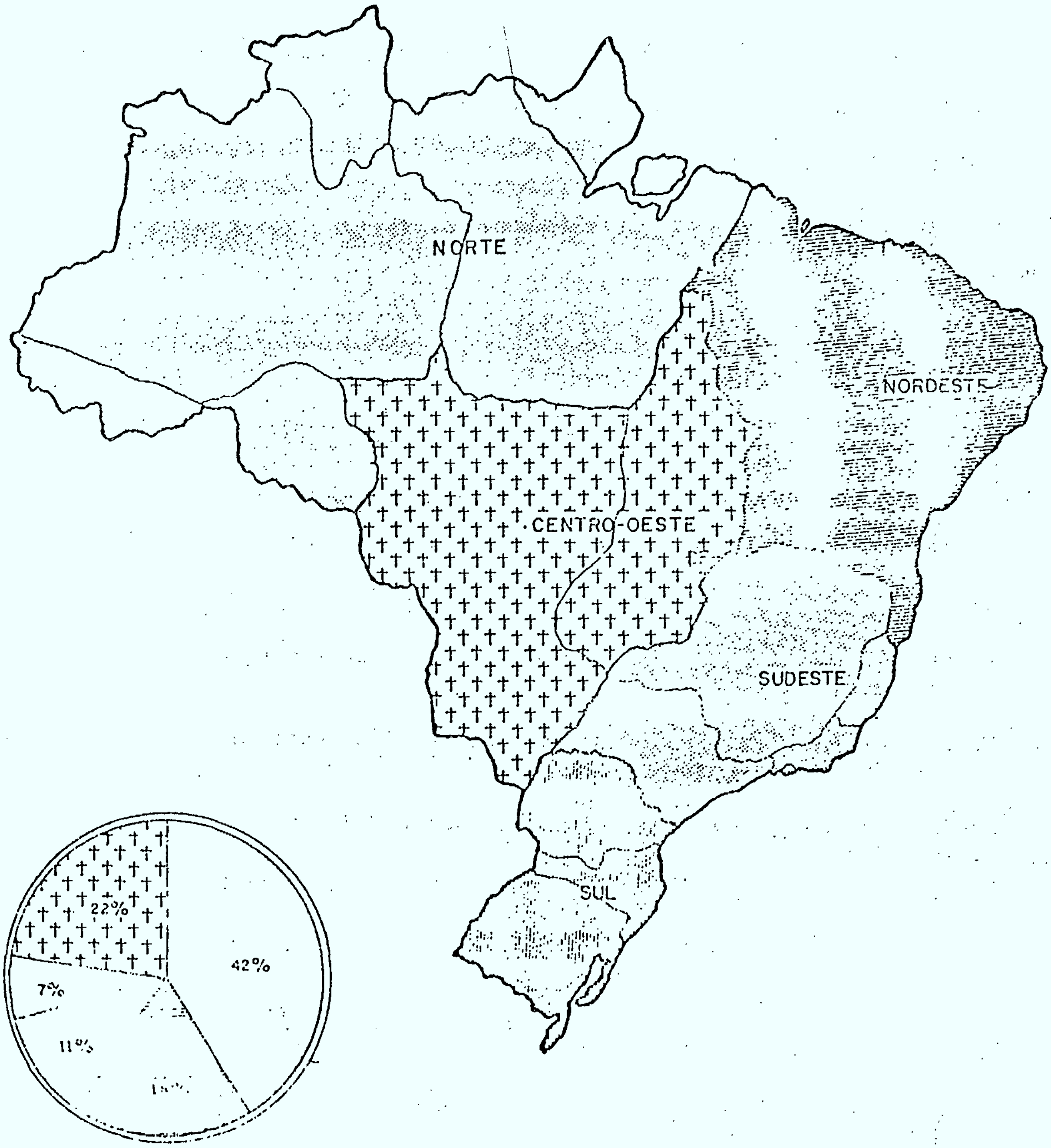
Figure 1

ÁREA DAS GRANDES REGIÕES

AREA OF THE GREAT REGIONS



THE OFFICIAL AMAZÔNIA

Figure 3

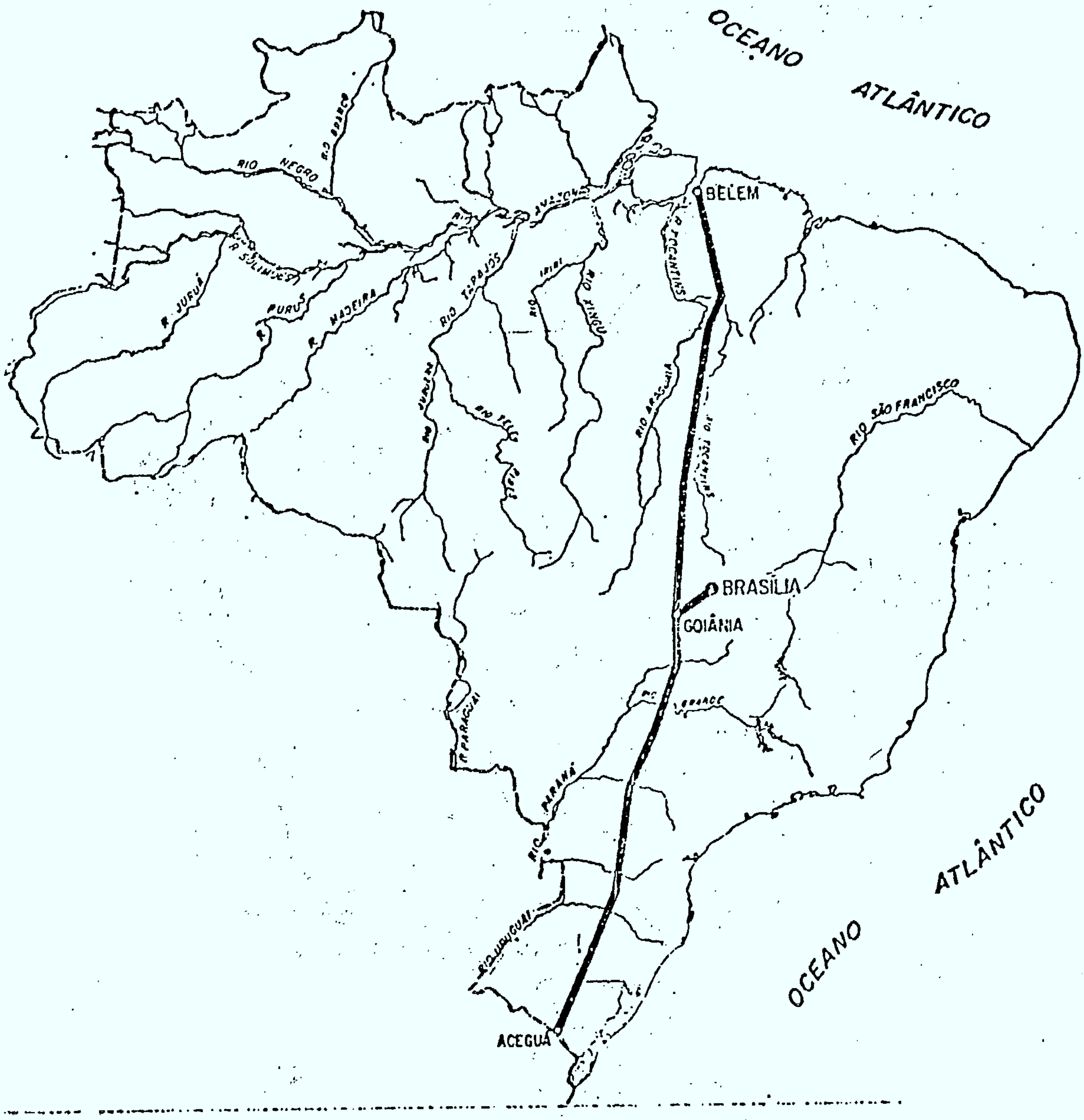

OCEANO
ATLÂNTICO
BELEM
BRASILIA
GOIÂNIA
ACEGUÁ
RIO NEGRO
R. JURUÁ
PURUS
R. MADEIRA
RIO TAPAJÓS
RIO XINGU
R. TOCANTINS
RIO ARAGUAIA
RIO SÃO FRANCISCO
R. PARAGUAI
RIO PARANÁ
RIO URUGUAI
ATLÂNTICO
OCEANO

Table 1

ĀREAS AND DEMOGRAPHIC DENSITIES IN THE AMAZONIA

STATES/ TERRITORIES	ĀREA (Sq.KM)	DEMOGRAPHIC DENSITIES (INHAB/Sq.KM)			
		1950	1960	1970	1977 (*)
AMAZONAS	1,559,000	0.33	0.46	0.61	0.74
PARĀ	1,227,000	0.92	1.26	1.77	2.21
ACRE	152,600	0.75	1.05	1.41	1.73
T.RORAIMA	230,100	0.08	0.13	0.18	0.22
T.RONDONIA	243,000	0.15	0.29	0.46	0.68
T.AMAPĀ	139,100	0.27	0.50	0.82	1.10
AMAZONIA (NORTH REG.) (1)	3,551,300	0.52	0.73	1.01	1.26
BRASIL (2)	8,456,500	6.14	8.39	11.01	13.38
(1)/(2) (%)	42.0	8.4	8.7	9.1	9.4

(*) ESTIMATED

Table 2

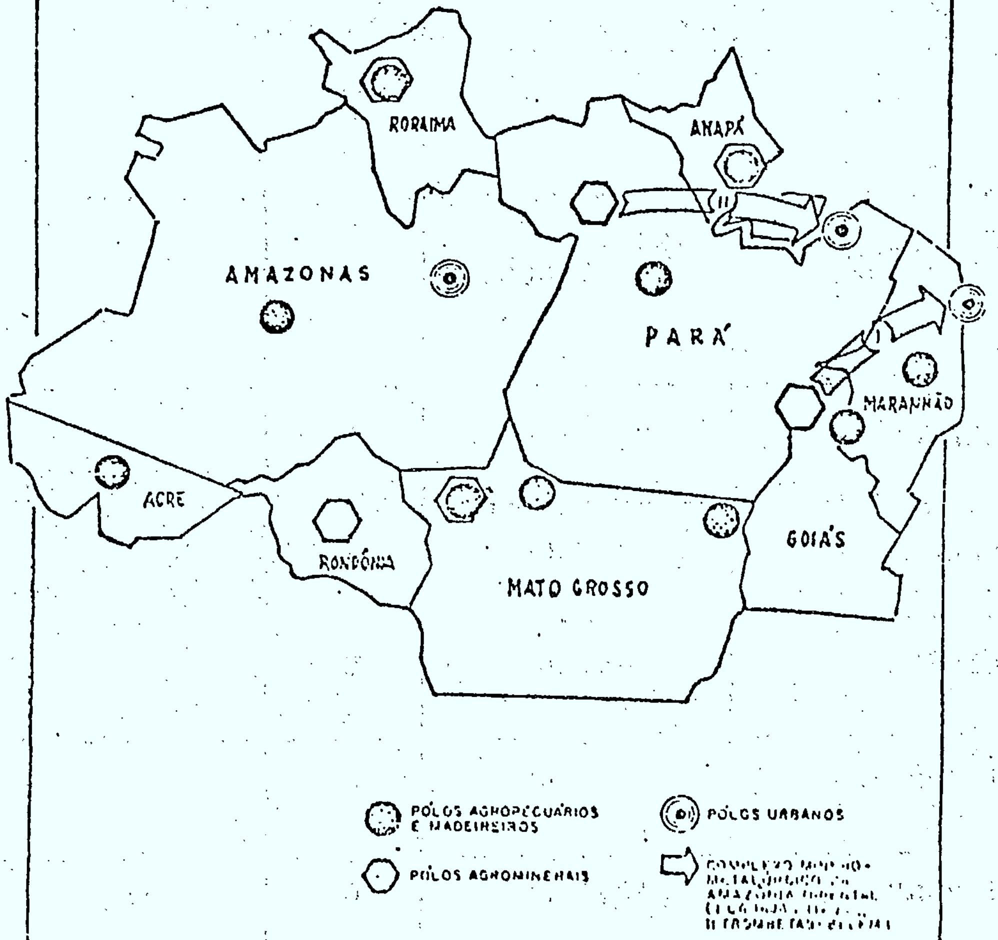
THE AMAZONIAN POPULATION

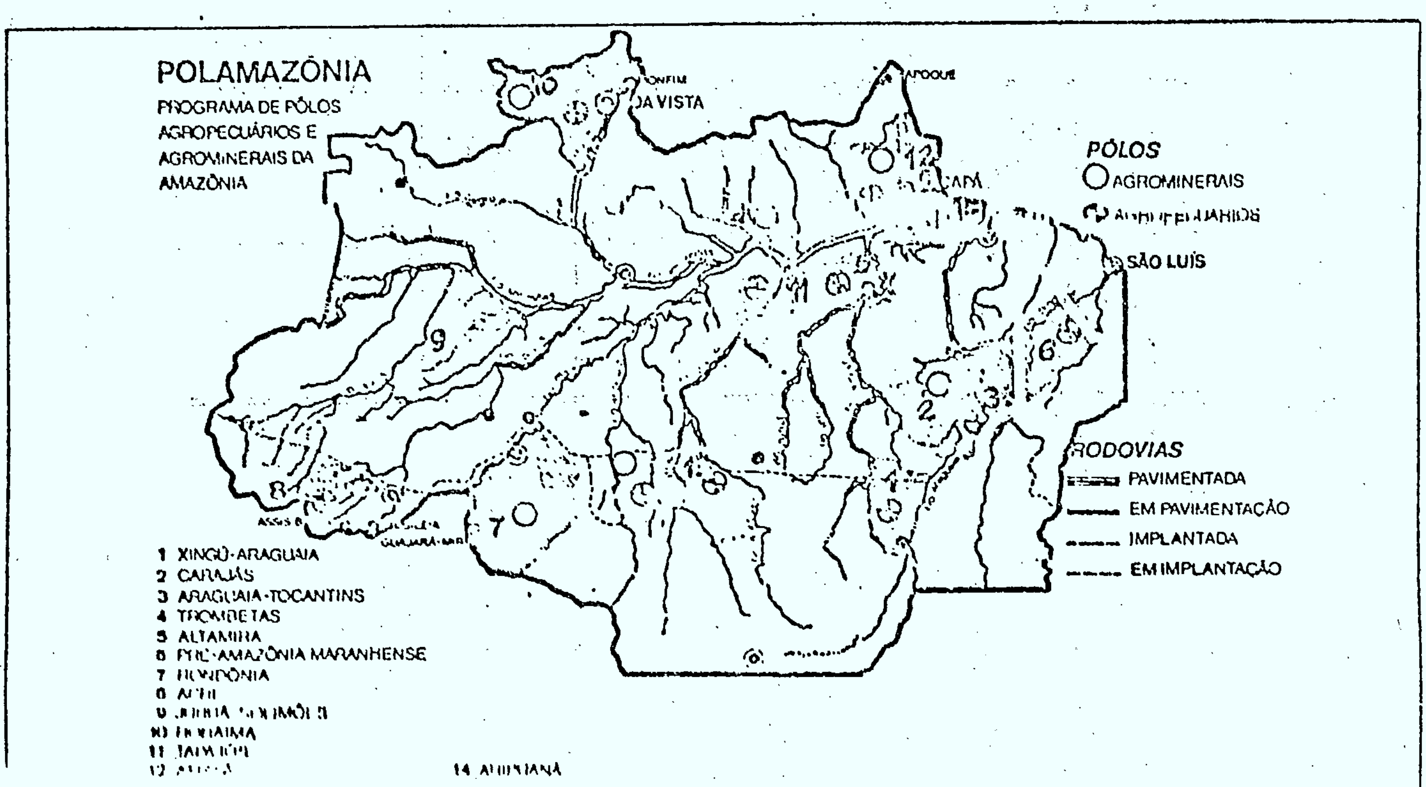
STATES / TERRITORIES	POPULATION				% POPULATION IN THE CAPITALS
	1 9 5 0	1 9 6 0	1 9 7 0	1 9 7 7(*)	(1977)
AMAZONAS	514,099	721,215	955,235	1,151,600	40.0
PARÁ	1,123,273	1,550,935	2,167,018	2,710,900	32.0
ACRE	114,755	160,208	215,299	264,000	47.0
T.RORAIMA	18,116	29,489	40,885	51,300	82.0
T.RONDONIA	36,935	70,783	111,064	153,100	79.0
T.AMAPÁ	37,477	68,889	114,359	154,300	80.0
AMAZONIA (NORTH REG.) (1)	1,844,655	2,601,519	3,603,860	4,485,200	48.0
B R A S I L (2)	51,944,655	70,992,343	93,139,037	113,208,500	–
(1)/(2) (%)	3.55	3.67	3.87	3.96	–

(*) ESTIMATED

II PLANO NACIONAL DE DESENVOLVIMENTO

PROGRAMA DE PÓLOS AGROPECUÁRIOS E AGROMINERAIS DA AMAZÔNIA (POLAMAZÔNIA)





GROSS DOMESTIC PRODUCT (1976)

STATES/ TERRITORIES	GDP (US$ 1,000)	%	
AMAZONAS	910,100	0.71	
PARÁ	1,371,600	1.07	
ACRE	166,600	0.13	
T.RORAIMA	25,600	0.02	
T.RONDONIA	128,200	0.10	
T.AMAPÁ	~~141~~,000	0.11	
AMAZONIA (NORTH REG.)	2,743,100	2.14	
B R A S I L	128,186,700	100.00	

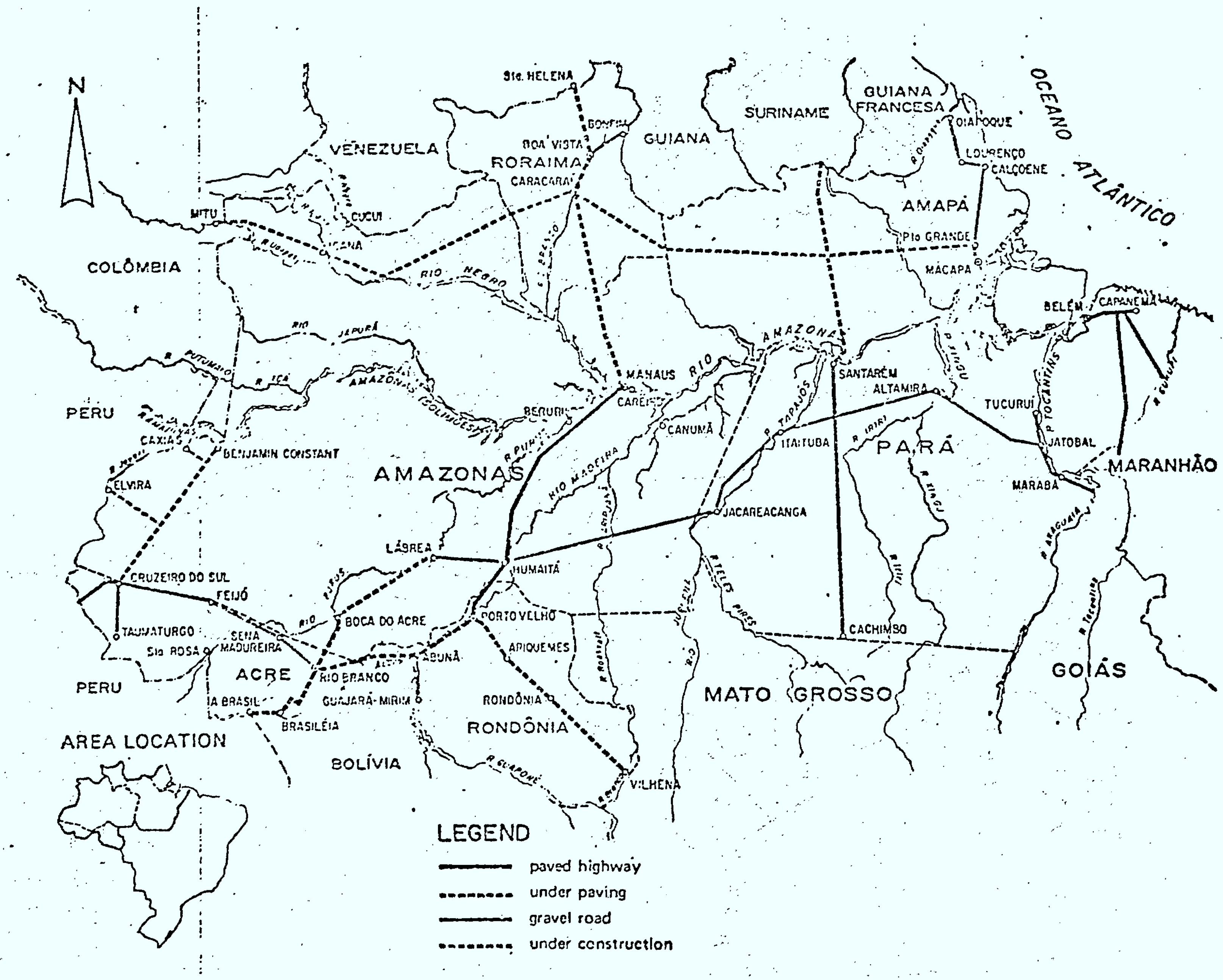

N
VENEZUELA
RORAIMA
GUIANA
SURINAME
GUIANA FRANCESA
OCEANO ATLÂNTICO
AMAPÁ
COLÔMBIA
PERU
AMAZONAS
PARÁ
MARANHÃO
ACRE
RONDÔNIA
MATO GROSSO
GOIÁS
BOLÍVIA
Sta. HELENA
BONFIM
BOA VISTA
CARACARAÍ
MITU
CUCUÍ
OIAPOQUE
LOURENÇO
CALÇOENE
Pto GRANDE
MACAPÁ
BELÉM
CAPANEMA
MANAUS
CAREIRO
SANTARÉM
ALTAMIRA
TUCURUÍ
JATOBAL
MARABÁ
ITAITUBA
CANUMÃ
BERURI
CAXIAS
BENJAMIN CONSTANT
ELVIRA
JACAREACANGA
LÁBREA
HUMAITÁ
CRUZEIRO DO SUL
FEIJÓ
TAUMATURGO
Sta. ROSA
SENA MADUREIRA
BOCA DO ACRE
PORTO VELHO
ARIQUEMES
ABUNÃ
RIO BRANCO
GUAJARÁ-MIRIM
RONDÔNIA
BRASILÉIA
VILHENA
CACHIMBO
RIO NEGRO
RIO JAPURÁ
R. PUTUMAYO
R. IÇÁ
AMAZONAS (SOLIMÕES)
AMAZONAS
RIO MADEIRA
R. PURUS
R. TAPAJÓS
R. XINGU
R. TOCANTINS
R. ARAGUAIA
R. TELES PIRES
R. GUAPORÉ
AREA LOCATION
LEGEND
paved highway
under paving
gravel road
under construction

Figure 5

Figure 6

The national telecommunication system

Table 4A

TELEPHONES INSTALLED IN THE AMAZONIA

STATES/ TERRITORIES	TELEPHONES INSTALLED			%		
	1950	1960	1970	1950	1960	1970
AMAZONAS	1,568	2,850	10,780	0,29	0.28	0.54
PARÁ	4,352	7,840	11,463	0,83	0,73	0.60
ACRE	65	65	665	0,01	-	0.03
T.RORAIMA	-	20	319	-	-	0.01
T.RONDONIA	42	181	694	0.01	0.01	0.03
T.AMAPÁ	-	91	760	-	-	0.03
AMAZONIA (NORTH REG).	6,027	11,047	24,681	1,14	1.02	1.24
BRASIL	526,200	1.075,800	1,980,000	100.00	100.00	100.00

TELEPHONES INSTALLED IN THE AMAZONIA

ESTADO	TELEPHONES INSTALLED				%			
	1977	1978 (*)	1980 (*)	1982 (*)	1977	1978	1980	1982
AMAZONAS	20,400	24,830	34,000	40,000	0.45	0.45	0.50	0.5
PARÁ	46,783	58,750	71,000	80,000	1.04	1.07	1.03	1.0
ACRE	5,845	7,160	10,500	11,000	0.13	0.13	0.15	0.1
T.RORAIMA	2,480	2,950	4,000	5,000	0.05	0.05	0.05	0.0
T.RONDONIA	4,836	4,850	5,100	10,000	0.10	0.09	0.07	0.1
T.AMAPÁ	3,504	4,610	5,000	8,000	0.07	0.08	0.07	0.0
AMAZONIA (NORTH REG)	83,848	103,150	129,600	154,000	1.84	1.87	1.87	1.9
BRASIL	4,505,700	5,490,000	6,932,000	8,164,000	100,00	100,00	100,00	100,

(*) ESTIMATED

Table 5

LONG-DISTANCE CALLS

STATES / TERRITORIES	ORIGINATED LONG-DISTANCE CALLS (10^3)					
	1972	1973	1974	1975	1976	1977
AMAZONAS	159.2	382.1	510.9	682.8	1,013.3	1,394.6
PARÁ	701.1	1,192.0	1,475.4	1,789.5	2,075.6	2,874.3
ACRE	15.7	93.5	93.1	99.1	129.3	164.6
T.RORAIMA	9.1	23.0	25.1	37.4	80.3	128.0
T.RONDONIA	9.1	100.6	133.3	211.2	286.9	417.6
T.AMAPÁ	43.4	86.6	112.2	124.4	145.2	184.0
AMAZONIA (NORTH REG)	937.6	1,877.8	2,350.0	2,944.4	3,730.6	5,163.1

STATES / TERRITORIES	TOLL TICKETING (MINUTES X 10^3)					
	1972	1973	1974	1975	1976	1977
AMAZONAS	1,514.4	3,384.3	4,891.7	5,504.3	7,304.4	8,011.2
PARÁ	4,969.9	7,865.7	9,534.9	10,982.8	12,352.6	18,041.9
ACRE	144.1	837.1	862.3	903.2	1,112.8	1,390.3
T.RORAIMA	73.4	198.4	224.0	323.0	671.0	871.1
T.RONDONIA	74.3	915.5	1,151.0	1,697.4	2,056.8	3,560.6
T.AMAPÁ	350.5	629.4	859.6	921.6	1,079.3	1,440.7
AMAZONIA (NORTH REG)	7,126.6	13,830.4	17,523.5	20,332.3	24,576.9	33,305.8

PLANO DE ATENDIMENTO A AMAZONIA

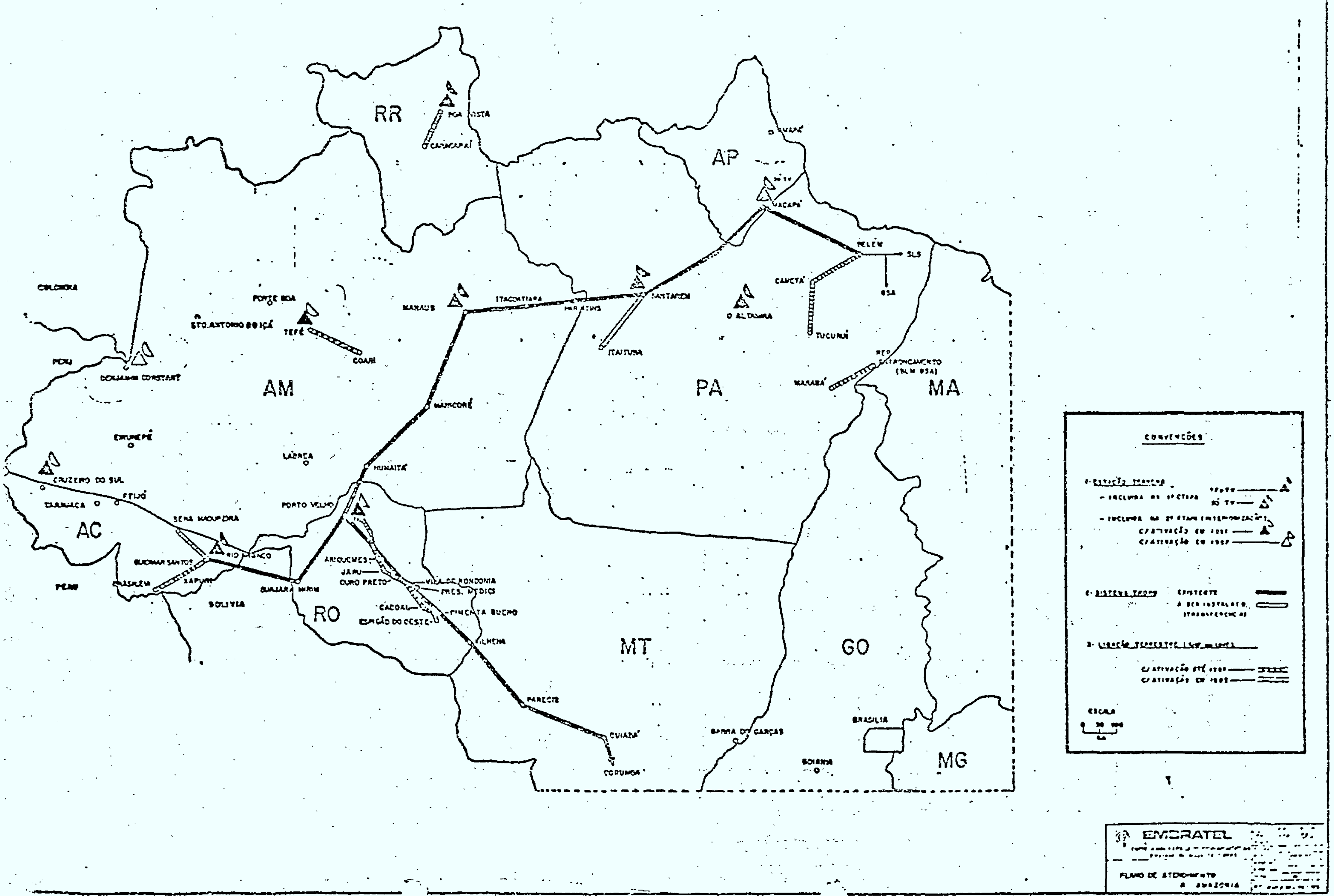


Figure 7

Figure 8


BOA VISTA
MACAPÁ
MANAUS
TEFÉ
COARÍ
SANTARÉM
CRUZEIRO DO SUL
PORTO VELHO
RIO BRANCO
ESTAÇÃO TERRENA EXISTENTE
ESTAÇÃO TERRENA PLANEJADA

CONSIDERATIONS SOCIALES SUR LA PLANIFICATION DU DEVELOPPEMENT DES TELECOMMUNICATIONS DANS LES REGIONS ISOLEES ET DEFAVORISEES DES PAYS

YAYA KOUROUMA
HAUTE-VOLTA

1. Avant Propos

Notre intervention sur les considérations sociales du développement des télécommunications dans les régions isolées et défavorisées des pays, voudrait se limiter à une partie de l'Afrique Occidentale et plus précisement la portion qualifiée de "Soudano-Sahélienne"; tant il est vrai que le développement intégré de cette vaste région fait l'objet, depuis un certain temps, d'une attention particulière, aussi bien de la part des dirigeants des pays concernés que des pays et institutions internationales surtout après la grande sécheresse de 1973-74.

Faut-il rappeler que la plupart des pays de cette région compte parmi les 25 Nations les plus pauvres du Monde, avec un revenu par tête d'habitant souvent inférieur à 100 dollars U.S.A. (voir tableau I); que moins de 15 enfants sur 100 d'âge scolaire fréquentent l'école primaire; que près de 95% de la population s'occupe d'agriculture et d'élevage avec une forte propension au nomadisme et à l'émigration vers les pays cotiers? Faut-il enfin souligner que la prénétration des moyens modernes de télécommunications dans ces contrées reste faible, avec une densité téléphonique inférieure ou égale à 1%, un nombre de postes récepteurs radio pour 100 habitants voisin de 10 et surtout une forte concentration de ces moyens dans les capitales (tableaux 2 et 3)?

Ces données succintes impliquent que le développment économique et social de cette région soit appréhendé d'une manière globale où les communications en général et les télécommunications en particulier, en minimisant les distances constituent à la fois un élément nécessaire d'animation et d'organisation et une courroie indispensable de transmission de messages et d'informations de tout genre.

2. Introduction

Prises dans le sens le plus large, les télécommunications englobent à la fois, les services téléphonique et télégraphique, la radiodiffusion et la télévision, les transmissions aéronautiques, maritimes, le service mobile terrestre, les transmissions météorlogiques et la transmission de données de toutes sortes. Nous nous en tiendrons, aux systèmes de télécommunications qui jouent un rôle important dans l'élevation du niveau de vie dans les zones rurales. L'impact socio-économique du développement des télécommunications dans les régions isolées et défavorisées, varie non seulement avec les systèmes de télécommunications susceptibles d'être mis en oeuvre, mais demeure fortement tributaire de la façon dont l'implantation et l'organisation de ces systèmes prennent en compte les préoccupations réelles et les conditions de vie des populations de ces régions.

Dans ce qui suit, nous allons tenter d'analyser l'apport que peut ou pourrait procurer les différents moyens de télécommunications dans le processus du développement économique et social des zones défavorisées.

3. La Radiodiffusion

Nul doute que la radiodiffusion joue un rôle de premier plan comme instrument d'animation et d'intéressement des populations dans l'action de développement. En effet des émissions radio spécialement conçues et adaptées au monde rural peuvent être réalisées pour promouvoir l'éducation civique, pour alphabétiser les adultes et maintenir le contact avec la fraction scolarisée du milieu rural. Ces émissions peuvent également contribuer à améliorer les méthodes culturales du paysan (culture en ligne, culture attelée, utilisation d'engrais...) ou à protéger les récoltes et les semences contre les parasites et sauteriaux, ou encore à introduire de nouvelles variétés de cultures dans certaines régions.

Aussi puissante que puisse être la radiodiffusion en tant qu'instrument de pénétration en milieu rural, son efficacité demeure conditionnée par un certain nombre de contraintes qu'il faut toujours avoir à l'esprit lorsqu'on s'occupe de la planification de la radiodiffusion en zone soudano-sahélienne.

La première contrainte concerne l'infrastructure qui doit être suffisamment légère et décentralisée pour coller de près aux réalités locales. N'oublions pas en effet la diversité des langues pratiquées dans nos pays, qui doit inciter le planificateur à choisir judicieusement l'emplacement des centres d'émission de manière à bien couvrir les zones de populations concernées. De plus l'inexistence d'un réseau électrique ramifié, jointe aux mauvaises conditions de propagation en pays sahélien, surtout en ce qui concerne les ondes moyennes, milite ardemment en faveur de l'utilisation des petits émetteurs en ondes métriques.

La deuxième contrainte a trait à l'organisation et à l'exploitation des centres d'émission qui doivent bénéficier d'un réseau de correspondants bien répartis pour alimenter les programmes. L'accent sera mis sur l'organisation des groupes et clubs d'écoute qui discuteront et critiqueront les émissions spécialement réalisées à leur intention de manière à instaurer un véritable dialogue entre les populations et les autorités administratives (voir en annexe un exemple de rapport d'écoute établi par le service de la Radion Rurale de la Haute-Volta).

4. La Télévision

Mieux que la radiodiffusion, la télévision, grâce à la force de pénétration de l'image, peut contribuer de diverses manières à l'amélioration du mode de vie des populations rurales. Sous forme scolaire, éducative et récréative, elle peut concourir à promouvoir l'hygiène individuelle et collective et à encourager les nouvelles méthodes culturales etc...

Mais, la diffusion de la télévision à grands échelle dans les zones rurales se heurte à deux obstacles de taille:

1/ l'importance et le coût de l'infrastructure

2/ le coût élevé de l'exploitation et de la production des programmes.

C'est pounquoi une grande attention doit être accordée aux problèmes d'implantation et d'exploitation de la télévision.

En particulier, on cherchera à utiliser au mieux les systèmes de transmission à grande capacité dans le pays ou la région (faisceaux hertziens par exemple) pour assurer la distribution des programmes. On évitera la création de réseaux parallèles entre la téléphonie et la télévision. On veillera à mettre en place des centre d'animation dans les villages ou groupements villageois d'une certaine importance, équipés de matériels de réception sous la responsabilité d'un personnel qualifié pour gérer et animer le centre. En effet le coût du poste récepteur de télévision dépasse largement les possibilités financières du paysan.

Sur le plan de la production des programmes, il semble souhaitable de ne pas disperser les efforts et d'orienter vers la création de centres de production et d'échanges de programmes couvrant plusieurs pays et dotés du matériel et du personnel nécessaires. La distribution à partir de ces centres, dont les activités couvriraient en partie la radiodiffusion pourrait se faire soit sous forme de films et de bandes enregistrées, soit directement en utilisant un réseau de faisceaux hertziens ou un système régional de télécommunications par satellite.

5. Le Téléphone et le Télégraphe

Si l'impact du téléphone et du télégraphe sur l'élevation du niveau de vie des populations des régions favorisées n'est pas aussi saisissable que celui de la radiodiffusion et de la télévision, il n'en demeure pas moins que le téléphone et le télégraphe interviennent directement dans le développement de l'agriculture comme facteur d'organisation des relations entre d'une part, producteurs agricoles et d'autre part producteurs de biens industriels et consommateurs. Le degré d'intervention dépend du dégré d'avancement de l'agriculture dans les zones concernées. S'agissant de la gestion des pâturages, de la protection des fôrêt et de la protection animale, le téléphone et le télégraphe permettent l'intervention rapide des services de sécurité et des services vétérinaires en cas de dégradation rapide des pâturages, de feux de brousse ou d'epidémies animales. Ils permettent de concentrer ces services d'intervention en vue d'en augmenter le rendement. De même, le meilleur encadrement sanitaire des populations rurales nécessitera l'utilisation d'un système léger de télécommunications entre les compagnes et les centres urbains, permettant en outre des interventions rapides en case d'épidémie humaine ou pour évacuer des malades vers des centres hospitaliers mieux équipés (femmes en difficulté d'accouchement par exemple). Notons enfin, que les cultures de la savane sont extrèmement sensibles aux dates des semailles et un retard d'un mois peut signifier une diminution de trois quarts des récoltes; c'est pourquoi les télécommunications demeurent le seul moyen de transmettre rapidement les données météorologiques prélevées en différents endroits du territoire au centre de traitement et de communiquer à la population et autres services les résultats après analyse et interprétation.

Ici également, l'implantation d'un réseau téléphonique et télégraphique en zone soudano-sahélienne doit tenir compte de la dissémination de la population sur de grandes étendues, du manque d'énergie électrique dans petites agglomérations, de la configuration du terrain, de la nature et du volume des informations à véhiculer.

Ainsi on pourra soit construire des lignes aériennes équipées ou non de courants porteurs, ou installer des faisceaux hertziens à faible capacité, ou encore recourir au système radioélectrique simple exploité selon le mode de service d'appel radioélectrique (Radion Call Service) dont le principe d'exploitation est articulé autour d'une station de base établie dans une grande agglomération et de plusieurs stations éloignées qui peuvent être fixes ou mobiles.

6. Les Télécommunications par Satellite

Les progrès récents accomplis dans le domaine des télécommunications spatiales tant au niveau des équipements embarqués que dans les installations terrestres ouvrent de nouvelles perspectives dans l'utilisation de ce moyen moderne de communications. En effet, dans le cadre d'un réseau régional de télécommunications par satellite, comprenant un satellite et plusieurs petites station terriennes judicieusement implantées à travers la région, des programmes de radiodiffusion, de télévision ou scolaires etc...peuvent être élaborés et diffusés à partir d'un ou des centres directeurs.

S'agissant des pays soudano-sahéliens, un cas d'application de ce système de télécommunications mérite une attention particulière, bien qu'il n'exerce qu'une action indirecte sur l'élevation du niveau de vie des populations rurales en décuplant les moyens d'investigation des responsables administratifs. Nous voulons parler de la télédétection des ressources terrestres par satellite. En effet dans les pays sahéliens, où l'on commence seulement à inventorier d'une manière systématique les ressources du sol et du sous-sol, la télédétection se montre particulièrement efficace dans la connaissance du potentiel hydrologique (eaux de surface et souterraines), l'évolution des eaux et le processus de perte.

L'apport des images de télédétection est fort utile dans l'étude des problèmes d'irrigation et l'évolution des dunes. Les images de télédétection permettent également d'établir rapidement des cartes pédologiques présentant un grand intérêt pour l'utilisation potentielle du sol, et de gérer efficacement les zones de pâturage.

7. Conclusion

Qu'il s'agisse de radiodiffusion et de la télévision, des communications téléphoniques par des moyens conventionnels ou par satellite, l'implantation d'un réseau de télécommunications en zone soudano-sahélienne se trouve fortement pénalisée par l'insuffisance ou le manque total de sources d'énergie pour l'alimentation des équipements; par la dissémination de la population sur de vastes régions distantes parfois de plusieurs centaines de kilomètres; par la faiblesse des revenus des habitants et par le manque qualitatif et quantitatif du personnel d'exploitation et d'entretien des installations de télécommunications.

Autant que possible, on s'orientera volontier vers des équipements simples et robustes, pourvant fonctionner dans de nombreux cas loin des réseaux d'énergie existants.

L'introduction des nouvelles sources d'énergie telle que l'énergie solaire peut contribuer à trouver une solution originale au développement des télécommunications dans les zones soudano-sahéliennes.

TABLEAU I

DONNEES ECONOMIQUES GENERALES

P A Y S	Population totale en milliers d'habitants	Production intérieure brute en milliers de F CFA	PIB per catita en CFA
BENIN	3 200	87 000	27 000
HAUTE-VOLTA	5 572	I05 000	I9 000
MALI	5 500	97 700	I8 000
MAURITANIE	I 343	78 800	59 000
NIGER	4 540	94 800	2I 000
SENEGAL	4 980	278 900	56 000
TOGO	2 225	I09 900	49 000

~~NOTA : Ces données sont de 1975.~~

NOTA : Ces données sont de I975.

TABLEAU 2

NOMBRE DE LIGNES PRINCIPALES TELEPHONIQUES DEBUT 77

PAYS	Nombre de lignes principales	% lignes principale de la Capitale	Nombre de lignes principales pour 1000 habitants
BENIN	5 863	63	I,73
HAUTE-VOLTA	3 884	57	0,69
MALI	3 6II	64	0,62
MAURITANIE	2 20I	67	I,57
NIGER	3 838	63	0,79
SENEGAL	I5 0I5	70	2,90
TOGO	4 978	82	2,I2

Pour la Haute-Volta, les données sont du 30 Avril I978.

TABLEAU 3

NOMBRE DE POSTES RECEPTEURS DE RADIODIFFUSION

P A Y S	Nombre de postes récepteurs	Pourcentage pour 100 habitants
HAUTE-VOLTA	90 000	1,6
MALI	75 000	1,3
MAURITANIE	80 000	5,9
NIGER	100 000	2,2
SENEGAL	280 000	5,6

ANNEXE I

RAPPORT D'ECOUTE DES RADIO-CLUBS

(A remplir par le responsable du Club d'écoute)

Nombre des membres du Radio-Club présents........................

lors de l'émission de la Radio-Rurale du..........................

Portant sur le/les sujets...

....

I°/ Quels sont les problèmes qui ont été soulevés au cours de la discussion ? ....

2°/ Quels sont les sujets pour lesquels les membres du Radio-Club désirent de plus amples explications ?..................

3°/ Des critiques ont-elles été formulées par les membres du Radio-Club à l'encontre de l'émission ? Si oui lesquelles ?....

....

4°/ Les membres du Radio-Club, ont-ils fait des suggestions pour les émissions suivantes et lesquelles ?....................

5°/ Vous même, avez-vous des critiques ou suggestions particulières ou des problèmes à nous soumettres et lesquels ?......

....

6°/ Les présentateurs des émissions, s'expriment-ils convenablement ?..

7°/ La qualité de l'émission, était-elle bonne, suffisante, mauvaise ? (rayer les mentions unitiles).

ECONOMIC CONSIDERATIONS IN PLANNING TELECOMMUNICATIONS DEVELOPMENT IN ISOLATED AND UNDERPRIVILEGED AREAS

FRANK M. MGAYA
TANZANIA

1. SYNOPSIS

Little attention has been paid in providing telecommunication services in isolated and underprivileged areas of the country because the high costs and benefits cannot be quantified. This paper examines the importance of these services and recommends that telecommunication is one of the major infrastructure as much as education, health, transport and water, forming part of rural development.

2. INTRODUCTION

The development of communication network in isolated and underprivileged areas, to satisfy the needs of the rural population is a method of lifting the society from poverty and a means of closing the gap between the elite and the common people.[1] One method to accomplish this is to provide reasonable telecommunication facilities in these areas.

The most difficult problem faced by telecommunication administrations in all countries of the world is to provide telephone service at reasonable cost to the sparsely populated and remote areas of the countries. Most developing nations do not regard telecommunication as one of the basic infrastructure due to the fact that, while many commodities can be quantified based on known values and direct benefits, telecommunications benefits are indirect and cannot be measured. This disadvantage is shown by the telecommunications expansion in the main cities. (Tanzania telephone distribution for rural area is 6.4%, while population is about 93%.)

Further, the planning of telecommunication network is based on the viability of the projects; thus, isolated and underprivileged areas with high capital cost for system provision and small traffic render them in a disadvantage in that, when the project is considered in terms of rate of return provision of service is uneconomical. In developing countries there is a great lag in forecasting of demand due to insufficient data available; this has led to large number of waiters. (Tanzania waiters/ELC is 36% February, 1978) large congestion due to underprovision of equipment, leading to less revenue earned, wear and tear of equipment causing reduction in its expected life. The planner is therefore more concerned with short term reliefs and little resources are invested for the isolated and underprivileged areas. The important service question associated with limited resources is whether service should be provided to as many subscribers as possible or should service criteria together with capital availability determine network growth or should some percentage of the capital be spent on the isolated and underprivileged areas of the country.

Examination of the need for the services in the isolated and underprivileged areas, and some economic aspects in the choice of systems, together with a typical example of telephone service in islated areas in Tanzania is given.

3. NEED FOR SERVICE IN ISOLATED OR UNDERPRIVILEGED AREAS

The basic needs for rapid development include health, education, welfare, transportation, safety, national defence, energy, productive commerce and political harmony, and telecommunications is embeddedin the process of satisfying these needs thus constitutes an infrastructure for those needs above.

Telecommunication plays a significant role in decentralization and rural development. In developing countries where conditions in the cities are more attractive to live, there is a definite need to concentrate equally on industrial and agricultural development so as to effect balanced economic growth. Some measures have to be taken to restrict further growth of urban areas and decentralize the nation's population and economic structure by increasing agricultural productivity and enhancing satisfaction of the rural isolated population's life to be commensurate with that of the cities. Telecommunication is one of the best answers.

Rao[3,4] has pointed out that when information comes to an isolated community it triggers changes and he holds that communication is a big contribution towards development. Indeed, in developing countries where large scale participation at all levels by all people is necessary for rapid development and the need to persuade people to adopt new ideas, techniques, social relationships requires education and training through use of one way communication (mass media), telecommunication plays the role of feedback channel.

Telecommunication in isolated areas is basically for communication in the local hierarchy and the district level[1]. The main uses of these facilities could incude health care, emergency information, development process and social activities.

3.1 Health Care

The difficulty of providing health care services and shortage of doctors and their reluctance to live in rural areas reduces medical facilities. Telecommunication can help to provide doctor service to people through paramedical personnel. And rural medical officers could have easy access to the doctors to discuss medical cases. Specialized services can easily be arranged through telecommunication.

3.2 Emergency Information

Cases such as floods, epidemics, accidents can easily be communicated and re-broadcast where need arises.

3.3 Markets

The need to improve agricultural productivity requires that the necessary tools are available, e.g. seeds, fertilizer and other requirements from shops and cooperatives. Telecommunication services greatly help in getting reliable information.

3.4 Development Process

As reiterated in the introduction, the need for large scale participation at all levels by all people for rapid development requires that good communication is available to isolated villages so as to share the development targets and plans.

3.5 Social Activities

Besides discussion of common problems among villages and district centres, telecommunication acts as social link between villages.

Saunders and Warford[5] report on a survey of rural telecommunication in Costa Rica that "By far the most prominent reason for which calls were made, however, was personal". They conclude that in addition to the more concrete contribution made by rural public telephone programme to regional economic development, it has also had the effect of improving the general quality of rural residents' lives, by allowing them to stay in touch with family and friends who have left their houses.

In this regard, in order to improve the living conditions of isolated areas and attract the population to live in these areas, improvement in education, health, transport and energy must go together with provision of telecommunication service.

4. ECONOMIC CONSIDERATION

Having established the need for telecommunication in isolated and underprivileged areas of a country, it is necessary to consider the economic planning aspect. Factors that must be borne in mind in the system design include:

1. Demand
2. Geographical conditions
3. Quality of service
4. Tariff structure
5. Constraints

4.1 Demand

Telephone demand is a function of population, income price and infrastructure of the country and its economy, these being interdependent. In principle forecasting of demand may be made by:

a) Comparing previous development trends and the future taking into account possible economic changes;

b) Comparing demand in another country with similar development periods.

c) Using combinations of factors like GDP, use of commodities like electricity, transport.

Isolated and underprivileged areas will lack most of the commodities mentioned in (c) and in general forecasting using (a) and (b) would be the only indicator. In developing countries in particular, there is not enough data on which to base the forecasts. Since forecasting influences the size of the system and technology to be chosen, it is necessary to try as far as possible to make reasonable forecasts so as to effect good system planning.

4.2 Geographical Conditions

The choice of telecommunication system to be used depends not only on demand and resources (material and manpower), but will also be dictated by the geographical conditions.[7]

a) Natural Barriers

These include mountains, rivers, forests and jungles, earthquakes, flora and fauna; all these will dictate type of system to be used in the most economical manner.

b) Climatic Conditions

Where there is marked regional temperature extremes, seasonal weather conditions, severe storms, and dust, special consideration in system design, such as determination of tension for overhead open wire routes, fading in radio links and specially designed radio towers has to be taken into account.

In planning such systems not only will the geographical conditions dictate the choice of the system, the maintenance aspect has to be taken into account. This calls upon the decision a country makes on quality of service.

4.3 Quality of Service

The provision of telecommunication service in the isolated and underprivileged areas cannot be decentralized from the national system; attention has to be paid to the desirability of standardizing subscribers' facilities and improving technical performance in the light of present and anticipated future technologies at the same time achieving full compatibility with accepted international standards in order to guarantee maximum usage.

Such a policy will and must mean a complete national integrated system involving transmission, national numbering and routing plan. This must aim at having an efficient, reliable and good quality service.

If the purpose of providing telecommunication in the isolated area is to improve the living condition so as to develop agricultural production, it would appear obvious that improved quality of service stimulates production thus increasing the income which in turn increases the telephone demand. Poor service invariably leads to users drifting to alternative communication means.

4.4 Tariff Structure

Telecommunication authorities generally revise tariff levels in order to ensure that there is sufficient revenue to cover expected operating expenses, depreciation and some surplus for expansion. The actual cost structure is generally unknown.

The main question is to what extent should tariffs influence utilization of equipment for the isolated areas. Should the urban centres subsidize the isolated and underprivileged areas of the country? It would appear that if the aim is to make full utilization of the equipment then the tariff structure should take into account the fact that isolated areas are underprivileged and some subsidy is required.

This should be possible because the number of subscribers in the isolated and underprivileged areas is small and hence the income generated is negligible compared to the telecommunication network as a whole.

4.5 Constraints

The major constraint in providing service to the isolated areas is resources, both financial and human (technical and managerial). It is difficult to assess costs and benefits of telecommunication and hence financial resources are allocated to projects which can be evaluated in terms of their technical and financial viability selected to yield high financial rate of return on capital.

a) High Demand

In developing countries in particular, because of large waiting lists in urban areas and the need to supply telephone service to satisfy the greatest number of requests for service, congestion is the order of the day hence planning is more oriented to relief. This coupled with limited capital resources forces the planner to concentrate on these areas where high rate of financial return is anticipated.

b) External Financing

This constraint is applicable to developing nations, where planning is dictated by the financiers who in the main have to recover the loans within the relevant period. Under such circumstances it is difficult to standardize equipment which leads to expensive interface problems and unnecessary large spare holdings.

c) Manpower Development

One of the major problems in implementation of projects is lack of human resources; caused in the main by environmental problems on enumberation and high labour markets for competent staff. Notwithstanding the above, it means that project planning, coordination and control is done by experts who may not have deeper knowledge of the country's goals. Thus comparison is made using the growth rate of a developed country leading to underprovision of services. As said in (b) isolated and underprivileged areas are neglected.

Even where service has been provided, maintenance personnel may not be available for the varied types of equipment used, thus precluding possible reliable service in these remote areas.

5. POSSIBLE SOLUTIONS

The isolated and underprivileged areas as previously asserted do not stand a good chance of being provided with telecommunication service unless the countries concerned make special emphasis on development of these areas. In any case when considering provision of service, and a project appraisal is made, consideration should be made on a system as a whole (preferably on a regional or country basis). It would be proper to allocate some funds on yearly basis for such development. Where possible the tariffs should reflect the need for the service instead of basing purely on rate of return or at least the major cost items should be spread across the network as a whole.

Further, all efforts should be made to standardize the equipment and thus reduce maintenance costs and increase reliability. Pitrode[9] suggests that, since telecommunication equipment is designed for use in developed countries and modified for adoption in other areas, an autonomous, non-profit Telecommunication Technology Centre with the objective of developing appropriate technologies for telecommunications needs for developing countries be established. Such an idea could be extended to isolated and underprivileged areas which require special attention, both in reliability and simplicity in maintenance.

As mentioned previously, human resources is one of the major constraints in telecommunication development. This fact has to be considered by the administration itself and the policy of the country in particular. Efforts should be made to retain manpower with local knowledge who should determine the requirements of the country.

6. PLANNING AND IMPLEMENTATION IN TANZANIA

Tanzania has an area of approximately 930,000 sq.km. with a population of about 15 million (estimated, census to be carried out in August, 1978). The telephone penetration is 5 stations per 1000. In the remote areas as previously mentioned there are only 6.5% of the total stations and the distribution is only 0.34 stations per 1000. In the past only about 4 % of the investment has been allocated to rural communication.

In view of this the development programme for 1978/81 has the aim, among others, to provide telephone service to all district administrative centres (which are remote) and border villages. In so doing services can be provided along the route (where overhead lines or radio links are used), and the investment is likely to increase substantially due to the need to develop the agricultural sector as well as the policy of grouping the population so as to provide the amenities enjoyed by the urban population.

Annex I shows a typical isolated area where services were provided and growth trends for these areas have been indicated in terms of investment, income. Return on capital is difficult to assess as no separate records are kept. It is shown that some of these areas have some economic growth enhanced by the provision of service while others depend on events that have occurred.

CONCLUSION

It is clear that provision of telecommunication service in the isolated and underprivileged areas of the country is in the main a basic infrastructure as much as education, health, water, energy and transport. In order to enhance development and reduce the migration of rural population to urban centres, it is necessary to provide good services in the isolated areas.

These services are unlikely to be viable so that administrations should calculate the viabilities in terms of overall network rather than a particular isolated service provision. This will depend on countries' policies on economic development and willingness to improve the rural life.

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ANNEX I

Typical Case in Southern Tanzania

1. Introduction

The Southern part of Tanzania has for a long time been isolated with respect to communication (both transport and telecommunication). The direct access road from the capital is only operational for half a year due to floods; sea transport is inadequate even to handle essential commodities and passengers while air service, though restricted, is expensive.

Telecommunication service is being improved at least to the Regional and District Centres. In the case of district centres, land line with rural carrier system has been provided. Since this land line traverses isolated areas, selected villages have been provided with telephone service.

2. Need to Provide Service and Economics

The particular villages were selected not only because they were along the overhead route; they had some economic or social activity. The population around these villages is mainly of subsistence farming with cashew nut as their cash crop. The cost of providing carrier system was low as there was an existing route except for Mahuta. Circuits so provided have been terminated on small manual switchboards.

CENTRE	ACTIVITY	APPROXIMATE POPULATION IN THE AREA	CAPITAL USED TO PROVIDE SERVICE * 10^3 US $	NUMBER OF SUBSCRIBERS			REVENUE US $		
				74	75	76	74	75	76
Mingoyo	Road Junction Trading	26,000	12.5	6	10	12	775	1570	3280
Mtama	Trading	38,000	3.75	4	4	7	1300	410	1440
Ndanda	Mission & Schools	35,000	3.75	6	8	9	1070	1480	1850
Chiungutwa	Small Village	33,000	1.2	4	3	3	120	280	220
Lulindi	Mission Schools Trading	26,000	1.2	7	9	9	13 0	1850	2330
Mahuta	Trading	39,000	22.5	–	32	27	–	2540	1710

* The cost excludes that of the overhead route, but includes the local network and carrier system where applicable.

All subscribers are small business people or schools or missions and in each centre one public call office has been provided. As seen from the data, the telephone growth rate is low, in certain cases it is negative, mainly due to the tariff structure (the rural population cannot afford). Most of the calls made are business; emergency and social calls contribute to total traffic.

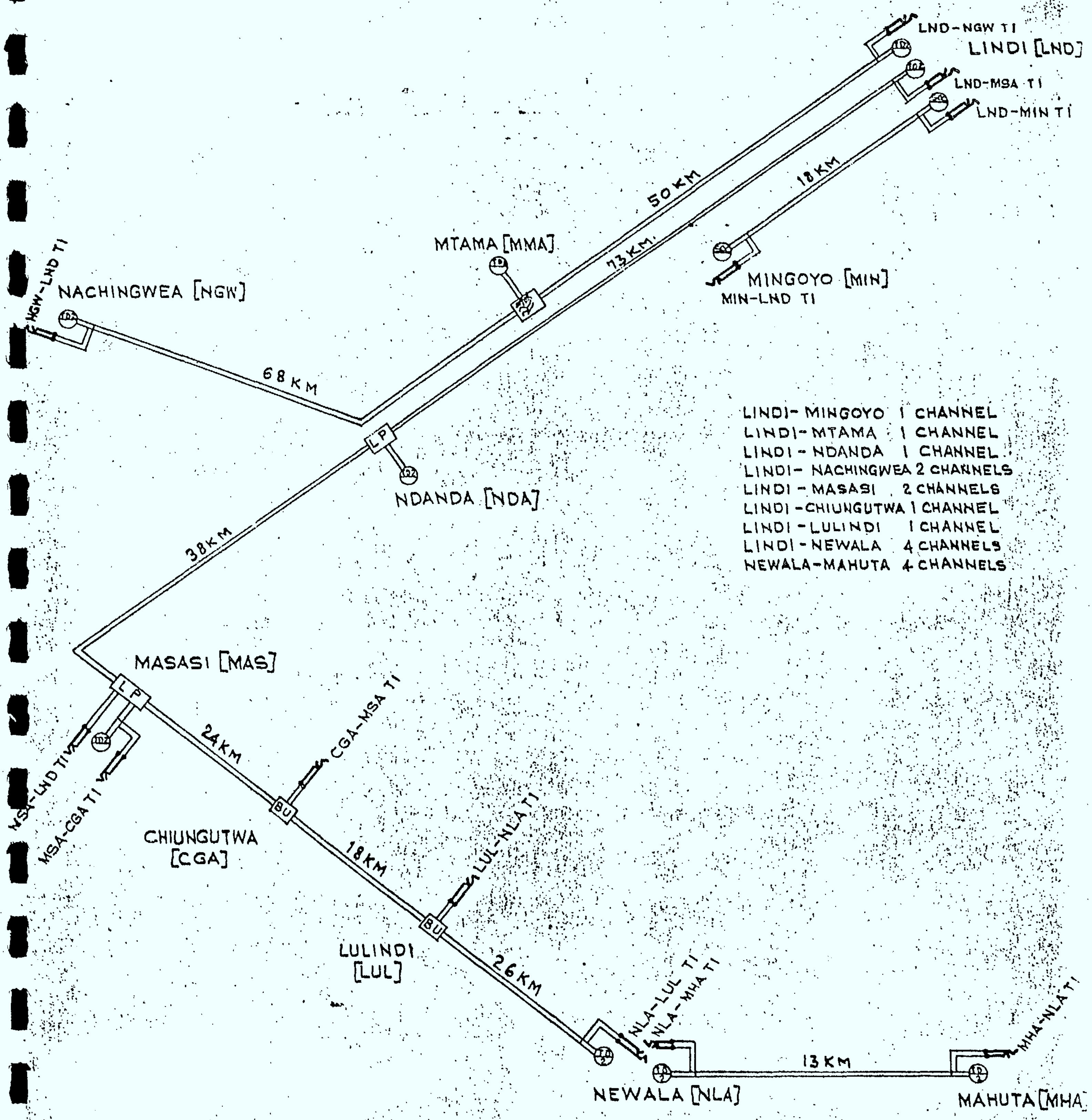
It should be noted that the telephone service itself is poor, due to maintenance problems of the overhead route which passes in bushy areas away from the trunk road and of technical skills to maintain the carrier equipment. Further all these stations have no AC mains supply, dry cells are used to power the system. The maintenance costs are high, though difficult to evaluate as no separate accounts are kept for each particular system.

CONCLUSION

It is shown that telephone service in isolated areas can be provided, only if in planning major economical systems isolated areas are taken into account. In this way the uneconomical project can be absorbed by the viable undertaking. The tariff structure will affect the utilization of the systems and thus consideration should be given to provide special rates in the isolated and underprivileged areas of the country.

In Tanzania, it is the policy of the government to improve rural life so that when planning telecommunication, these factors have to be taken into account.

TYPICAL CASE



LINDI- MINGOYO 1 CHANNEL
LINDI- MTAMA 1 CHANNEL
LINDI - NDANDA 1 CHANNEL
LINDI- NACHINGWEA 2 CHANNELS
LINDI - MASASI 2 CHANNELS
LINDI -CHIUNGUTWA 1 CHANNEL
LINDI - LULINDI 1 CHANNEL
LINDI - NEWALA 4 CHANNELS
NEWALA-MAHUTA 4 CHANNELS

PAPER ON SPECIAL TECHNICAL PROBLEMS
OF PLANNING TELECOMMUNICATION SERVICES
DEVELOPMENT IN ISOLATED AND UNDERPRIVILEGED
AREAS

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NIGERIA

I intend to deal with this subject under four distinct headings, viz:

i) Physical Features
ii) Human Factors
iii) Choice of Plants
iv) Planning

Of course my discourse will centre on Nigeria and problems that affect provision of adequate telecoms facilities in isolated areas.

1) PHYSICAL FEATURES

Nigeria is located on the southwest of the coast of West Africa, just above the equator and slightly east of Greenwich Meridian. It covers an area of 923,768 Sq. Km. and extends about 1,000 km. from north to south. The territory is roughly divided into three sections in a "Y" formation at the junction of the two main rivers, Niger and Benue, at Lokoja.

Politically, the whole country is divided into 19 states which are further divided into local government areas. At the moment the country's administrative and political headquarters is located in Lagos but there is a long term plan to move this headquarters to the middle of the country. The coastal area is honeycombed by a network of lagoons, creeks and mangrove swamps. Vegetation here is luxuriant, predominatly palm, banana, pawpaw and other fruits, as well as timber and underbrush. A few miles inland, forest belt begins, ranging from 50 to 100 kms. in width. Further north the terrain is more open, averaging 600 meters in elevation and sometimes reaching as high as 2000 meters. In the extreme north the country emerges into the Sahara Desert.

From climatic point of view, the country lies in the tropics. It has two seasons: wet from April to October, and dry from November to March. The average monthly rainfall in Lagos is 18 to 51 cms during the wet season with temperatures in the lower eighties. Humidity is very high and further north the climate is drier with temperatures reaching as high as 110^{o}F. During the rainy season, flooding is common, disrupting rail and automobile traffic for days. These vast variations in climate, temperature and terrain make the provision of simple telecoms facility difficult and at best very expensive.

a) Existing Facilities

In the past and up to 1960, the provision of telecoms facility was restricted to pure government business and most of the lines were on open wire carrier working into magneto and other types of manual exchanges. The difficult terrain in riverine and delta areas of the south made planing of open wire cable poles difficult, hence a microwave network was constructed to link inaccessible areas.

In some parts of the country, rural call offices were provided, and it is not uncommon to have copper conductors used in open-wire link disappear from telephone poles only to turn up later as bracelets and other forms of jewelry. The customers have telephone instruments of various makes with different electrical characteristics. The equipment ranges from fairly modern in urban areas to antiquated in remote sections.

Up until very recently few standards or specifications were available and this mixture of systems create operational problems as well as maintenance of standard facilities. It is against this background that modern telecommunications facilities have to be provided to meet the socio-economic development of the country.

2) HUMAN FACTORS

Besides the lack of modern plants there are human factors to contend with. Nigeria is purely an agricultural country with closely-knit family communities. The dispersal of population is very small, the peasant population often quite content living and dying in their localities. However, the educated and young ones tend to migrate into urban areas; this problem is "helped" by inadequate infrastructural facilities in rural mainland areas of the country. In contrast, delta and riverine areas are still largely inaccessible. However, efforts are underway to construct bridges, floating bridges in order to open up these parts of the country. Planning of telecommunications facilities for this sort of society requires considerable knowledge about the social interaction of the people in order to determine the traffic flow and hence quantity of circuits.

Unfortunately, the statistical data on community of interest and cross-state boundary trade, travel, etc. are not available; therefore "educated guesses" are usually made to determine the quantities. Also the level of literacy in the isolated areas is low and the use of sophisticated telecoms facilities is limited. This inevitably leads me to choice of plants, i.e. local line plant, switching systems and transmission network.

3) CHOICE OF PLANTS

In choosing the right type of plant for telecommunications facility in isolated areas, cognizance must be taken of:

a) Flexibility
b) Reliability
c) Ease of Operation
d) Mean Time between Failures
e) Time to repair failure
f) Climatic adaptability

Fortunately the electronics technology has progressed to a stage where plants are made and capable of meeting majority if not all of the conditions listed above.

a) Local Line Plant

The main difficulty confronting a telecommunications administration in deciding the mode of connection to a customer's premises is the level of development of the localities. As most of the isolated and underprivileged areas are developing, local line plants are provided on aerial cables that can be moved to allow for future development of the municipality. Besides, economic cost of burying a cable becomes prohibitive in riverine and delta areas of the country. Therefore, these localities are served by aerial cables on wooden poles with Ready Access Terminals (RAT) as junction boxes for drop wire to customers' premises.

Having decided on the type of local line plant, there is an uneasy task of providing adequate plant to meet the requirements over a period of 5-10 years. In an advanced society this may be an easy task. However, in a developing country like Nigeria, demand forecast beyond a period of two years is unreliable and socio-economic growth might and usually does alter the character of an undeveloped village overnight. Therefore, a flexible method of providing service is called for in deciding the size of cable for subscribers network.

b) Switching Systems

Although there are sophisticated and modern switching systems available in the world telecoms markets, the choice for an isolated area must take into consideration cheapness, spare parts and ease of maintenance. It is not unusual in riverine and delta areas to have problems of constructing exchange buildings. The type of soil is marshy and therefore building costs take a huge proportion of the total cost of providing an exchange facility.

In order to reduce cost, therefore, small mobile exchanges that can be stood on four props are being widely employed.

c) Transmission Network

Existing transmission network is predominantly open-wire system. Because of the theft and maintenance problems over a long bushy part, recourse was made to microwave systems.

However, undulating terrain and lack of suitable survey maps for proper planning of microwave routes have made radio transmissions difficult to many parts of the country. In order to meet the demand for improved trunk networks, more revolutionary methods are being planned. One of such methods is the use of tethered balloons (Aerostats) which have been used successfully in the Americas (USA and Bahamas) as well as Iran (Middle East) to carry telephone and television messages. In remote and isolated locations, the terminal equipment are conventional multiplex and radio equipment - the choice of which must be simple and easy to maintain.

4) PLANNING

The present number of working telephone lines in Nigeria represents a telephone density of less than one line per 1,000 inhabitants. It is therefore desirable to increase the number of working lines to a level appropriate to the conditions of Nigeria. It is well known that there is a high correlation between economic growth and the growth of telephone lines. The gross domestic product for the third National Development Plan is around 10%. It is therefore expected that telephone density will increase proportionately to bring the total number of lines to 500,000 lines. In order to distribute the macrocosmic number of lines into towns and villages, information of population distribution and other statistical data are required.

Unfortunately, detailed information of this type is very scanty and in most cases not available. Therefore a planner has to resort to the 1963 Nigerian National Population Census and carry out appropriate projection to arrive at projected population figures. Therefore underprivileged areas end up having more or less number of lines than are socially necessary for their economic level. In this regard, planners have to use other planning criteria than are recommended by the ITU. It is not only in areas of number of lines that planning for isolated and underprivileged areas do not follow strictly the recommendations of the ITU. It also manifests itself in such areas as numbering, charging and routing plans.

a) Numbering

For routing and charging purposes, the country has to be divided into:

i) Numbering areas, each of which is allocated a trunk code;
ii) Charging areas, each with its own charge point: these form the basis of time-zone metering;
iii) Primary areas, each served by a primary centre through which trunk traffic is normally routed;
iv) Secondary areas, which are groups of primary areas, each served by a secondary centre for switching transit trunk traffic.

Allocation of numbers for a specific area and allowance for an increase in numbers in the future are the main problems of a numbering plan. This problem is more difficult in small rural locations where growth cannot be forecast but has to be provided for in the numbering plan. In Nigeria the numbering plan consists of:

i) the trunk prefix code;
ii) trunk code (or numbering area code);
iii) subscriber's telephone number (the number to be dialed to reach a subscriber in the same local network of numbering area).

A combination of open numbering and closed numbering is used and because of wide dispersal of population distribution within the country this comprises of 7 and 8 digits national numbers. However, within a numbering area a closed numbering plan has been based on projected demand of telephone for a period of 50 years in accordance with CCITT recommendations.

The problem posed by small exchanges in an exchange having seven digits numbering is that routing translation has to be delayed for up to the fifth digit. In normal telephone planning, if there is enough traffic between local exchanges a direct route may be established between the two locations. This may be so in large urban networks but hardly economic for small rural exchanges as expensive charging equipment would need to be purchased.

b) <u>Charging Plan</u>

All local and STD calls in the automatic exchanges in Nigeria are charged on Subscriber's Call Meters. The interval between the pulses for an STD call depends on the distance between the looal exchanges involved. Within a charging area one charge will be applied to STD calls.

In rural and isolated locations, two exchanges which are located close to each other but on different sides of the charging area; an adjacent area charge which is equal to the area charge may have to be applied as charging area may not be synonymous with community of interest. In addition, charging plan had to be devised such that underprivileged areas should not need to pay highly for calls to their headquarters.

c) Routing Plan

There are many ways of routing telephone traffic in a hierarchical structure. Most local exchanges are connected to a primary centre which are in turn connected to secondary centres, etc. for STD traffic. In some multi-exchange locations, exchanges have direct junctions if there is traffic justification. However, this facility is usually not available in small rural exchanges for more than 5-10 routes. Therefore in isolated areas calls are routed only to the primary centre.

5) CONCLUSION

In conclusion, this paper has attempted to highlight some of the problems that are usually encountered in the provision of telecommunications facility in isolated and underprivileged areas. All telecommunications administrations have continuing problems in meeting the demands for telecommunications facilities throughout the world. The tasks are more daunting and onerous in a developing society where due to decades of neglect and lack of reliable statistics, planning provision and development of telecommunications facilities are handicapped by lack of infrastructure and climatic conditions. It is my hope that at the end of our deliberations this Workshop would have identified most of the problems and provide guidelines to help developing countries like Nigeria.

Thank you.

THE INTEGRATION OF TELECOMMUNICATIONS SERVICES PLANNING WITH PLANNING IN OTHER SECTORS

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KENYA

INTRODUCTION

It seems reasonable to state that developing countries or better, "underdeveloped" countries are those in which there is a predominance of isolated and underprivileged areas or districts. These countries are mainly in the vast stretch of the planet, extending eastwards from Latin America, through Africa and the Middle East to South and Southern Asia. In these vast regions can be found virtually every race and creed which exists on earth, every kind of geographical environment and climate, and communities in differing stages of development. Most people are poor in the material things of life, but there is in much of this area a tremendous wealth of resources. Land in some places is dangerously overcrowded, but in other places, it could support two or three times the present population even without much economic advancement.

Africa as a continent of the underdeveloped or the "third world" countries, has in nearly each of its countries isolated and underprivileged areas. The telephone density in this continent has persistently been the lowest; second usually to Asia until the end of 1977 when the telephone densities were 1.4, 4.5 and 5.2 telephones per 100 of inhabitants in Africa, South American and Asia respectively. This figure considerably reduces to approximately 0.7 telephones per 100 inhabitants during the same period in the case of black Africa.

Telecommunications play an essential role in the development process. Unfortunately, an assessment of the relationship between economic development and the nature, magnitude and timing of telecommunication investments has not progressed far, since development economists have, to date, paid little attention to telecommunications and many empirical and conceptual issues still remain unresolved. Further still, whereas it is relatively easy to aggregate investments in telecommunications during a specified period and compare it to the magnitude of investments in other sectors in a particular country or region, there is no established evidence of integration of telecommunication services planning with planning in other sectors of Africa.

There are at least two reasons for this: firstly, development economists have not paid adequate attention to telecommunications and evaluation of its contribution to the development process, especially in Africa - the underlying constraint is that very limited financial resources are being shared amongst many desperately needed development projects. Secondly, the general African telecommunications development has not kept pace with other sectors of economic development owing to the diverse kinds of organizations set up to be responsible for it and to the rather low priority accorded it, particularly in the isolated and underprivileged areas of countries which inevitably form most of the area of almost any country. The experience of Kenya in the treatment of this vast subject is now reviewed in the remainder of the paper.

GENERAL FEATURE OF RURAL AREAS IN KENYA

Kenya occupies an area of 580,367 sq. km. of which 11,230 sq. km. (2%) is under swamp and water. The present population is estimated at 14,348,000 (10,943,000 was the 1969 census population). In 1969, 9,927,000 lived in the southern part within an area of some 266,376 sq. km. being the agriculturally fertile part and providing the bulk of the livelihood for Kenyans. The remainder of the population (1,016,000) or 9.3% resided in all of the northern part with extension to the south which is mainly semi-desert, and only 998,022 or 9% of the population lived in main urban centres. This state is maintained to date where at least 90% of the population live in the rural areas.

The social structure consists of very close communal ties and the main economic activity is peasant farming. The younger generation generally drift to urban areas in search of new economic opportunities thereby causing large internal population migration. Everyone generally tends to know everyone else and the close circle is limited in its geographical extent. Needs are simple, the basic ones being usually obtainable within the confines of the area inhabited by the community. Nevertheless, the "extended family" phenomenon where rather distant cousins are regarded as belonging to the family, widens the circle of communal ties even wider than would be the case with western society. The growing pace of modern life is steadily loosening these ties though they still have to be recognized.

Agriculture is the main economic activity in Kenya and the majority of the population is engaged in agriculture ranging from extensive traditional subsistence to well organized large scale and small-holder agricultural farming. Only a small part of the farmer population uses modern farming techniques to increase the yield in large scale farms. However, the co-operative movement is considerably successful in Kenya. Farmers of every description are organized in varying sizes of a co-operative system designed to improve their social and economic output. The need for efficient telecommunications in this sector is high, being an essential element for successful agricultural activity.

Unfortunately, this relatively impressive economic activity is taking place in the southern part which is fertile and in which there is at least 90% of the population. The northern half of the country is semi-desert and very sparsely populated. The infrastructure is very much underdeveloped, it is remote and the roads are very difficult; sometimes impassable during the wet seasons, where they exist. The population in this part are mainly nomadic tribesmen - constantly moving from one part to another in search of grass and water for their cattle. They dwell in temporary mud or bush huts. Permanent accommodation exists at few and isolated centres where there is the administration, schools and trading activities.

Thus, because of the absence of a relatively developed infrastructure, there is much strain on the administration of law and order and other government services in this part of the country. Worse still, telecommunication services are grossly inadequate in this part even where they exist in whatever form.

ECONOMIC ACTIVITY AND TELECOMMUNICATION SERVICES IN ISOLATED AND UNDERPRIVILEGED AREAS OF KENYA

These areas embrace some eleven districts each with an administrative headquarters; and lie mainly in the northern half of the country bounded by common borders with Uganda to the west, Sudan to the north west, Ethiopia to the north and Somalia to the east (Fig. 1). It is a vast area; some 363,991 sq. km. in area with a currently estimated population of 1,129,000. Telecommunication services are inadequate, represented by only 893 telephone stations as at 1st January, 1978 or an average telephone density of 0.079 telephones per 100 inhabitants serving mainly the administrative and trading centres in the area. These services are supplemented by a network of radiocall stations connecting the more remote centres. Recorded waiting list is usually very small and not persistent.

The comparison with the rest of the country, having 142,875 telephone stations or 1.08 telephones per 100 inhabitants with Nairobi having the lion's share (87,225 telephone stations) is quite minimal.

The public telephone exchanges are all manual switch boards whose individual capacities vary between 30 and 140 lines. They are each connected to the public network by a mixture of overhead open wire trunk telephone lines and single channel VHF radio relay links. The HF radiocall system connects the public offices as well as the subscribers who are on it with the Nairobi radio control where the "phongram" operator makes a connection with the public system. Available telecommunication services only serve the district administrative community, trading community and lone subscribers such as the national game park lodges and various government project groups.

The rest of the infrastructure is also generally much underdeveloped, although efforts recently focussed on its development are now becoming real achievements as now briefly surveyed.

Road Communications

Very large distances separate administrative and trading centres in the area and interconnecting roads are very scarce or non-existent. However, the need to have all-weather highways linking Kenya with her northern neighbours has grown considerably through the regular ministerial consultative committee meetings that are maintained between Kenya and her neighbours. Specifically, because of the excellent port facilities at Mombasa on the Kenya Coast, Mombasa is naturally the sea gateway for most of the hinterland of Eastern and Central Africa. Southern Sudan depends upon Mombasa port to a very large extent and so would southern Ethiopia. Consequently, the long awaited Nairobi-Addis Ababa highway was opened to traffic in October, 1976 but owing to the adverse military situation in the Horn of Africa this highway has not been put to much economic use. Alternatively, Mombasa is extensively used to serve Uganda, Sudan, Rwanda Burundi, and Eastern Zaire by road and rail through Uganda.

Kenya and Sudan are jointly constructing an all-weather highway to connect Juba in Southern Sudan and Kitale in Western Kenya. This highway will provide an easy and direct outlet for Sudanese goods via the Kenya port of Mombasa. Thus while the main economic support for these crossborder highways is the transportation of goods between the commercial gateways in both Kenya and in her neighbouring countries growth of branch roads off the main highway occurs in the process. This is similar to the Pan African Telecommunications network where the evolvement of an intra-African telecommunications network has led to greater development of the individual national networks of the participating countries to take traffic to and from the main international system.

Telecommunications is therefore bound to follow the road development in these areas.

Commercial Activity

The main occupation of the population in the area is cattle keeping by nomadic means. There is wild game enabling national game parks to be established with corresponding increase of tourist activity in the area. In this regard, there are the Omo and Dawa rivers along the Ethiopia and Kenya border which flow into Lake Turkana - one of the deepest lakes in this part of the world. These rivers over flood their basins seasonally and the two governments have been discussing the need to develop these basins for crop growing and for attraction of wild game. This would encourage evolution of orderly growth of permanent settlement of population and exploitation of available resources in the area.

There is an active fishing industry along the shores of Lake Turkana which with substantial government support has been transformed into one of the largest co-operative Unions in the country. This Union operates an efficient quota system for the fishing and marketing of the fish in the home market as well as in the export market such as Zaire and Angola where smoked fish are exported.

In the case of the eastern part, Africa's largest irrigation project is under construction along the Tana River basin in which families will be settled to be engaged in farming for basic food needs and for trade.

Education and Cultural Activity

Since attaining independence the Kenya Government has been examining the best methods to be adopted in improving the educational and cultural levels of its people, especially those in the most underdeveloped rural areas. Basic features of such methods are firstly that they are multipurpose in extent; secondly that they have boarding accommodation facilities for pupils and trainees at the educational centres; and thirdly that the ultimate desire must be encouragement of permanent settlements of the nomadic population in the areas selected.

The Ministry of Education in association with the Ministries of Agriculture and Social Services has with a financial grant from the International Development Association (IDA), started projects for building centres for nomads to be established in 13 districts in the most underdeveloped areas in the education field; these will include construction of primary schools with boarding facilities and will train youth and adults and provide vocational training. Courses at the village polytechnics (to be re-named Craft Training Centres) will be modernised under this programme. These centres will be at Lamu, Tana River, Garissa, Mandera, Wajir, Marsabit, Isiolo, Turkana (two schools), Samburu, West Pokot, Kajiado and Narok.

OBJECTIVES FOR THE DEVELOPMENT OF THE TELECOMMUNICATIONS SECTOR

The Kenya Posts and Telecommunications Corporation, as a self-financing public body, is adequately convinced of the substantial role telecommunications play in the economic and social development process as well as ensuring a comfortable return over invested capital. Its general objective is therefore to provide postal and telecommunications services to all parts of Kenya within the financial and human resources available to it.

This means commitment to place greater emphasis on taking telecommunications services to the rural areas, especially where none exist at the present time and to improve on existing services where these are inadequate during the 1979-1985 seven year rolling Telecommunications Development Programme.

The theme for the government's next national Five Year Plan 1979-1983 is "alleviation of poverty". So that this aim may be better achieved, the district has been designated the "basic planning Unit", and the Corporation is required to provide correspondingly adequate postal and telecommunications services in every district of the country during the plan period.

Over the longer term, however, and apart from similar efforts in other sectors, the National Water Plan aims at providing each member of the Kenyan population with clean water at home by the year 2000. This is a basic human requirement for better living and calls for corresponding allocations in the telecommunications sector.

In setting the objectives for the Seven Year rolling Telecommunications Development Programme 1979-1985, presently under preparation, the service demand in all urban areas and villages in the country are being assessed. The waiting list (currently 20,441 overall) is to be reduced to a minimum level at the end of the programme period and telephone service will be provided to all villages where none presently exists even by means of public call offices in the villages. The telephone density is expected to increase substantially.

The size of the programme to cope with these objectives will be quite large in every respect and will be broken up into financial and implementation phases which will be subsequently rolled forward.

INTEGRATION OF TELECOMMUNICATIONS SERVICES PLANNING WITH PLANNING IN OTHER SECTORS OF THE ECONOMY

Since it is axiomatic that in every national development effort, telecommunications fulfills a vital contribution, correlation of telecommunications development plan objectives with those of other sectors seems paramount for the purpose of gaining greater national benefit at every level. Each element of an overall sectoral development plan should therefore be carefully evaluated and a suitable integrating quantity from the telecommunications sector suitably assessed therefrom.

However, when such quantity in the telecommunications sector has been determined, its cost would be quite large; probably so large as would be inhibitive for a national telecommunications organization. Most national telecommunications organizations in developing countries are self-financing public bodies which derive the bulk of their income from telecommunication services in the urban and government administrative centres. Services in the rural areas are often regarded as uneconomic and even more so in the case of isolated and underprivileged areas.

It seems that there are at least two feasible ways to integrate telecommunications services planning with those of other sectors particularly in the rural areas including the isolated and underprivileged areas: firstly, that in view of their contribution to success of plans in other sectors, governments should subsidize their planning and implementation. And secondly, that if telecommunications services are regarded as essential elements of the more crucial sectoral development plans such as those which are food based, health, education, etc., such food and health based development plans easily secure long term financing allocations with lowest possible interest rates; typically 40 years repayment period up to 1% interest rates per annum with between 5 to 10 years moratorium.

In this manner, commercial motives normally paramount in the organizations' considerations for telecommunications investment would be essential for the purpose of securing funds for the development of the sector so comprehensively assessed.

Besides increases in production, there are other areas or targets of national policy. For instance, social integration, however defined, is an important issue of national policy because of its contribution towards overall national economic and social progress. One example is in India where a Domestic Communications Satellite experiment using an ATS Satellite has been carried out to evaluate contributions to family planning objectives, improvement in agricultural and health practices, and to enhance social integration in all fields through educational broadcasting. The spin-off effect is the enhancement of India's electronics industry since most portions of required equipment and hardware was planned for production in India. Substantially successful results have been obtained and the project is being implemented initially by the leasing of INTELSAT's spare transponder capability.

In a similar manner, a well established educational broadcasting to schools exists in Kenya and relies on the telecommunication network for distribution of programmes from studios to broadcasting stations. So far, these programmes are by radio only but the long term plans include educational television rather like the United Kingdom's Open University Programme. Any programmes necessary for national development can be broadcast through this scheme.

This is an example where planning in other sectors has been made dependent upon availability of telecommunications services for conveyance by means of radio or television broadcasting. Integration of all the elements of such national plans is therefore crucial.

The normal measure for telecommunications development is its density - generally defined as the number of telephone stations per 100 inhabitants in a country. However, for the purpose of estimating the benefit of telecommunications to both the economy and the population of a nation, the International Telecommunication Union's CCITT GAS 5 Study Group has tried to establish a general relationship between the number of telephones and the per capita GDP in a country.

It is felt that the rates of population growth in developing countries are generally so high that significant increases in per capita income or in telephone station density are muffled. Consequently, the Gross Domestic Product (GDP) correlation would appear to be a better measure, since the ultimate economic aim in all development plans is to increase the nation's GDP.

To evaluate the adequacy of telecommunication services in Africa, the United Nations Economic Commission for Africa (UNECA) has evolved an index of measurement based on the correlation between the GDP and the number of telephone stations called Utilisation Factor (UF); defined as the number of telephone stations per US$100,000 of GDP. The UF then, is an index of measurement for assessment of telecommunication development in relation to a nation's overall economic development; thereby calling for integration of telecommunication services planning with planning in other sectors.

As an example, the telephone stations density and corresponding UF as at 1st January, 1970 in Kenya were 0.66 telephone stations per 100 inhabitants and 6 respectively. As at 1st January, 1977, seven years later, the density was 0.95 telephone stations per 100 inhabitants and UF was 4.2 respectively. This means that an average annual growth of 6% has been sustained in telephone stations density. But, the growth of UF has decreased over the period and the reason is that some agricultural products such as coffee and tea have been fetching very high prices in the world market since 1974 thus increasing the GDP figure considerably.

If suitable integration of telecommunications services planning with planning in other sectors can be achieved, an appropriate technology - essentially inexpensive and most suited to the environment - can be found for the telecommunications development planss implementation.

CONCLUSIONS

A clear understanding of the state of a country/s infrastructure especially in isolated and underprivileged areas is essential for aggregating inputs to a telecommunications development plan. In this regard, a general overview of the infrastructure in Kenya's rural areas and the state of telecommunications services therein has been given. These states are similar in other isolated and underprivileged areas of countries in Africa and inevitably deserve similar treatment.

The important subject of traffic forecasts and the types of system to be employed have not been included in this paper as it is felt that identification of the more fundamental economic and social development issues have greater significance in considering the cases for integration of telecommunications services planning with planning in other sectors. However, modern techniques in telephone switching and transmission give greater system flexibility and efficiency in providing services to the isolated and underprivileged areas and one most successful example is a domestic communications satellite system. With regard to traffic forecasts, Kenya's experience is that the majority of telephone traffic from rural areas is long distance traffic rather than local. Consequently, it would appear that, contrary to the general view, telecommunications investments in the rural areas are bound to be profitable over the long term.

A country's economic activity and telecommunication development are complementary and greater examination and understanding of the economic and social development plan objectives are essential for setting objectives for telecommunications services planning.

Integration of telecommunications services planning with planning in other sectors will enable a balanced plan to be achieved for all sectors of a country's economy. But, for the isolated and underprivileged areas, it is more essential as it will accelerate procurement of funds for investments in the telecommunications sector at the same period as those of other sectors so comprehensively integrated with it.

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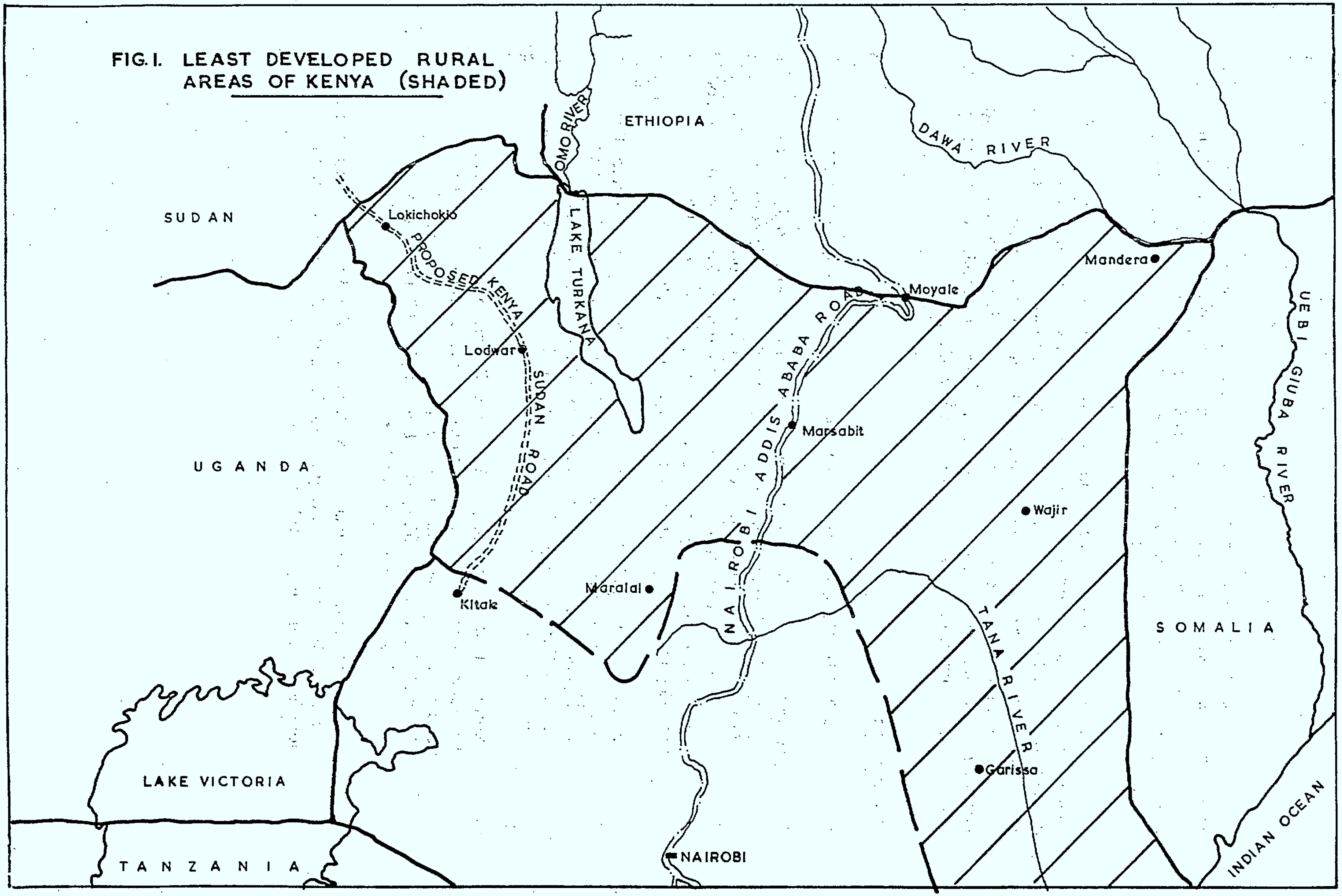

FIG. I. LEAST DEVELOPED RURAL AREAS OF KENYA (SHADED)

Figure 1

ECONOMIC CONSIDERATIONS IN TELECOMMUNICATIONS DEVELOPMENT IN ISOLATED AND BACKWARD AREAS

S. SANKARA RAMAN
INDIA

1. Introduction

It is generally recognized that telecommunication services provide one of the basic items of infrastructure for the economic development of a country. With expanding trading and commercial activities, efficient communications have become a vital necessity. Communications are provided by roads, railways, air lines and telecommunications. For exchange of information, the medium of telecommunications provides the speediest and most cost effective solution. Except in the case of telex and telephone communication, the party wishing to communicate with another party has to travel and meet the other party for a two-way communication. This involves time and cost. Telegram service obviates the necessity for the person to travel, but it is not as effective as face to face discussion or discussion by means of telex or telephone. Thus, telecommunication services provide the most effective form of communications and all the countries in the world have gone in for large investments in telecommunication development.

Telecommunication development cannot, however, be viewed in isolation. Development plans in this sector, as in other sectors, have to take into account the environment - administrative set-up, relative priorities of the Government, the present status of the telecommunication services, and the special needs and constraints under which the development is to take place.

In India, for purposes of administration, the country is divided into 22 States and 9 Union Territories. Each State or Union Territory is sub-divided into Districts which are again sub-divided into small units called Taluks. Each Taluk includes a number of towns and villages. State Headquarters, District Headquarters and Taluk Headquarters are the seats of administration at the respective levels. For purposes of development, small areas called Blocks have been identified, each with its own Headquarters called Block Headquarters. Telecommunication services have been provided, by and large, in such centres of administration and in towns with sizeable population.

2. Development of telecommunications in India

All the big cities and towns and a large number of smaller towns and villages have been provided with telecom services. At present, there are 6,238 telephone exchanges with 1,726,746 direct exchange lines in the country. While telecom services have been provided by telephone exchanges where there is viable telephone demand, a number of long distance public call offices have been established in villages, mostly in backward, hilly and tribal areas which may be termed underprivileged areas. There are 8,730 long distance Public Call Offices in the country as on 31-3-78. These long distance PCOs are located in the village Post Offices and any person wanting to use the telephone service comes to the Post Office and the call is established by the Post Master. In some of these Public Call Offices, extensions have been provided to subscribers at their premises on payment of rentals.

The long distance transmission media are provided by coaxial, microwave, and UHF in the major routes, while the last links to the PCOs have generally been provided by open wire lines with or without multichannel carrier.

Statistical data on telecommunication services as on 31-3-78 may be seen at Annexure I.

3. Economic Considerations and Future Trends in Telecommunication Development in Isolated and Backward Areas

In India, we may consider rural areas, hilly areas and areas with a predominantly tribal population as comparatively backward areas. Such areas have been for a long time devoid of any industrial or commercial activity and hence the demand for telephone services was practically nonexistent. On 15-8-1947, when India attained independence, there were only 230 long distance PCOs in such areas and this figure rose to 338 by 31-3-1951.

The first attempt at planned development took place on 1st April, 1951, when the first Five Year Plan was introduced. This resulted in penetration of telecom services into the underprivileged areas. However, the constraints on material and financial resources did not permit this development to take place at a significant pace. As on 1-4-1969, when the fourth Five Year Plan came into operation, the number of PCOs increased to 3,011. By the end of the fourth Five Year Plan, the number of PCOs rose to 5,009 (i.e. on 31-3-1974).

The policy for provision of telecommunication services in underprivileged areas has been under periodic review by the Indian Posts and Telegraphs Board. The last review indicated that the average annual revenue from a Public Call Office is of the order of Rs. 1,600/- while the annual recurring expenditure per PCO for maintaining the service is about Rs. 7,500/-. The average investment per PCO has been ofthe order of Rs. 60,000/-. Thus, there is an annual loss of Rs. 5,900/- per PCO.

As stated earlier, the underprivileged areas are mainly rural areas, hilly and tribal areas in the country. There are also desert areas. The population is sparsely distributed and the revenue is small, due to the low level of economic and industrial activity. Lack of adequate infrastructure in such areas inhibits new industrial investment. Due to a low level of job opportunities, there is a tendency for the population in such areas to migrate to the larger cities and towns which are already congested causing pressure on the already inadequate civic amenities. The Government of India has, therefore, laid great emphasis on implementation of new policies which will lead to the general development of the so-far underprivileged areas. The objective of stemming the flow of population to urban areas can be achieved only by providing the necessary infrastructure in such areas. Telecommunications can play a very significant role in attaining the objective. It is expected that, once a telecom facility is provided, it will facilitate establishment of cottage industries, small scale and medium size industries, agricultural marketing centres, etc. since they will have the lines of communication to major consumer centres and markets on whom they depend for their inputs. Taking all these factors into account, the Indian Posts and Telegraphs Board took a deliberate decision to extend telecommunication services to the underprivileged areas even on financial loss.

As per the latest policy decision, all headquarters of Districts, Taluks and Blocks have become entitled to telecom services even on loss. All villages with a population of 5,000 or above are also eligible for provision of PCOs on loss. In respect of hilly and backward areas, the population limit of a village is reduced to 2,500 for entitlement to PCO on loss. Further, all stations with a police station under the charge of a Sub Inspector have also become eligible for the service, if the revenue is at least 25% of the annual maintenance charges. By the application of this policy, the number of PCOs in underprivileged areas has risen to 8,730.

The Government of India has now formulated a Roll-on Plan of development for the period April 1978 to March 1983. The Posts and Telegraphs Board has also formulated its plan for telecommunication development during this period. The Board has decided to accelerate the pace of development in the underprivileged areas by providing 15,000 PCOs during the period as against the existing 8,730. Out of these, 3,000 PCOs are to be provided in the tribal areas.

As brought out earlier, most of these PCOs will be working at a loss, at least in the first few years. The losses on these systems will not, however, make the telecommunication service as a whole a non-viable proposition. Even as it is, the telecommunication service is subsidizing the postal service in India. A broader view of the economic benefits of providing the service to such areas has to be taken. Though it may involve a financial loss to the P&T administration, it is felt that the economic benefits to the user will be quite considerable. The user has recourse to the telephone call in places where such facilities exist, since he finds that this method provides him with the least-cost means of effective communication and this will be true in other cases also, if the service is introduced. Other means of communication will involve more time and will be less effective. Even if the party moves to the other location of interest to him, it will take more time and involve higher costs.

In this context, it is worthy of mention that a limited survey of existing PCOs was undertaken by the Indian Posts and Telegraphs in cooperation with the National Council of Applied

Economic Research. One of the most important findings related to the value of the calls to the user. A large number of users of the PCO service were interviewed regarding the purpose for which they were making the call and whether they would have been prepared to spend more money for doing the same transaction if the PCO service was not there. Every 7 out of 8 persons in the sample survey indicated that they used the telephone because of the need for "instant contact". 30% of the users would have been prepared to spend twice the cost of the call and 55% more than twice the cost of the call for transacting their business if the telephone service was not available. This clearly brings out that the value of the call is very much more than the cost of the call and establishes, beyond doubt, the economic benefits of the service.

It is obvious, in the above circumstances, that provision of telecom service is of great economic benefit to the community. As far as the Telecom Administration is concerned, it has to examine the most cost-effective solutions for providing the service. Again, as a result of data collected from the field units of the telecom service, it was seen that 75% of the calls originated from exchanges of sizes ranging from 25 lines to 100 lines, terminated within the District; 5% went beyond the District level but terminated within the State; and only 20% of the calls extended beyond the State level. This would be true of calls originating from PCOs also. In the switching hierarchy in India, the top level is the main centre followed in order by the primary, secondary, tertiary and terminal centres. The District Headquarters generally correspond to the secondary level while the State Headquarters correspond to the primary level. Since as much as 75% of the calls terminate within the secondary area, it might be possible to effect some cost savings if the transmission standards as laid down for the National Network are relaxed to some extent in their application to the rural network. What is required, at least in the initial stages, is to provide "good" communication between the rural PCO and the District Headquarters and "satisfactory" communication from PCO to the State level. The status of rural telecommunications can be brought up to the National Standard progressively as the traffic develops. This will enable the telecommunication administration to pass on the economic benefits of the service to the community while, at the same time, reducing the investment liability to the administration.

Any discussion on the economics of rural telecommunication development will not be complete without consideration being given to the constraints on the facilities available in such areas. These are reliability considerations and maintenance aspects. It will be readily appreciated that the level of technical attention that can be provided for such rural centres cannot be of a high order. This will require that the equipment to be provided in the rural centres should be rugged and as highly reliable as possible. Frequent failures of the equipment calling for technical attention impose very heavy strains on the maintenance personnel. The credibility of the rural service itself will become questionable. Providing for a high order of reliability is also likely to result in higher costs, while at the same time, it is desired to provide the service at minimum costs to the administration. Thus, it will be necessary to strike a happy medium between costs and reliability in the design and manufacture of the equipment. Another feature in rural areas is the quality of the commercial power supply. In a number of these areas, the commercial power supply is not quite reliable. Even when there is continuity of power supply, the voltage is likely to fluctuate far beyond the accepted limits. If the equipment depends on the commercial power supply, it will be necessary to provide for regulating equipment which can take care of the wide variations in the voltage. This will also add to the cost factor.

The rural telecom systems are likely to be small in capacity and widely distributed over a larger area. From economic considerations, provision of technical maintenance separately for each of these centres, is ruled out. The concept of "group maintenance" has been evolved and is already adopted in some areas of the country. Under this group maintenance scheme, a trained technician or a supervisor is located at a central place and he is in charge of the maintenance of a cluster of small switching centres or PCOs in the area. This concept of group maintenance requires that the necessity of fault rectification at the location of a particular station should be avoided. Construction philosophy should be such that a faulty unit is easily identified and substituted by a good one from the stock at the central maintenance station. The faulty units are to be rectified at the central maintenance centre for use in the case of faults at other locations. Only thus can the cost of maintenance of the service be optimized.

As has been brought out earlier, the requirements in the case of equipment to be provided to the rural centres may have to be more stringent than in the case of equipment installed at the urban centres where high level technical skill will be readily available. At the same time, it is essential that the costs, both in terms of capital investment and maintenance, are kept to the minimum. Quite a lot of effort is called for in provisioning of equipment meeting both the objectives and in evolving an administrative and maintenance structure to ensure a satisfactory level of operation of these services.

Data on major items of telecommunication services in India are given in the Annexures to this paper.

Status of Telecommunications Services in India as on 31.3.78

1.	LOCAL TELEPHONE SYSTEM	
1.1	Switching equipment (Capacity in lines)	2016585
1.2	Underground cables pair Kms.	9988319
1.3	Direct Exchanges Lines	1726746
1.4	No. of Exchanges	6238
2.	LONG DISTANCE SYSTEM	
2.1	Long Distance System Switching	
2.1.1.1	Trunk Automatic Exchange No.	17
2.1.1.2	Trunk Automatic Exchange Lines	30450
2.1.1.3	Stations connected to TAXs	77
2.1.1.4	Subscribers Trunk Dialing Routes (point to point)	114
2.1.1.5	International Subscriber Trunk Dialing Routes (point to point)	2
2.1.1.6	Group Dialing STD Routes	47
2.1.2.1	Manual Trunk Bds.	6438
2.1.2.2	Circuits connected to Trunk Boards	36374
2.2	LONG DISTANCE TRANSMISSION SYSTEM	
2.2.1	Cable Systems Coaxial and other Trunk Cables Coaxial Cable Systems	
2.2.1.1	Routes Kms.	13759
2.2.1.2	Systems Kms.	14487
2.2.1.3	No. of Channels	19676
2.2.1.4	Channels Kms.	10003364

II.	<u>OTHER TRUNK CABLES SYSTEMS</u>	
2.2.1.5	Route Kms.	3771
2.2.1.6	Systems Kms.	29135
2.2.1.7	No. of Channels	4244
2.2.1.8	Channel Kms.	329765
2.2.2	<u>MICROWAVE SYSTEMS</u>	
2.2.2.1	No. of Channels	8620
2.2.2.2	Channels Kms.	4453534
2.2.2.3	Route Kms.	13275
2.2.2.4	Radio Channels Kms.	27675
2.2.3	<u>UHF/VHF MULTI & SINGLE CHANNEL SYSTEMS</u>	
2.2.3.1.1	No. of Channels	910
2.2.3.1.2	Route Kms.	2462
2.2.3.2	<u>H.F. SYSTEMS</u>	
2.2.3.2.1	No. of Channels	291
2.2.3.2.2	Route Kms.	56624
2.2.4	<u>OPENWIRE CARRIER SYSTEMS</u>	
2.2.4.1	<u>Open Wire Carrier Systems Departmental</u>	
2.2.4.1.1	No. of Channels	15187
2.2.4.1.2	Channels Kms.	2046099
3.	<u>OPEN WIRE AND TELEGRAPHS</u>	
3.1	Telegraph Office Nos.	17780
3.2	Voice Frequency Telegraphs No. of Channels	14315
3.3.1	Telex Exchange Nos.	101
3.3.2	Telex Capacity in Lines	19865
3.3.3	Telex Subscribers connected to	14641
3.3.4	Long Distance PCOs	8730

STATEMENT SHOWING PROGRESS OF PROVIDING TELEPHONE & TELEGRAPHS FACILITIES AT CATEGORY STATIONS IN VARIOUS CIRCLES AS ON 30-9-1977.

Sl. No. Name of the Circle	District Headquarters Total	P.	T	Sub-Divl. Headquarters Total	P	T	Tehsil Headquarters Total	P	T	Sub-Tehsil Headquarters Total	P.	T	Block Headquarters Total	P.	T	Places with 5000 population or more Total	P.	T	Police station under S.T. Total	P.	T	Places with population 2,500 or more in Hilly & backward areas Total	P.P.	T	Total number of places yet to be provided with P.	T
1. Andhra Pradesh	21	21	21	45	45	45	122	122	122	42	42	42	319	307	307	479	386	411	778	567	550	3430	360	269	3386	3369
2. Bihar	31	31	31	36	36	36	-	-	-	-	-	-	512	433	455	179	86	100	-	-	-	2379	256	384	2295	2131
3. Gujarat	19	19	19	28	28	28	127	127	127	12	12	12	202	202	202	315	242	242	157	133	133	704	222	222	579	579
4. [illegible]	10	10	10	6	5	5	32	27	27	23	13	11	36	21	21	4	2	2	10	6	5	102	10	10	129	132
5. Kerala	11	11	11	19	19	19	43	43	43	-	-	-	96	95	95	688	358	269	144	128	132	1703	1555	1821	495	614
6. Karnataka	19	19	19	27	27	27	129	129	129	-	-	-	175	175	175	114	100	106	174	166	169	1274	680	664	616	623
7. Madhya Pradesh	45	45	45	51	51	51	98	98	98	53	40	40	259	189	198	237	224	227	467	179	183	530	276	266	638	632
8. Maharashtra	26	26	26	64	64	64	152	152	152	-	-	-	73	67	67	644	435	456	276	194	194	1073	134	140	1255	1209
9. North East	39	37	37	74	39	48	73	57	66	48	8	8	168	100	103	6	2	3	-	-	-	9	1	1	173	162
10. North West.	35	33	35	103	92	100	119	110	115	17	13	14	269	243	251	266	193	193	-	-	-	926	80	80	971	947
11. Orissa	13	13	13	43	43	43	57	50	54	-	-	-	206	160	191	12	6	6	87	39	50	113	38	48	182	126
12. Rajasthan	26	26	26	53	53	53	124	124	124	35	34	34	49	44	48	67	50	53	184	100	140	579	202	225	484	414
13. Tamilnadu	16	16	16	31	31	31	81	81	81	20	20	20	213	213	213	1222	999	999	883	830	834	1966	827	827	1415	1411
14. U.P.	55	55	55	31	31	31	237	237	237	-	-	-	877	750	750	573	290	290	911	839	839	5400	3180	3180	2702	2702
15. West Bengal	18	18	18	36	35	35	2	1	1	-	-	-	134	103	119	352	171	171	108	93	100	352	152	156	429	402
Total:	384	380	382	647	599	611	1396	1358	1370	250	182	181	3588	3102	3195	5158	3545	3528	4179	3274	3329	20540	7973	8095	15729	15451
Number yet to be provided		4	2		48	36		38	26		68	69		486	393		1613	1630		905	850		12567	12445		

Note: Stations under earlier categories are excluded from the list in the later categories.

P. Provided with Telephone facility.

T. Provided with Telegraph facility.

TOORA
31-5-78

Extracts from Census Report, 1971 Part 2A - Table A III- No. of Villages in different Population categories.

Sl. No. Name of State/ Union Territory.	Total No. of Inhabitated villages.	Population less than 200	200 to 499	500 to 999	1000 to 1999	2000 to 4999	5000 to 9999	10000 & above
1. Andhra Pradesh	27,221	5352	4383	5438	6411	4833	724	80
2. Assam	22,224	5615	6744	5986	3061	788	29	1
Bihar	67,566	17440	20483	15232	9313	4337	675	86
4. Gujarat	18,275	2054	4351	5242	4395	1968	248	17
5. Haryana	6,731	618	1400	1909	1673	975	148	8
6. Himachal Pradesh	16,916	12020	3723	861	260	50	2	-
7. J&K	6,503	1748	2200	1556	764	226	9	-
8. Kerala	1,268	2	2	2	16	122	316	808
9. M.P.	70,883	19754	27276	16516	5952	1292	87	6
10.Maharashtra	35,778	5053	9088	10529	7439	3102	492	75
11.Manipur	1,946	974	476	237	172	89	8	-
12.Meghalaya	4,583	3192	1093	237	54	7	-	-
13.Mysore	26,826	4939	7974	7082	4556	2014	252	9
14.Nagaland	960	334	325	169	114	17	1	-
15.Orissa	46,992	18548	15223	8821	3546	830	22	2
16.Punjab	12,188	1887	3311	3577	2392	940	79	2
17.Rajasthan	33,305	8771	11010	7817	4008	1524	165	10
18.Sikkim	215	-	31	114	63	7	-	-
19.Tamil Nadu	15,735	988	1981	3425	4547	3902	752	140
20.Tripura	4,727	2995	969	473	222	65	3	-
21.U.P.	1,12,561	27356	34856	28295	16081	5400	515	58
22.West Bengal	38,074	7604	10957	9085	6622	3342	412	52
UNION TERRITORIES								
1. Andaman Nicobar	390	266	72	32	19	1	-	-
2. Arunachal Pradesh	2,973	2405	413	107	38	10	-	-
3. Chandigarh	26	3	5	10	7	-	1	-
4. Dadara & Nagar Haveli	72	3	20	18	26	5	-	-
5. Delhi	243	20	23	53	79	60	6	2
6. Goa Daman & Diu	409	66	74	82	85	77	23	2
7. Laccadive Minicoy Amindive Islands	10	1	-	-	1	6	2	-
8. Pondichery	333	64	98	85	57	26	3	-
GRAND TOTAL	5,75,933	1,50,072	168561	132990	81973	36005	4974	1358

TOORA

Table A IV - Towns in different population categories

State/	Total Towns	Above 100000 (I)	50,000-99,999 (II)	20,000-49,000 (III)	10,000-19,999 (IV)	5000-9,999 (V)	Less than-5,000 (VI)	
Andhra Pradesh	224	13	18	61	79	45	8	AP.
Assam	74	1	5	10	26	24	8	AS
Bihar	202	9	11	51	72	47	12	BH
Gujarat	216	7	18	42	73	71	5	GR
Haryana	65	2	9	14	15	20	5	Haryana
Himachal Pradesh	36	-	1	1	5	6	23	HP
Jammu & Kashmir	45	2	-	3	3	17	20	J&K
Karala	88	5	7	40	25	9	2	Kerala
Madhya Pradesh	250	11	14	43	74	96	12	M.P.
Maharashtra	289	17	25	65	98	70	14	M.H.
Manipur	8	1	-	-	-	4	3	Manipur
Meghalaya	6	-	1	-	3	1	1	Meghalaya
Mysore	245	10	11	42	105	51	26	MY
Nagaland	3	-	-	1	2	-	-	N.Land
Orissa	81	4	2	20	23	30	2	Orissa
Panjab	108	4	8	22	33	30	11	PB
Rajasthan	157	7	7	31	67	41	4	RG
Tamil Nadu	439	17	27	79	118	97	101	T.N.
Tripura	6	1	-	-	4	1	-	Tripura
Uttar Pradesh	325	22	21	71	100	94	17	U.P.
West Bengal	223	15	31	49	60	59	9	W.B.
UNION TERRITORY.								
Andaman Nicobar	1	-	-	1	-	-	-	A.N.
Arunachal	4	-	-	-	-	1	3	Arunachal
Chandigarh	2	1	-	-	1	-	-	CH.
Delhi	3	2	1	-	-	-	-	DLI
Goa Daman & Diu	13	-	1	3	1	4	4	GD & D
Pondichery	6	-	1	3	-	2	-	Pondichery
TOTAL:	3119	151	219	652	987	820	290	Total

* TOORA *

SPECIAL TECHNICAL PROBLEMS OF PLANNING TELECOMMUNICATIONS SERVICES IN ISOLATED AND UNDERPRIVILEGED AREAS

J. SUTANGGAR TENGKER
INDONESIA

Geography

The Republic of Indonesia consists of an archipelago between Asia and Australia, and two oceans, the Pacific and the Indian Ocean. The Indonesian island chain spreads along the equator some 5100 kilometers.

Indonesia consists of 13,677 registered islands, ranging in size from a few acres to the 540 000 sq km Kalimantan. The total land area is about 1 500 000 sq km, but the telecommunication services have to cover an area of 5000 x 2000 sq km or 10 000 000 sq km since large areas of water have to be bridged. Virgin forests cover parts of Irian Jaya, Kalimantan and Sumatra, a chain of volcanoes runs over the islands of Sumatra, Java, the smaller Sunda islands and Irian Jaya. On this last island one can find eternal snow, yes, snow in a tropical area! I think some names might sound familiar to you, such as Sumatra(tobacco), Java(coffee), Krakatau (its eruption in 1883), Bali (paradise island) the Moluccus (spice islands).

Economy

Like all vast countries, the 135 million population of Indonesia, as well as the economy, is not equally divided among all islands. 65% of the whole population (85 million) is crowded together in only 7% of the total area of the whole country, where most of the local and international organizations have their headquarters and the business world their head offices. But the real economy of the country is generated on the other islands: oil on Sumatra, Kalimantan, Irian Jaya and in the Java Sea; nickel on Sulawesi and Irian Jaya; bauxite and copper on Irian Jaya; tin on the islands of Bangka and Singkep; and gold, silver, iron, coal on the outer islands. Agricultural products, palm oil, tobacco, pepper, tea, timber, rattan and other forest products are grown on Sumatra and Kalimantan.

State of Telecommunications in the early '70's.

It is obvious that communication is needed to link these centres of agriculture and mining outside Java with their headquarters and the Government on Java. Unfortunately, not all areas of the country are uniformly well served by telecommunication services. Until the late sixties, only Java was adequately served but the eastern and northern part of the country lacked adequate telephone services.

A microwave system linked Jakarta with most provinces. West Java, Central and East Java were commissioned in March of 1973. Another microwave system from Jakarta westward over the whole island of Sumatra to Medan was taken into operations in August of 1975.

A direct dial system was introduced between the biggest cities on Java and Sumatra; automatic telephone and telex exchanges served the principal cities in Indonesia. It was clear, however, that the capacity of the automatic telephone and telex exchanges and the facilities to connect a centre of activity (whether it is mining or agriculture) with their headquarters in the biggest cities in a fast, reliable and easy way was far from adequate.

With one of the capital cities in Celebas, Jakarta had a broken schedule of only 2 times 2 hours a day by H.F. This meant a good connection of not more than 2 hours a day. As mentioned before, the economic activities such as timber ventures, estates and plantation and other undertakings are in more or less remote areas of the other islands where they need the necessary means of communications to run the business (export, needs for money transfer, personnel needs, confirmation of shipping-space etc.). The Government, i.e. the P.T.T., cannot provide them with this; since the economic situation of the country has moved upwards very rapidly since 1966, the telecommunication administrations must partially solve problem of the everincreasing demand for telecommunication, by granting temporary concession to some governmental and non-governmental institutions to establish and operate their own telecommunication network (mostly SSB-HF radio circuits and VHF/UHF links). This concession will be terminated when the Administration is capable of providing the services required.

These concessions resulted in a mass of independently operated and ineffecient low-traffic carrying networks. Until now there still exists 17,000 concessions/licenses.

There are even cases of domestic traffic that has to be transferred via a neighboring country because of the bad conditions of the link. So the Indonesian government decided at the end of 1973 to build up a reliable communications system that covers the whole country. The system had to be in operation in the fastest possible time (2 or 3 years was mentioned).

In one of his addresses President Suharto stated that:

> "Rapid increase in development includes not only the production of goods, but also encompasses increased production of services in several sectors, among which are: ... communications..."

> "Improvement in the production of services in the communications sector will not only smooth the flow of goods and people, but will also play a decisive role in building the unity of our people and our nation, which spans great distances and thousands of islands."

The Java Bali, Trans Sumatra and Eastern Microwave System

It is clear from the above that good telecommunications will contribute to the socio-economic development of the country. This led to the following policy statement by the Department of Communications as set forth in the Telecommunications Development Plan 1974/1975 - 1978/1979.

> "The objective of the operation of Perumtel is the provision of telecommunication services which will constitute infrastructure for national economic development. The role of telecommunications is vitally important considering the geography of the Republic of Indonesia."

As is the case with hundreds of developing countries, Indonesia had to face problems in a great many fields in the early seventies, such as those related to burgeoning population, agriculture, housing, transportation, and many other important amenities of life.

Indonesia started in 1969 with its first Five Year Development Plan (1969-1974). In this period we achieved some progress in the telecommunications field. As the need and demand for telecommunication services were considerable but capital was scarce, some priorities had to be made. To attract foreign investment, priority was given to the international and domestic services. On the 27th of September, 1969, the Jatiluhur Earth Station was inaugurated.

It was one of the first stations working with the Intelsat Indian Ocean Satellite. Another priority was to take up again the construction of the Java-Bali Microwave System, a more than 1000 km M.W. System consisting of 32 stations, the planning of which had been started in 1964.

In 1971 we began the planning of a 2000 km Trans Sumatra Microwave system, consisting of 54 stations.

The first system was commissioned on March 11, 1973, after a 9 year planning and construction time, while the second system, after having experience with the first system, needing only 5 years, was commissioned on August 7, 1975.

The major problems that we experienced with these two Microwave systems were mainly in the building of the access roads and other civil works. Another problem was the power supply, as the system had to pass areas where commercial power was not yet available. About 60% of the relay stations had to be built on mountain tops to provide line of sight and prevent overshooting.

It is clear that for remote areas the cost of a microwave system becomes the manifold of that for more developed centres.

The more we go to the east in our Archipelago, the bigger are the distances between the islands, so it becomes more and more difficult to jump from one island to the next one. The most eastern part of the Eastern Microwave System has a section, one hop, of 170 km over water.

It is clear that it will not be easy, perhaps even impossible, to extend the now existing Microwave Systems further eastward to Irian Jaya. Certainly not in the short time frame of 2 or 3 years.

Furthermore, we all know the attenuation and phase problems inherent with the transmission of microwaves over long stretches of water.

Power Supply

As there is no power supply, and the system has to be planned for 24 hour operation, it is not sufficient to rely on only one power generating set. For greater reliability we have planned 3 power generating sets per station in the remote sites. The cost to buy, transport to and install these sets at the site is as much as the cost of the radio equipment.

On the smaller islands we communicate by H.F. For the same reasons as above we have to install generating sets to get the power needed. To transport the fuel to these remote islands by sea is a big problem. It is very difficult to find a ship that is willing to transport flammable material. Even if we find one, the cost will be prohibitive.

Because diesel is less flammable compared to petrol, we use diesel generating sets, although a smaller generating set working with petrol will satisfy. It is easier to get transportation for diesel than for petrol.

On the other hand, in places like Longnawan, in the interior of the island of Kalimantan, to which no roads exist, fuel must be carried on the backs of bearers. This journey from the coast city of Samarinda to Longnawan can last forty days.

As no radio connections can be made without the necessary power supply, and as these connections are necessary to exercise Government tasks and other social functions, one can imagine that this power and fuel problem can cause great difficulties. These factors must be taken into consideration very seriously when planning a telecommunication system.

Access Roads and Civil Works

In the remote areas no roads exist to the places where the relay stations had to be built. These roads are needed to bring the equipment and other materials to the site during the construction period. Later the roads are needed for maintenance of the station and for bringing in the fuel for the power supply.

57 km of roads had to be built for the Java-Bali Microwave system, 93.5 km for the Eastern Microwave and 83 km for the Trans-Sumatra Microwave. This 250 km of mountain roads has to be maintained by the Perumtel for the good functioning of the system. It could be that the price of a Microwave project doubled or tripled because of the civil works. At one site the civil works cost the Perumtel fifteen times the price of the radio equipment plus the mux plus the antennas.

With the remote H.F. stations it can be even worse, as these stations usually are situated in more isolated parts of the country. Sometimes one cannot even find stones and bricks for the buildings. We must transport them from overseas, hundreds or even thousands of miles away. We need these materials to build the station and the residences of the personnel. Although most of the stations are built for unmanned operation, all of the stations are watched and guarded against wild beasts and unaccountable acts.

The Indonesian Domestic Satellite System (Palapa)

To build a reliable telecommunication system that covers the whole territory of the Republic of Indonesia by means of a terrestrial system would cost us a good deal of money, because of the great distance from end to end.

The country needs this communication very badly and therefore, the construction has to be accomplished in the shortest possible time; if we take into consideration the experience that we had with the construction of the Java-Bali and other microwave system, we will need more than ten years to cover the eastern part of the country by means of a microwave system. Therefore, a terrestrial system does not seem to be a practical way to satisfy the needs of the country.

By order, a committee was set up in September 1973 to study the technical, operational and economical aspects of a domestic satellite system. This Committee had to finish its work and report to the Director General of Post and Telecommunication in the unbelievably short time of six months.

As a matter of fact the first acquaintance that we, the Indonesian PTT, had with the world of communications satellites was in 1967. At that time outer space was still the playground of the developed and rich countries and we dared not even dream of this modern application. We tried to follow its development through literature. But in the summer of 1971, we could not resist an invitation of the Hughes Aircraft Corp.

The Director General and I visited their premises. From that time the satellite world has not left us. And so it was not very strange that the order came out in 1973 to study the satellite system.

A comparison between the satellite system and other terrestrial systems showed that, economically the satellite system is cheaper for a country like Indonesia.

In construction time, which was one of the main factors, the satellite system was unbeatable, if we were willing to use a spacecraft model that had already been used, so that we did not need to plan a new kind of spacecraft.

For the PTT administration it was clear which system to choose. To convince the general public including the National Planning Board, the Parliament, the Government, of the necessity to have this satellite system, however, was not an easy task. This was needed before the project could start, and to make the story short, the Director General succeeded in getting the approval, but not without persistent effort.

On the 15th of February, 1975, contracts were signed with Hughes for the 2 spacecrafts, the MCS and 9 earth stations, with ITT and Philco Ford for 15 earth stations each. The whole system would be taken in operation on the 17th of August, 1976, Indonesia's 31st Independence Day.

We did understand that the time was very short, and therefore good coordination between the Perumtel staff and the suppliers' staff was needed. The suppliers themselves and the various departments and groups in the Perumtel, the DG's office and the other departments and institutions had to cooperate to shortcut all kinds of inevitable red tape.

The progress of the project was followed with the greatest accuracy. Not the slightest delay in any part of it was tolerable. To avoid the difficulties with transportation and building materials, the ground stations for the very remote areas had to be put into one container, which then had to be transported by aircraft.

On the 8th of July, 1976, the Palapa-I was successfully launched from Cape Canaveral, Florida and on the 16th of August, 1976, the President of the Republic of Indonesia inaugurated the system. This was the spacecraft and all 40 ground stations. spread out over the whole of Indonesia, eighteen months from contract award and according to the contract without the slightest delay.

With the Palapa in orbit we have solved a great deal, if not all, of the technical problems in planning of telecommunications in the most remote and isolated parts of the country. Just put a mobile ground station wherever the need is felt (Saroako, P. Gag., Tembagapura etc.).

We used 10 meter dishes for the first 40 ground stations. This year and next year we are going to construct many smaller ground stations, with 4.5 meter dishes, the contract for twenty of which was signed. In the future, the off-shore oil rigs and production platforms will be provided with these, or even smaller ground stations.

Manpower

Another problem for the remote and isolated stations is the manpower problem. Not only is recruiting and professional training for proper manpower essential, we have to create an atmosphere in which the operators are willing to stay in these remote places for a reasonable length of time to keep the cost of their transportation low enough. As most of the satellite ground stations are provided with TV reception, the situation at these stations is more bearable.

Conclusion

Palapa has already provided Indonesia with the much needed communication capabilities. The flexibility and versatility of this new communication system will allow us to configure the system to meet the changing and challenging requirements of our rapidly developing country.

THE INTEGRATION OF TELECOMMUNICATION SERVICES PLANNING WITH PLANNING IN OTHER SECTORS

S.N. KAUL
INDIA

I.

In April, 1978, India's sixth Five Year Plan was launched to continue the process that began 27 years ago when in 1951 the first Five Year Plan was introduced. Planned growth of Indian economy was regarded essential for mobilizing resources for development of agriculture which comprised the largest sector sustaining almost 80% of the population, and industry which was disproportionately small for India's size. The major problem in agriculture was low productivity and under-utilization of available land and water resources and in industry, it was lack of basic infrastructure and an extremely low capital base. While the long term objectives of rapid and balanced growth remained unchanged, there were periodic shifts in emphasis (Table 1) and the debate about which sector should receive how much priority has never quite ended. It is, in fact, a part of the planning process where shifts in priority are influenced by the local circumstances, national exigencies and international economic environment.

The first few years of planning provided the opportunity for reviewing the country's needs and resources required to meet them. This period was characterized by the creation of new institutions that could assess, implement and carry forward the programme for bringing about socio-economic change. By the mid sixties the institutional structure was sufficiently broadened to permit acceleration of development in agriculture, industry - particularly heavy industry - and transport. Basic infrastructure like railways, roads and communication received special emphasis. The main objective of the planned development continued to aim at a higher level of production, investment and employment.

Table 1

National Plan Outlays Between Sectors

	Total Plan Outlays (Rs. millions)**	Agri-culture	Irriga-tion & Power	Industries & Mining	Trans-* port & Communi-cations	Tele-com.	Services	Others
	PERCENTAGE OF OUTLAY							
First Plan (1951-56)	23780	14.89	27.25	7.91	22.00	1.98	22.37	3.62
Second Plan (1956-61)	45000	11.33	18.22	21.11	28.31	1.47	18.00	1.56
Third Plan (1961-66)	75000	14.24	22.16	23.79	17.63	2.19	17.33	2.67
Annual Plans (1966-69)	66650	17.66	22.36	25.05	16.73	2.39	14.67	1.16
Fourth Plan (1969-74)	159020	17.10	22.29	22.81	17.23	3.07	16.27	1.23
Fifth Plan (1974-79)	39322	11.0	36.9	18.7	14.57	3.02	15.8	-
Sixth Plan (1979-83)	69380	12.4	43.9	14.9	12.56	2.66	13.5	-

* excluding telecommunications
** 1 U.S.$ = Rs.8

Table 1

With the advent of the seventies, Indian agriculture showed signs of revolutionary change. After the initial increase in agricultural production brought about by bringing in newly reclaimed lands into use in the fifties, the productivity levels had almost stagnated in the sixties as no more land was available for exploitation. The break-through occurred in the seventies when the new seed-fertilizer technology changed the productivity profile in wheat growing regions. Productivity gains have since been achieved in some rice and sugarcane areas as well. Higher production meant higher incomes which led to new demand for non-traditional farm inputs like power, high yielding variety seeds, chemical fertilizers, irrigation pumps, etc. and thus created in rural areas a new scenario for supply of utility services like transportation, banking, farm advice and marketing. From 50 million tons of food grains production in 1950, the output has reached 121 million tons in 1978. The situation today is that of foodgrain surplus against the chronic deficiency leading to the desparate call for help that characterized the sixties and early seventies. Agrarian prosperity is still unevenly distributed. The problems of low income, poverty and unemployment are even more severe now than ever before.

Industrial production is currently marked by sophistication and diversity in intermediate goods and consumption goods. Great strides have been made in engineering, electronics, textiles, petro-chemicals and power generation. Even food processing has come up lately to add to the diversity of the secondary sector of the economy. The progress of this sector has, however, not followed a smooth path. There have been years of recession and idle capacity, shortage of raw materials and quite often, constraints on plant modernization.

Table 2

Gross Domestic Product (at Current Prices)
(Rs. Crores*)

Year	Primary	Secondary	Tertiary	Total
1960-61	7,153	2,721	4,197	14,071
1968-69	15,030	6,137	9,381	30,548
1969-70	16,496	7,081	10,215	33,792
1970-71	17,762	7,731	11,445	36,938
1971-72	18,420	8,509	12,556	39,483
1972-73	20,202	9,431	14,028	43,661
1973-74	26,975	10,817	16,441	54,233
1974-75	29,875	13,516	19,991	63,382
1975-76	28,263	14,918	22,070	65,251

* 1 crore = 10 million

A look at the sector-wise growth of the GDP (table 2) shows that the primary sector which includes all extractive industry such as agriculture and mining has increased almost 4 times in 1975-76 when compared to 1960-61. However, its share in total GDP declined from 51% in 1960-61 to 43% in 1975-76. Secondary and tertiary sectors have likewise not only grown but their share of total GDP has also shown a progressive increase (Table 3).

Table 3

Percentage Share of Gross Domestic Product by Sectors

Year	Primary	Secondary	Tertiary	Total
1960-61	50.83	19.34	29.83	100.0
1970-71	48.09	20.93	30.98	100.0
1974-75	47.22	21.29	31.49	100.0
1975-76	43.32	22.86	33.82	100.0

While it is too early to suggest that Indian economic development could be described to conform to Rostow's "stages" of growth, there nevertheless are signs of expanding secondary and tertiary sectors as a consequence of accumulation of social overhead capital like roads, educational institutions, hospitals, airports, water supply and a "surge" of technological developments in agriculture and industry. This could perhaps be close to the typical "take off" stage where rate of saving rises to 10% of national income and a relatively larger proportion of investment is directed towards manufacturing and social overhead capital formation resulting in higher demand for professional and public utility services. This "stage" is characterized by appearance of new industries and modernization and expansion of old manufacturing plants. Diversification of consumer products, increase in commerce, trade and advertising become important aspects of economic life. In India, however, this transformation, even though markedly visible from the beginning of the seventies is still regarded as being sustained by a relatively small segment of the urban affluent. It is theorized that this "narrowness of the market" comes in the way of giving further boost to the effective demand* since economic gains from development have accrued to a small segment of India's population. In other words, the GDP originating from the primary sector is shared by far too many people - the rural inhabitants - and the problem is further aggravated by high population growth rate, whereas gains from secondary and tertiary sectors flow to a small proportion of the population living in urban areas thus accounting for the "narrowness" of the market. This imbalance is primarily regarded as a distributive problem that has perhaps led to the recent shift in favour of higher public investment in rural areas.

* Draft Five Year Plan 1978-83: Planning Commission, Govt. of India, 1978 p.2

II.

Telecom Use in Various Sectors: An Inter-Industry Transaction Profile

In the early stages of economic development, investment in telecommunications was motivated primarily by the need to control and administer areas considered important from the point of view of general administration and internal security. With the ushering in of planned development in the fifties, investment in telecommunication began to be regarded as an important supportive infrastructure.

Indian telecom set-up has grown into a vast network covering almost all the cities and towns through various transmission media - open wire, coaxial, microwave, and lately satellite - reflecting a mix of old and new technology. While the horizontal expansion of the network over the vast sub-continent has been achieved over a period of three decades, a substantial proportion of the network appears to be highly concentrated in a few urban agglomerations. This urban bias, even though a universal pheonomenon, has come in for criticism lately by the planners.

Policy makers have in recent years raised the question of whether the nation's resources - limited as they are - should be allowed for major network expansion which inevitably tends to concentrate in large urban centres benefitting mostly those who are already doing well economically and socially. In other words, a large investment outlay involved in network expansion in the Indian context is looked upon with a great deal of reservation. Questions are often raised about the contribution of telecommunications in the general economic development when decisions for allocation of public funds are taken for each plan period. A high rate of return in telecommunications, which is currently 16-18%, is not regarded as a sufficient condition for justifying expansion. Public investment decisions are guided by overall resource availability and the need for utilizing these resources for rapid and balanced economic growth which has lately been interpreted to mean creation of new employment opportunities in rural areas through promotion of secondary and tertiary activities that have so far characterized only large urban cities.

Telecom development has therefore to be viewed against the background of national priorities which form the basis for resource allocation. What priority telecom development should receive has lately aroused considerable debate. As stated earlier, a highly favourable rate of return in telecommunications is not regarded as the answer in view of the narrow market it appears to serve. If it should be possible to prove that telecom service has wide ramifications in various sectors of the economy, some justification for according it a higher priority may emerge.

Methodological constraints in measuring telecom benefits to the society are well known. Telecom utilization factor or density and growth of GDP are rather weak parameters to yield any meaningful relationship especially in less developed countries. With the high growth population parameter entering as a denominator, the growth of per capita GDP over time appears to be so sluggish that no functional relationship between telecom development and income is possible. An alternative approach that has been attempted is to study the use of telecom service by various sectors of the economy and relate its expansion with the growth of these sectors. An inter-industry transaction table is seldom available due to the massive effort involved in tracing the input-output relationship in readily identifiable organized and not so readily identifiable unorganized economic activity. The one that is fortunately available for the first time for Indian economy relates to the year 1968-69 (Table 4).

The inter-industry transaction table reveals that use of P&T services falls into three broad consumer (demand) groups:

	(% of P&T Services Used)
Intermediate Consumption	42.11
Private Consumption	42.93
Public Consumption	14.96

The actual use of P&T's service by these three categories constitutes the P&T's gross output (Table 4). The share of each category in the use of P&T's services is indicative of the effective demand for telecommunication. Obviously 42% of the P&T's value-added is traceable to intermediate demand. Another 43% is traceable to private household and non-profit institutional use. Government departments account for nearly 15% of demand for P&T services.

Table 4

Demand for P&T Services by Sectors: India 1968-69*

	Value (Rs. 00,000)	Percentage Share
a) Intermediate Demand	9,024	42.11
- Primary	32	0.15
- Secondary	365	1.70
- Tertiary	8,627	40.26
b) Final Demand **	12,403	57.89
- Private Consumption	9,198	42.93
- Public Consumption	3,205	14.96
Gross value of P&T Output	21,427	100.00

* Source: *Central Statistical Organization: National Accounts Statistics, 1978, Dept. of Statistics, Ministry of Planning, Govt. of India.

** Private consumption represents expenditure by households and non-profit institutions. Public consumption represents consumption by Government departments and agencies.

Note:

a) The total gross value of P&T's output in 1968-69 was Rs. 2142.7 million. The value of intermediate consumption by P&T Department in that year was Rs. 3.47 million. Hence the gross value added (GDP) by P&T services in 1968-69 was 1796 million.

b) The terms P&T Services and telecommunications are used interchangeably in this paper. P&T services include postal and telecommunication services. The proportion of postal earnings to total P&T services was 30% in 1976-77.

The intermediate demand for P&T services throws up an interesting evidence. It confirms the available evidence that tertiary sectors of the economy are the major users of telecom services.* In India almost 95% of intermediate demand for P&T services arises from the tertiary sector. The share of readily identifiable services sectors that constituted the intermediate tertiary demand in 1968-69 was:

	Rs million	%
Trade	5,838	67.75
Banking and Insurance	1,197	13.69
Education and Research	801	9.30
Transport	695	8.07
Others	96	2.29
Total Tertiary	8,627	100.00

While the total intermediate demand accounted for 42% of the P&T's total gross sales, the final demand arising out of private household consumption and public consumption accounts for the remaining 58%.

The contribution of telecommunications, apart from the social and security needs, must be seen in its use amongst various sectors of the nation's economy. The overall dominant use of P&T services in trade, banking, insurance and transport which together account for intermediate demand, and private and public consumption that account for the rest of the demand for P&T's services, is closely linked with services sectors. The evidence clearly shows that even if there is a large scale dispersal of manufacturing units, their use of telecommunication services will comprise a very small part of the P&T's total output.

* Bebee, E.L. and Gilling, E.J.W., "Telecommunications and Economic Development: A Model for Planning and Policy Making" Telecommunications Journal, Vol. 43 VIII 1976 pages 537-43.

III

Integration of Telecommunication Development with Development in Other Sectors

India's telephone network currently spans the entire country with an equipped capacity of 1.9 million lines. Three-fourths of this capacity serves the cities with more than 100,000 population. There are 142 such cities representing 11 to 12% of total population. Even among these cities the network is not evenly distributed since 4 metropolitan cities share almost 35% of the country's total equipped capacity. An idea about the distribution of equipped capacity can be had from Table 5 below.

Telecommunication development in India is thus related directly to urban growth. Even though there has been considerable expansion in telecom network over time, yet it has tended to concentrate mostly in large urban centres. This has, as stated earlier caused concern to the planners since swelling up of the large cities due to migration and population growth has resulted in ghettos, congestion and deterioration in public utility services. While urbanization in countries with large rural population is regarded as a sign of modernization, the trend towards polarised urbanization in selected cities - particularly metropolitan cities - is beginning to cause concern. Planners have been emphasizing the need to stem the migratory tide and have suggested measures to encourage development of small and medium towns and rural growth centres to weaken the trend of large scale migration of rural youth seeking employment in large cities. Expansion of telecom network therefore may have to be viewed in this context. To what extent telecom expansion can help spatial dispersal of new enterprise would of course depend on its potential role in each sector of the economy.

1. Telecom development vis-à-vis growth of primary (or rural) sector

Agriculture, animal husbandry, forestry, fishing and mining comprise the primary economic activity. Even though primary sector accounts for almost half of the GDP in India, the use of telecommunications in this sector is very negligible - less than 1% of P&T's output.

Table 5

Distribution of Telephones in Urban and Rural Areas, India, 1977

Class/ Size of city/ towns	Number of cities/ towns/ villages	Population 1971 (million)	Working Connections '77	% of Working Connections
Urban				
1. Cities				
a) Metropolitan	4	19.09	537,986	34.51
b) above 1 million	5	7.60	153,239	9.83
c) 500,000-1 million	10	6.68	100,404	6.44
d) 200,000-500,000	54	16.54	259,853	16.67
e) 100,000-200,000	69	11.84	109,668	7.03
	142	61.75	1,161,150	74.48
2. Towns				
Below 100,000	2,799	46.25)	389,135*	
Rural		)		25.62
3. Villages	575,936	439.00)	8,643 PCOs	
Total		547	1,558,927	100.00

* Population according to 1971 census.

Low productivity and economic backwardness in rural communities is due to their weak resource base and lack of opportunities for gainful employment. Wherever new farm technology has been successfully adopted, especially in areas with assured irrigation, productivity levels have registered a spectacular increase. Rise in levels of income in these areas have resulted in demand for new farm inputs and services. While the planners have encouraged this trend by facilitating the creation of market and credit institutions, there has been an increasing awareness that a very large proportion of rural households continue to remain outside this progressive trend. Benefits of new farm technology have percolated to those who were fortunately endowed with better resources. For the remaining under-privileged and backward communities, therefore, new strategies for development require to be planned.

In the sixth plan (1978-83) that has just been launched, a new strategy has been evolved for dealing with economic backwardness of rural areas. The essential elements of this strategy, called integrated rural development are:

- small and marginal farmers development
- drought prone area programme
- integrated tribal development schemes
- hill area development schemes and
- rural industries and rural artisans programme.

The role of telecommunications in rural development can be visualized within the framework of this strategy. Penetration of rural areas by providing rural telecom facilities is not merely meant to provide a direct access to a rural household, in fact, very few households require this facility. The few who use it are a small segment of the rural community engaged in business.*

Provision of quick and efficient means of communication could help in monitoring of information and mobilization of service support in view of the massive labour-oriented development programme envisaged under the integrated rural development schemes.

Special provision has been made in the sixth plan for supply of 15,000 long distance rural PCOs. This is in addition

* NCAER: Survey of Rural Public Call Offices. May 1978. This survey was done to find out the current use of available telecom facilities in rural areas.

to the existing 9,000 PCOs already functioning in villages. Distribution of new PCOs may present problems of choice of location - since the supply is not guided by any recognized demand. Therefore, for those rural areas where new technology has made headway, provision of telecom facilities could be linked up with the Government's plan to ppen distribution outlets in rural areas for the supply of seeds, fertilizers, plant protection chemicals, kerosene and diesel. Since these distribution outlets will cover a cluster of villages, which will thus attract frequent visits by rural families, providing a rural PCO as a part of the package of services to the rural community may prove very useful. This is one aspect which may deserve serious consideration.

Possible Rural Plan

The other strategy worth considering for a long term rural telecom penetration is to cover villages of different sizes by linking these to the important district towns that provide health, educational and repair facilities to surrounding villages. So far, proposals for providing a rural PCO are guided by the size of the village in respect to population. This criterion leaves out a large number of villages from the purview of telecom coverage. In order to understand the magnitude of the problem, the distribution of villages according to size of population is presented. Table 6 may be examined.

Table 6

Distribution of villages and rural population by size

Size of village	No. of villages	% of villages	Rural population (million)	% of rural population
Population less than 200	150,072	26.2	15.2	3.5
200-500	168,564	29.2	56.6	12.9
500-1,000	132,990	23.1	94.4	21.5
1,000-2,000	81,973	14.2	113.2	25.8
2,000-5,000	36,005	6.3	104.6	23.8
5,000-10,000	4,974	0.8	32.7	7.4
10,000-& above	1,358	0.2	22.3	5.1
Total	575,933	100.00	439.0	100.00

The above distribution, on further summarization, provides a useful guide to the telecom planners. For example, the distribution of the entire rural population can be examined in relation to the size of villages as shown below.

Size of village, population	% of villages	% of the rural population
Small (up to 1,000)	78	38
Medium (1,000-2,000)	14	26
Large (above 2,000)	8	36

Short run

Planners can take a view: as a first step, provide PCOs in all the large sized villages with more than 2,000 population. That would mean covering all the 42,000 villages falling in this category. In doing so, 36% of rural population would have access to the telecom facility.

Long run

The next step may be to cover the medium sized villages. This would be a stupendous task for as many as 214,963 villages accounting for 26% of the rural population would have to be covered. The same is the case with small sized villages which characterize the hilly and tribal areas. The planners may have to be guided more by social needs of some of the isolated communities than by the size of population and economic potential of the area proposed to be served by the telecom facility.

From the revenue point of view, the P&T administration is likely to incur losses in the initial years when the rural PCOs are opened. Either the technology available should reduce the costs for providing rural services or the network expansion should be so rationalized that the losses incurred are sufficiently balanced by the network expansion in more profitable areas. Some kind of a break-even rural/urban ratio may have to be evolved for each region.

2. Role of Telecom Development vis-a-vis Secondary Sector

Like the primary sector, the use of P&T's services in manufacturing is very low. From the inter-industry transaction table, it was seen that the use of P&T's services in secondary sector formed a very small (less than 2%) part of the total demand for P&T services. The prevailing view at the national policy planning forum is that dispersal of telecom networks and other infrastructural facilities may help bring up new enterprise in new locations and thus reduce the pressure on a large city concentration. There is reason to believe that location of new units in larger cities or their suburbs is influenced more by such infrastructural facilities like transport, power, water, etc. and labour availability. Telecommunications is perhaps the weakest instrument influencing the location of new units, at least in the initial stages. For the Governments' policy of encouraging new enterprise away from the large city centres, it would have to choose far stronger instruments for discouraging growth in cities. But once the city grows, telecom expansion would have to keep pace.

3. Role of Telecom Development vis-a-vis Tertiary Sector

The available evidence shows that the tertiary sector, comprising trade, banking, insurance, educational research and government departments, which are invariably located in larger cities, accounts for the entire use of the P&T's services. If the planners visualize that the trend is likely to intensify, i.e. the service sector will continue to grow around large and medium cities, it is only rational that telecom expansion should keep pace with its growth. In fact, the increase of tertiary sector GDP between 1968-1969 and 1975-1976 has been five times, but the use of P&T's services has only doubled. This might perhaps explain the large pent up demand in large cities. Supply of telecom services has obviously fallen short of demand and the gap may only be widening further.

The Next Five Years

The Telecommunication plan for the period 1978-83 reflects the new policy of providing the service support to small towns and rural growth centres. The proposed addition of 1.15 million working connections (DELs) to the 1978 base of 1.73 million DELs is expected to be allocated under three broad groups of areas as indicated in Table 7.

Table 7

Planned Expansion of Telephone Working Connections (DELs) 1978-83: India (00,000 lines)

	1978 Working Connection	1978-83 Lines to be added	% of addl. lines	1983 Working Connections	% increase in 5 years 1978-83
Metropolitan (4 cities)	5.74	3.5	30	9.24	61
Telephone Districts (18 cities)	3.16	2.0	18	5.16	63
Telephone Circles (cities, towns and villages)	8.37	6.0	52	14.37	72
	17.27	11.5	100	28.77	66

The four metropolitan cities - Bombay, Delhi, Calcutta and Madras - will receive only 30% of the new lines and the next group of 18 cities (comprising telephone districts) 18%. Over half (52%) of the additional lines during the next five years shall be distributed amongst other cities, towns and villages grouped into telecom circles. While the first two categories of cities exhibit visible demand (and yield the major portion of telecom revenue) arising mostly from the tertiary activity described earlier, the last group represents a mix of known and unknown demand; unknown because the vast Indian hinterland dotted with more than half a million villages, has never had access to any telecom facility. A relatively larger allocation of new lines for this group should give P&T management an opportunity to extend the benefits of telecommunication to these underprivileged and isolated communities.

APERCU DU DEVELOPPEMENT DES
TELECOMMUNICATIONS AU CANADA

J.T. FOURNIER
CANADA

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PREFACE

Mesdames et Messieurs, c'est avec un peu d'appréhension que j'aborde la tâche qu'on m'a confiée. On m'a demandé de vous donner un aperçu du développement des télécommunications au Canada, et c'est un domaine si vaste que je ne saurais vous le décrire que de façon très générale dans le peu de temps qui m'est alloué. Je laisserai donc à mes collègues le soin de vous présenter le détail et les ramifications de l'industrie des télécommunications en ce qui concerne les régions isolées et défavorisées du Canada.

Je me propose pour ma part de vous informer en quelques mots des obstacles géographiques qui gênent les communications, des objectifs économiques et culturels qui nous guident et des solutions que nous proposons actuellement, compte tenu de notre cadre institutionnel.

INTRODUCTION

Les services de télécommunication sont d'abord et avant tout le système nerveux de notre économie. Sans cet élément fondamental, il est certain que la vitalité économique et la structure industrielle du Canada seraient très différentes de ce qu'elles sont aujourd'hui.

Le "droit de communiquer", c'est-à-dire d'entendre et de se faire entendre, est une composante précieuse de notre système politique. Tous les Canadiens reconnaissent l'absolue nécessité de partager leurs connaissances du Canada et du monde. Le peuple canadien est une national disséminée sur un vaste territoire, et nous estimons qu'il est essentiel, pour lui conserver son identité nationale, d'entretenir chez lui un sentiment d'appartenance et de recherche d'un objectif commun, en faisant appel aux meilleures techniques de télécommunication à notre disposition.

A première vue, les télécommunications se sont beaucoup répandues au cours des dix dernières années. C'est bien naturel, car la radiodiffusion repose sur des services perfectionnés de télécommunication. Aujourd'hui, plus de 98% de la population captent les émissions du réseau public de Radio-Canada. Près de 85% des Canadiens ont accès à trois canaux de télévision ou plus et plus du tiers d'entre eux, à huit canaux ou plus. C'est aussi au Canada que la <u>câblodiffusion</u> est la plus répandue. En effet, quatre millions et demi de foyers y ont maintenant accès; plus de 50% et, dans la plupart des grandes villes, de 75 à 90% des foyers jouissent d'un réseau de câblodiffusion offrant en moyenne seize canaux.

Toutefois, ce sont les <u>services téléphoniques</u> qui nous occupent davantage ici aujourd'hui. Au Canada, ces services sont assurés par le biais de diverses entreprises. L'an dernier, plus de 60% des foyers étaient dotés d'un téléphone -- moyenne surpassée seulement aux Etats-Unis, en Suède et en Suisse. Soixante-dix pour cent des appareils en service sont des téléphones résidentiels.

Pourtant, aussi favorables que paraissent ces statistiques, il y a encore de grandes régions où les services de télécommunication ne sont pas adéquats. C'est d'ailleurs ce qui nous a amené ici pour étudier avec vous pendant ces trois jours le problème de la prestation de services adéquats dans les régions isolées et défavorisées et partager l'expérience et les connaissances qui permettront d'y répondre. Avec votre permission, j'essaierai donc maintenant de vous décrire l'organisation de l'industrie canadienne des télécommunications et sont exploitation dans le cadre économique et institutionnel actuel, compte tenu des contraintes géographiques et culturelles que nous connaissons.

<u>CONTRAINTES GEOGRAPHIQUES ET CULTURELLES</u>

Vingt-trois millions de Canadiens habitent un territoire de 5,000 milles (8 000 kilomètres), d'est en ouest, sur environ 3,000 milles (4 800 kilomètres), des Etats-Unis au pôle nord; mais 80% d'entre eux vivent à moins de cent milles (160 kilomètres) de la frontière canado-américaine, et de grandes étendues de notre pays sont inexploitées et à peine peuplées. Le nord du Canada se caractérise par de grandes distances, une terre aride, un climat inhospitalier et de petites agglomérations. Des langues différentes et des cultures variées en sont aussi un trait distinctif.

Le Canada est en effet un pays aux multiples cultures qui possède deux langues officielles, l'anglais et le français. En outre, beaucoup de Canadiens sont de langue maternelle étrangère, car des immigrants venus de toutes les parties du monde ont importé plusieurs langues. Il ne faut pas oublier non plus les premiers habitants du pays, les autochtones -- Indiens, Métis et Inuit - qui forment une bonne part de la population du Nord. Leurs besoins culturels créent d'ailleurs une demande tout à fait différente de celle de la société canadienne du Sud, en ce qui concerne les communications.

A l'heure actuelle, les services de télécommunication offerts dans bien des régions isolées et du Nord ne suffisent pas, en particulier au nord du 55^{e} parallèle. Cette situation touche sept des dix provinces en plus des deux territoires du Nord. Au-delà de 200,000 personnes y habitent dans des petites localités très dispersées où il y a un besoin élémentaire inassouvi de communications fiables entre points fixes et d'une plus grande abondance de renseignements de tous genres, y compris d'émissions régionales de radio et de télévision.

Avant le lancement d'ANIK, le premier satellite national de communication, on utilisait toutes sortes de méthodes de communication à grande distance, avec plus ou moins de succès. Certaines n'étaient pas assez fiables, d'autres étaient extrêmement coûteuses. Encore aujourd'hui, même si l'avènement des services par satellite a eu des répercussions très grandes dans le Nord, on y utilise encore beaucoup la radio à haute fréquence, les diffuseurs troposphériques et les relais hertziens à micro-ondes.

Les contraintes économiques, géographiques et culturelles ont naturellement influencé les techniques utilisées et leurs applications. Par ailleurs, le développement des télécommunications au Canada a aussi, dans une grande mesure, subi l'influence des institutions qui gouvernent le pays.

INSTITUTIONAL FRAMEWORK

Telecommunications services in Canada are provided by a mixture of investor-owned or private companies and government-owned or public agencies. Canadians have developed a telecommunications system that includes partly and wholly-owned public corporations which may compete with private ones or enjoy a monopolistic position. Since certain aspects of our telecommunications needs are considered best served by a monopoly, a system of regulatory boards and agencies has been established to ensure that these monopolies charge fair and reasonable rates, and in some cases it is also an explicit objective that they contribute to the social goals of the various levels of government.

Canada is a federation consisting of a federal government and 10 provinces from east to west plus 2 northern territories. Jurisdiction over telecommunications is divided between federal and provincial governments. Under the Canadian constitution all radiocommunication, including broadcasting, transmitting and receiving undertakings (which includes cable television) are federally regulated. The federal government through the Department of Communications is responsible, both nationally and internationally, for the development and efficiency of communications in Canada and for the long-range planning of Canada's telecommunications policy. To this end it carries out research in the field of telecommunications and manages the radio-frequency spectrum in Canada. The Canadian Radio-television and Telecommunications Commission (CRTC) is the federal regulatory body responsible for the monitoring and regulation of various aspects of telephone and broadcasting services.

The provincial governments are responsible for regulating and overseeing telephone companies which are chartered under provincial law authorizing them to operate within the boundaries of a given province. A few of the larger telecommunications carriers are incorporated under federal legislation and can operate in more than one province. These companies are regulated by the federal CRTC.

The major common carrier organizations in Canada include the following:

a) the Canadian Telecommunications Carriers Association (CTCA) is composed of twenty-three organizations including virtually all of the carriers of any kind of information that can be transmitted electronically. The CTCA is a non-profit organization operating as a vehicle for industry-wide co-operation to represent the interests of its members, to promote the development of telecommunications and to develop and coordinate views and policies affecting the telecommunications industry on a national basis.

b) the Trans Canada Telephone System (TCTS) is a consortium of nine of Canada's major telephone companies plus Telesat Canada. These member companies own and operate facilities for the transmission of voice, video and data across the country. The three telephone companies serving the western prairie provinces are provincial government-owned Crown corporations; the other six telephone companies are investor-owned. Two of these companies, Bell Canada and British Columbia Telephone, operate under federal charter; the others are regulated by provincial agencies.

c) Telesat Canada is a corporation jointly owned by the federal government and all of the major common carriers and has responsibility for the ownership and operation of Canada's domestic satellite system. Telesat is regulated by the CRTC. Its activities do not include ownership of ground terminals operating into the INTELSAT and other international satellites as this responsibility is vested in a federal government agency - Teleglobe Canada.

d) Bell Canada is Canada's largest telecommunications common carrier. It is investor-owned and has more than 8.6 million telephones in service in the provinces of Ontario and Quebec and in the eastern part of the Northwest Territories.

e) CNCP is a consortium of the federal government-owned Canadian National Telecommunications and investor-owned Canadian Pacific Telecommunications. Through its microwave facilities CNCP offers private line and data services across Canada in competition with the TCTS.

The Canadian broadcasting system, in terms of the number of radio and TV stations, is more or less equally split between public and private stations. The public network, the Canadian Broadcasting Corporation or CBC, was established to provide a national broadcasting service in English and French, giving due consideration to the special needs of geographic regions and supported largely by public funds voted annually by our federal Parliament. The CBC is essentially an independent corporation free to air whatever programs it sees fit so long as it conforms to certain general objectives, such as balanced programming, as laid down in the Broadcasting Act.

Private broadcasting in Canada relies on commercial advertising since Canadian viewers do not pay licence fees. Privately-owned television networks have long existed in Canada, together with innumerable private AM and FM radio stations. In addition, during the last several years there has been a veritable explosion in the growth of cable television companies.

At this point, leaving the institutional framework and the geographic realities to the side, it remains important, when viewing Canadian telecommunications development as a whole, to properly comprehend our economic and cultural goals.

ECONOMIC AND CULTURAL GOALS

The economic and cultural aspects of policy are naturally closely inter-related, and Canadian experiences in this regard probably find several parallels to those of other countries.

As a point of illustration, broadcasting in Canada has always been subject to outside influence mainly due to our proximity to the United States which is heightened by the fact that a majority of Canadians share a common language with our neighbours to the south. The Canadian Broadcasting Corporation was established in the 1930's partly as a counter-measure to being overwhelmed by American broadcasting. In order to build and develop a distinctly Canadian broadcasting system, regulatory measures have been introduced which require a minimum level of Canadian program content on all radio and TV stations. Similarly, measures have been taken to ensure limits on the extent of foreign ownership in private, commercial broadcasting undertakings. Canadian audiences, however, continue to have wide access to American broadcasting.

Another important cultural goal involves the provision of more regional program content by our broadcasting networks. This is particularly important in the northern regions of our country where the native peoples are concerned with safeguarding their cultures.

In the economic sphere, the financing of maximum penetration of telephone service has traditionally been achieved by the use of cross-subsidies. Virtually all of the telephone companies practice some form of cross-subsidization whereby revenues from densely populated areas and long distance rates are used to promote service extensions to rural and remote regions, which are much less attractive in terms of revenue. This approach tends to equalize, more or less, the price of basic telephone service to the consumer, despite the great differences in the actual cost of servicing urban, rural and remote residents. It is a principle that has long been recognized by the industry as an important tool in achieving social goals.

SOLUTIONS

Maintenant, permettez-moi de vous décrire brièvement quelques-unes des mesures en cours de planification ou d'exécution pour améliorer les services de télécommunication qui sont offerts dans les régions isolées et défavorisées.

a) Satellites de télécommunication

Les satellites se sont avérés un moyen efficace d'étendre les services de télécommunication aux régions du Nord et aux régions éloignées. Le satellite ANIK-A de Télésat Canada, qui est entré en service en janvier 1973, était le premier satellite géostationnaire national de télécommunication au monde à être mis totalement en exploitation. Il a apporté la télévision de Radio-Canada et un service téléphonique interurbain de haute qualité à de nombreuses agglomérations du Nord. Il comprend maintenant 88 stations au sol dans le centre du Canada et dans les régions éloignées, et Télésat compte porter ce nombre à 104 d'ici la fin de 1978.

Hermès, le satellite technologiue canado-américain de télécommunication, a été lancé en janvier 1976. Il fonctionne dans la bande des 12/14 GHz, et sa grande puissance permet de le relier à de petites stations au sol. Grâce à lui, on effectue diverses expériences techniques et sociales, y compris des applications en télémédecine, télé-enseignement et relations intercommunautaires. Il a déjà permis de prouver la possibilité technique de faciliter la prestation de toutes sortes de services publics dans les régions rurales et éloignées par l'emploi d'un réseau de télécommunication. Son emploi a aussi créé un cercle croissant d'utilisateurs éventuels des télécommunications.

Il nous reste maintenant à passer des expériences et des démonstrations à l'exploitation proprement dite, et c'est ce que nous permettra le satellite ANIK-B de Télésat. Satellite hybride devant être lancé en 1978, il comporte un réseau sur 4/6 Ghz destiné à l'expérimentation. Ce dernier a été loué au ministère des Communications pour deux ans, à un coût de 34 millions de dollars, et permettra, avec l'aide de stations au sol d'une valeur de 4 millions de dollars, d'exécuter des projets pilotes qui devraient donner naissance à de nouveaux services pour les résidents des régions rurales et éloignées. Le Ministre des Communications a d'ailleurs annoncé dernièrement l'approbation des premiers projets pilotes des domaines social et technique. On envisage aussi dans ce cadre la transmission des débats de la Chambre des communes dans tout le pays.

Un troisième satellite d'exploitation ANIK, ANIK-C, fonctionnant sur 12/14 GHz, sera lancé en 1980 afin d'apporter des services supplémentaires aux provinces. En outre, ANIK-D remplacera éventuellement ANIK-A dans la bande des 4/6 GHz pour servir les territoires du Nord.

A plus longue échéance, l'évolution des systèmes à satellite prévoit l'emploi de satellites pour les communications mobiles du gouvernement canadien, sur terre et sur mer. On envisage aussi leur utilisation pour la recherche et le sauvetage, l'exploration des ressources terrestres et la météorologie, ainsi que pour la radiodiffusion en direct dans les régions rurales et éloignées.

b) <u>Plan de rayonnement accéléré de Radio-Canada</u>

La Société Radio-Canada mène actuellement un programme de sept ans qui lui coûtera 80 millions de dollars. Il comprend quelque 630 projets destinés à étendre les services anglais et français de radio et de télévision de Radio-Canada à toutes les localités canadiennes d'au moins cinq cents habitants. A la fin du programme, en 1981, 99% de la population aura accès au service national de radiodiffusion.

c) <u>Emissions de Radio-Canada pour le Nord</u>

Le Service du Nord, qui sert les deux territoires et le Nord des provinces, produit maintenant une bonne part des émissions radio, y compris des émissions régionales et locales en langues autochtones. Par contre, le Service de télévision du Nord ne diffuse qu'une demi-heure par semaine en langue inuit; toutes les autres émissions sont produites par le réseau du Sud. Etant donné la nécessité d'aider les autochtones à sauvegarder leurs cultures, on augmentera cette année les émissions télédiffusées en langues autochtones dans les régions du Nord. On espère aussi que cette activité prendra de l'envergure au cours des prochaines années, surtout grâce à l'acquisition par Radio-Canada d'émissions réalisées par des producteurs indépendants, dont certains proviendront de centres autochtones de production établis dans le Nord.

d) <u>Programme d'aide aux télécommunications dans le Nord</u>

Le Programme d'aide aux télécommunications dans le Nord vise à apporter le service téléphonique local et interurbain de base à toutes les localités des Territoires du Nord-Ouest d'ici le début des années quatre-vingt. Le gouvernement fédéral, par l'entremise du ministère des Communications, versera environ 9 millions de dollars, répartis sur cinq ans, pour couvrir les immobilisations associées aux installations téléphoniques reliant ces localités. Les deux télécommunicateurs autorisés dans les Territoires du Nord-Ouest (Bell Canada et les Télécommunications du Canadien National) placeront un montant équivalent dans l'installation et l'exploitation du réseau local et dans l'exploitation des circuits téléphoniques reliant les agglomérations. Les lignes interurbaines seront fournies soit par des stations au sol des réseaux de communication par satellite, soit par des circuits au sol, selon ce qui sera le plus économique.

Le Programme d'aide aux télécommunications dans le Nord fait suite à la politique fédérale des communications dans les Territoires du Nord-Ouest et du Yukon. L'objectif de cette politique est avant tout de donner à la population de ces endroits des services de communication comparables à ceux qui sont offerts dans le Sud à des collectivités semblables. On entreprendra donc les travaux nécessaires dès que des fonds publics ou privés seront disponibles à cette fin. Nous sommes très fiers du Programme, car en apportant des installations fiables à peut-être 28 des localités les plus éloignées au monde, il mettra le Canada au premier rang des pays de l'Artique pour l'expansion du service téléphonique public.

e) <u>Rural Communications Program</u>

The Department of Communications has also initiated a major research program aimed at assessing the demand for communications services in rural areas, identifying ways in which they could be improved, evaluating the potential contributions of new technologies and stimulating the development of required systems and equipment. Current studies are intended to stimulate Canadian industry towards the development of responsive and marketable products. Unit costs of delivering services to rural areas can in all likelihood be substantially reduced through more effective use of present technology, the introduction of new technology and the identification of a broader market.

This program should also provide better insight into the nature of the rural population, possible patterns of future change, and cross impacts between telecommunications and socio-economic activity. Institutional changes needed for implementation of certain solutions and advantages and disadvantages of various financial schemes associated with upgraded communications will also be considered. The Rural Communications Program studies will be completed about 1980 and specific recommendations for follow-up action will be made at that time.

One of the field trials of the Rural Communications Program which was announced this month by the Minister of Communications is the delivery, through a fibre optics transmission system, of a minimum service of single party telephone service, at least five and possibly more TV channels, FM radio and some two-way computer interactive signals.

f) Bell Canada Non-Urban Service Improvement Program

Many of Canada's more than 5 million rural residents currently must share their telephone lines with several neighbours. However, major improvements are being made in rural telephone service. Bell Canada embarked last year on a $600 million, four-year construction program to upgrade facilities covering most of the rural population in the provinces of Ontario and Quebec. By 1980, Bell's rural subscribers will have a maximum of 4 parties sharing a single telephone line and 80 percent of the Bell population is expected to have one or two party service by the time this Non-Urban Service Improvement Program is completed.

The objective of no more than 4 parties on a rural telephone line has already been met in the province of Alberta in western Canada and in most of the non-Bell areas in the province of Quebec. Several other provincial telephone companies are also making impressive progress towards meeting this goal.

g) Communications Research Centre

In addition, the Department of Communications' Communications Research Centre has two research projects currently underway to develop new technology which may meet specific communications needs in remote regions at modest cost. These projects may be of particular interest to other countries with remote communications problems.

One of these undertakings is the Integrated Remote Communications Project which has as its objective the development of an upgraded automatic high frequency (HF) radiotelephone system which could be fully integrated with the country's switched network and with trail radios. It is hoped that the quality of the system will approximate that of satellite service while costing considerably less; we are aiming at an operational reliability of greater than 90 percent, as compared to the 60 percent usually obtained with current HF systems. A number of equipment developments have been undertaken including a prototype transceiver, a new voice processing technique and a rugged antenna unit. It is anticipated that all these units will be integrated into a system for field trial purposes by late 1979.

The second activity, the Inuit Trail and Remote Camp Radio Project, is aimed at developing a reliable portable radio system primarily for the use of Canada's native people to maintain contact with their home communities from forest or northern barren lands during traditional activities of trapping, fishing and hunting. A prototype of the system, which utilizes portable transceivers operating at both HF and VHF frequencies is currently being field-tested at a remote Inuit community in northern Quebec to provide communications up to 200 miles (320 kilometers) from the settlement. It is expected that, once the results of the field trial are evaluated, Canadian industry will manufacture this improved trail/remote camp radio for sale to the public.

CONCLUSION

Ladies and gentlemen, my remarks have scanned the broad panorama of telecommunications development in Canada with special emphasis on our provision of services to isolated and underprivileged areas. As I have pointed out, our communications structures in this country are admittedly complex and contain weaknesses which we are attempting to remedy.

The challenges which face us are not of a technical nature only. Political considerations arise as federal and provincial governments strive to assert jurisdiction over areas of special importance. As well, certain conflicts exist among industry sectors involved in Canadian telecommunications.

These difficulties, of course, are not unique to Canada. Their resolution requires dialogue, awareness, cross-cultural sensitivity and understanding. Workshops such as this one can play an important role in fostering such understanding and awareness as we learn from one another and benefit from the experience of others.

I hope my paper and the presentations of the other Canadian speakers who follow me will be useful to all those participating in this Workshop. I look forward to hearing your comments and exchanging views with you in the discussions later today.

SOME ECONOMIC CONSIDERATIONS IN PLANNING TELECOMMUNICATIONS SERVICES DEVELOPMENT IN ISOLATED AND UNDERPRIVILEGED AREAS OF CANADA

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CANADA

PREFACE

Ladies and gentlemen, I am very pleased to have the opportunity to address you today on the subject of telecommunications development in isolated and underprivileged areas of Canada. I share Mr. Fournier's trepidation in attempting to cover this subject in the course of 20 minutes. I do not need to tell this distinguished gathering that the subject matter of telecommunication economics is complex. It is especially difficult to separate the economic aspects of telecommunication development in the special areas from those of overall national development.

In approaching this subject, one might question the meaning or the scope of telecommunication economics. Occasionally, the subject is confined to a type of engineering economics where a proposed service is analysed in terms of various cost factors, the types of equipment, the level of technology, volumes to be handled and so on. Calculations are then made to arrive at an overall cost of extending that particular service and then equating it to estimated revenues that might be derived. This is a function that is carried out primarily by the operating companies and it is a very valid process. Careful engineering studies are essential, if a company is to develop and provide the level of services expected of it at a reasonable and just price.

In my paper today, I propose to approach this problem from a broader point of view. I propose to look at the economics of telecommunications development in terms of the forces that have shaped the demand, the supply and the institutional aspects of providing telephony services to the remote, isolated or underprivileged areas of our country. In doing this I will deal with the development of telecommunications in a historical sense and in a very summary form, I will try to show how different situations served to marshall some of the capital that is now embodied in the extensive telecommunication system of this country.

HISTORICAL SETTING

The telephone is in part a Canadian invention. Alexander Graham Bell, a Scotsman by birth, was at the time of this invention resident of the United States. However, the accounts show that he had earlier immigrated to Canada with his father who had settled in Brantford, Ontario in 1870. It was here that the main principles of a telephone were worked out and the first transmissionof the human voice was made at his father's residence in Tutela Heights, Brantford, Ontario. This all occurred in 1876. The first telephone conversation over any distance was conducted between Brantford and Paris, Ontario, a distance of 14 kilometers; this event occurred on August 10, 1876. Canada had celebrated its birth date July 1, 1867, a mere 9 years before invention of Alexander Graham Bell's telephone. The point is, of course, that we have here, in the annals of history, an example, possibly unique, in which the creation of an industrialized country and the development of a national telephone system have gone hand in hand.

At the time of Confederation and shortly thereafter, Canada was comprised of a union of what now constitutes the provinces of Ontario, Quebec, Nova Scotia and New Brunswick. At the outset it was intended that the territory of the new nation should stretch from coast to coast. This meant acquisition of the western frontier lands through massive settlement and economic development. In 1871, the most westerly province, British Columbia, entered confederation on the condition that construction of a railway would commence within three years.

It took a few years to finish the job, but on November 7, 1885 the last spike on the main line was driven. Transportation was identified as one of the main economic instruments of a National Policy, and in Canada there has always been a close relationship between rail transportation and communications; specific Acts involving communications seem to have been complementary measures to transportation policy. The Post Office, perhaps, is an exception. In 1867 the Post Office Act established a mail service throughout Canada. Historically, the Post Office has remained separate from telecommunications. To this date the postal service in Canada has been operated under a government department with public funds providing necessary capital construction and providing subsidies as required to its annual operations.

At the time of Confederation telegraph services had already been well established in Canada. In 1868, the Dominion Telegraph Company was organized. These services were operated under the Telegraph Branch of the Federal Department of Public Works. Its general objective was to furnish rapid communication for outlying and sparsely settled districts where the amount of business is so small that commercial companies would not enter the field. Later, this operation merged with Canadian National. Early telephony, however, appeared likely to be able to survive without governmental help, although in granting a Dominion Charter to Bell Canada in 1886, the Government of Canada granted special privileges to that company in recognition of its importance to the nation as a whole. In particular, the charter included clauses which provided the company with right to construct telephone lines on streets of incorporated municipalities without the consent of the municipality itself. This feature of the Bell Act remains in force to the present day.

THE DEMAND FOR TELECOMMUNICATIONS SERVICES

One of the remarkable features about the development of telecommunications service in Canada is the rapidity with which it spread. As a case in point, the Montreal Telegraph Company commenced operation between Montreal and Toronto on August 3rd of 1847. By the year end, it had sent over 33,000 messages between these two cities. Telecommunications service was among the first arrivals in the development of the western frontiers. The railways were, of course, prime builders of the telegraph system. For the most part, telegraph lines were built on railway rights of way well in advance of the rails. Telegraphic services reached Calgary, Alberta five years before the arrival of the railway itself.

Less than five years after the invention of the telephone, Bell Canada was planning to move west with the construction of the Canadian Pacific Railway. By this time also, several other companies were trying to gain a toe-hold in various commercial markets. Entrepreneurs had read the signs well. Strong initial demands for telephone services came from the North West Mounted Police.

The Mounties were few, their obligations were many, and the Territory was vast. One of the difficulties was that the bad guys could move at the same speed as the Mounties. Even a routine message was costly, consuming time and energies of man and horse, leaving fewer staff to maintain law and order. As a consequence, a campaign for telephone service was undertaken and a number of commanding officers wrote reports to Ottawa requesting that lines be constructed. After the service was installed, Commissioner Hershimer from Saskatchewan could write: "The introduction of telephones at a very early date has greatly increased our efficiency and effected an enormous savings on the wear and tear of the men and horses. In a few places where we have had them we find them a great boon and we cannot understand how we got along without them before." This tradition is being maintained with our Royal Canadian Mounted Policy today. When broadband services were introduced across Canada in 1967, the RCMP was one of the first organizations to use the network for high quality transmission of fingerprints, photographs and documents between headquarters at Ottawa and division headquarters across the country.

There were other stimuli to the demand for long distance service. Merchants and others in various commercial activities sought long distance connections with other cities or communities. Even in the early 1880s, tourism was making a bid for long distance service and received a special appropriation from Parliament which provided a telephone line to the Banff Springs Hotel in Alberta.

In the historical and geographical context of Canada, the multiplicity of companies, both large and small, has played an important role in the development of telecommunications services in the rural, isolated and generally underprivileged areas. An analysis of this role reveals several interesting insights. Among the foremost was the ability to marshal capital for the provisioning of communiations services from a variety of sources. Some of these funds were channelled into the industry from the domestic and international money markets, through the activities of the large corporations, such as Bell Canada and the Canadian Pacific Railway. The latter, along with the Canadian National Railway, also benefitted directly from government subsidies or grants. The smaller corporations, partnerships, municipalities and co-operatives tapped the local areas for funds. Frequently these took the form of capital in kind, where an operating company supplied the hardware and technical expertise while local people supplied poles and labour to develop a system. The process created not only an involvement of local people in the supply of telephone services, but also an acceptance and demand for such services. This is an important factor, and one which is appropriately dealt with in other papers presented to this Workshop.

The presence of a large number of individual telephone operating companies also provided the opportunity for the industry in total to adapt to the changing technology of the telecommunication industry. There was, for example, a great deal to learn about the construction of outside plant to with-stand the rigors of Canadian weather. Some of the first systems to extend telephone lines used 16 poles per mile, but by the time the Trans-Canada Telephone System was constructed in 1932, many practical lessons had been learnt, resulting in system constructed to very rigid standards, having 40 poles per mile, heavy gauge copper wires and pyrex insulators. Today some of our companies have ambitious programs of buried cable as part of their commitment to service in rural and less densely settled areas.

The Canadian telecommunications system, in proportion to population, soon became one of the most extensive in the world. It operated under considerable climatic and geographical disadvantages. Its use was virtually essential to the operations of the railways. In addition, because it facilitated the receipt and despatch of market and press reports over vast geographical distances, its services to the nation became invaluable.

With reference to local demand, it appeared that commercial interests led the way. Doctors and druggists were among some of the first to install telephone services into their offices. Records show that other parties, too, were interested in subscribing to local telephones which ranged from funeral parlours to ice companies. One of the priorities with respect to telephone services on a community level related to a fire warning system. The urgency of having a reliable fire warning system prompted 24-hour telephone exchange service in most communities.

THE SUPPLY OF TELECOMMUNICATIONS SERVICES

Characteristically the supply of telephone communication services in Canada has taken place through a variety of institutional arrangements, which over the course of years have involved a large number of independent entities. In 1925 there were no less than 2,495 telephone companies operating in Canada. A small proportion of these companies were formed and financed by federal or provincial governments; a large number involved municipal corporations, stock companies, partnerships or private companies. The largest proportion of the telephone entities were organized along some form of a cooperative structure.

In the Canadian setting there are several factors which contributed to this situation. The expanse of the country itself led to regional and very strong local interests. There was a strong pioneering spirit among the people, who also held a rigid mistrust of big organizations which posed a threat of domination from afar; but "afar" could mean as close as the neighbouring municipality.

The diversified institutional structure led to a variety of business practices within the telecommunication industry. As early as the 1890s, Bell Canada had established a policy of maintaining sound financial reserves. Bell recognized that not only was maintenance an important factor, but also that setting up additional funds for plant depreciation was of crucial importance. This was a lesson that some of our companies learnt the bitter way. Today, whether the operating company is government owned or privately owned, sound business practices are observed as a matter of course. In this regard, I would like to comment on the appropriateness of much of the work being carried out at the ITU level through the CCITT's studies. Certainly the work of GAS/5, which this Workshop is designed to support, has dealt with associated important topics such as tariffs, budget procedures, personnel policies and planning concepts, and now is in the midst of this work relating to the role of telecommunications and economic development.

I have discussed the institutional structure of the Canadian telecommunication industry in an attempt to highlight to significance of some of the factors that are so frequently taken for granted. My story, however, does not end here. In fact, I have yet to come to what I consider to be the most important point of this paper, namely, the financial vulnerability of systems serving rural, isolated and underprivileged areas, not just from the point of view of initial capital funding, but also in respect of the need for maintenance and replacement. This vulnerability was most vividly demonstrated during the Great Depression of the 1930s with reference to western Canada. Extensive rural systems were already in place, but with the deepening of the depression and the devastating drought of those years, the prairie region truly became an underprivileged area, and rural families were unable to pay rates, however low, sufficient to carry the system. With revenue dropping off, neither could the owners carry the system. As a salvage measure, bold plans were put into effect which turned over ownership and responsibility for operations to local municipalities and local co-operatives. The effect was to fragment ownership and control even further, and the number of systems in Canada jumped from a previous high of 2,495 in 1925 to an all-time peak of 3,212 by 1939. The scheme was successful to the extent that through local control, lower costs of maintenance were achieved, usually on a do-it-yourself basis. More important, the maintenance costs were reduced for reasons that high grades of service were no longer maintained nor expected.

The sequel to this is that as the economic climate has improved, a rationalization has been taking place in the structure of the telecommunication industry, and the smaller systems are rapidly being integrated. Again, there are two forces that predominate. With rising incomes, the demands and expectations of subscribers increase with respect to the quality and reliability of service; and as the technology advances, local systems no longer possess nor can they afford the technical competence required of modern telecommunications systems. Associated with this is a growing sense of maturity within the industry. Governmental support of telecommunication satellite programs, and subsidies with respect to northern service provided by the Canadian National Telecommunications system are examples of current economic instruments employed to provide telecommunication services to Canada's northlands. At the same time, industry cohesiveness is provided through the activities of the organizations such as the Trans Canada Telephone System in relating to matters of long line arrangements, and the Canadian Telecommunications Carriers Association which serves as a spokesman for the industry, monitors policies, serves on ITU matters and works toward the general betterment of the industry.

CLOSING OBSERVATIONS

While the historical setting with regard to telecommunication development as framed here may be unique to Canada, I hope that I have touched upon some of the underlying factors that can be readily associated with the concerns of other countries now in the process of planning telecommunication systems.

To summarize very briefly, I would identify from our Canadian experience the following:

- The demand for telecommunication services has been prominent. The main stimuli can be linked to the needs of commercial or business enterprises in the first round. National and regional sercurity measures including emergency situations affecting individuals with regard to fire or sickness have also been important influences. The need for communications for purely social reasons appeared to develop at a later stage.

- The financial vulnerability of services to rural or other special areas must be recognized, not only in terms of initial capital costs, but also of maintenance and replacement.

- The degree of technology required to meet the needs of the area, and considerations affecting decisions to install the latest technology and upgrade systems, are dictated as much by economic and financial constraints as by the availability of the technology itself.

Finally, I must touch upon the question as to whether telecommunications is truly an instrument of economic development in a causal sense. From our experience, there is little evidence to support a conclusion that telecommunication service by itself is a sufficient condition to stimulate or lead economic development. There is, nevertheless, overwhelming evidence that it is a necessary condition. In light of my earlier remarks that we have in the annals of our history a somewhat unique study of telecommunication and economic development, it would be difficult for me to imagine comparable economic development in Canada in the absence of concurrent telecommunications development.

Thank you.

Notes and References

The quotation attributed to Commissioner Hershimer of the Northwest Mounted Police, along with other examples of early demand for telecommunication services, were obtained from a book written by:

Mr. Tony Cashman: See:
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REMOTE COMMUNICATION DEVELOPMENT IN CANADA
AND SOCIAL INTERACTION -
A MIDDLE MANAGEMENT PERSPECTIVE

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During the last decade, Canada has gone through a remote-communication development process that, if not unique in the world, is certainly significant from a pattern-setting point of view. The most visible aspect of the process falls into the realm of technology and one is tempted to build a model around technology - for example, Canada's domestic satellite or the development of other relatively heavy route systems, such as tropospheric scatter and microwave systems - but it takes more than technology to make viable telecommunication services available to society. In addition to technology, it takes appropriate economic, institutional and social arrangements. This paper will focus on the social interactions which have occurred in the communication development process in northern Canada.

The most common approach used to deal with the social or human aspects of telecommunication development is to look for, and describe, its impact in relation to the society receiving the new or improved communication services. In-depth impact studies of the Canadian scene have been carried out, and will be carried out in the future, bringing to light additional information. Studies by Hudson, Dicks, Steinbring and Granzberg, as well as reports by such organizations as the Inuit Tapirisat of Canada representing native people, are some of the available sources now. The types of social interaction that take place between different types of societies can have a very important impact on the development process and, in turn, on whether the development which occurs is measured as a success or failure in human terms.

Development that is considered successful from a technical or system point of view can, of course, also be viewed as unsuccessful from a social or human service point of view. Human reaction to development frequently conforms to the basic law of physics which says that for every action there is an equal and opposite reaction. It is the opposite reaction that is so often dysfunctional to development and yet so seldom necessary. A solution to overcoming the problem of negative reaction exists in the form of communication in the human sense, communication between individuals of the societies that leads to an understanding of the needs, concerns, priorities, policies and objectives of the interacting societies.

In identifying the interacting societies in the Canadian development situation, group definition is clear enough for us to use the term "indigenous northern society for one group and "southern technological Euro-Canadian society" for the other. Both of these societies can be further stratified and, in the North, the Inuit, Indian and Metis along with various linguistic divisions can be used to identify sub-groups. Geographically, the Inuit inhabit the Arctic coastal regions and tundra area north of the treeline from coastal Labrador in the east to the Mackenzie River Delta in the western Arctic. Northern Indians, speaking dialects of several major linguistic groups, are located generally in the Boreal forest area between the Plains and Aspen parklands of the south and the tundra of the north, in a broad arc running from the southeast to the northwest across Canada. Interior and coastal British Columbia, together with the southern Yukon forms another remote Indian area with distinctive physiographic, cultural and linguistic characteristics.

In the case of the south, I see a somewhat less obvious but extremely significant stratification in relation to interaction with the northern society. I see an important and powerful group that I will call the "institutional society" and while it may not be scientifically correct to assign institutions the status of society, institutions do have many identifiable development impact characteristics which are distinctly different from those of the southern society at large. Institutions, and more specifically government institutions, are charged with responsibilities for administering resources both human and otherwise and an emerging northern society interacts (or maybe the word is collides) with the institutional society long before it is exposed to southern society at large. As a result, the northern society's view of the interacting, institutional society of the south tends to be that of government in the north. This has certainly been the case in the past but, as the range of telecommunication facilities available in the developing north increases, a greater amount of information is available upon which conclusions about the external society may be based.

The impact of telecommunications facilities on the remote developing society is considerable, not only from the benefits that are perceived, but also from a realization that there is a human cost involved, a cost that must be paid in terms of effects on cultural identity and erosion of a human value system that has served the society well in the past. Upon realizing this, the society's normal reaction is to explore ways of ameliorating the impact; however, it very quickly becomes clear that control is centred elsewhere. Development decisions tend to be made in the south by southerners. If, during the process of trying to influence development decisions, the north perceives that communication links through the institutional structure are insensitive to their concerns or are slow to react, then alternative communication links will be sought out. A general appeal to the broad southern society and direct action at the political level are examples of alternative courses of action that have emerged. We are fortunate in Canada that the indigenous society is a non-violent society and forms of violent confrontation have not emerged. The deciding by northerners to restructure the social impact of telecommunication technology puts in motion a whole new approach to the telecommunication development process, based on organized lobbying, northern autonomy and efforts to control the technology. This tends to change the area of impact from the north to the south. We begin to hear comments in the south like - "After all we've provided for the north, what more can they want?" or - "We are damned if we develop the north and damned if we don't". These reactions are symptomatic of poor communication at the human level and a lack of understanding of the gut issues involved, the cultural survival issues and the human value system issues.

The value of an effective interface within the institutional society to facilitate dialogue with the developing northern society has long been acknowledged, but it is not the easiest position to establish and maintain. The traditional communication medium of the native society is a face-to-face encounter. Personal contact is not only desirable but a matter of necessity, at least during the early stages of social interaction. A basic problem that the institutional society has in this regard is that is representatives come and go in the work force so fast that, to the native society, there appears to be little or no continuity even within ongoing programs. Several years ago, a representative of the institutional society was arranging a meeting in a remote Arctic community and he was described by a local person as "the man who comes to talk about radio and we know him because he is the one that comes back". Accordingly, continuity of contact emerges as an important element for successful inter-society interfacing.

The individual in an interface position must not only have lines of communications externally to the developing society, but must also be able to communicate vertically within the institution to the senior decision-making levels, and horizontally to the various centres of technological expertise. Horizontal communication is particularly important because institutions tend to establish centres of expertise based on their mandate, and mandates for social development and other kinds of development seldom reside within the same department, branch or section. Social development and the other kinds of development are tightly inter-related and one cannot take place without affecting the others. An individual acting in an interface position who is sensitive to the concerns of the evolving indigenous society, who has formal contact with the decision-making levels and who understands the basic principles underlying areas of expertise such as electronics, system engineering, economics and the social sciences, can be a powerful tool in the development process.

Several forms of the interface positions have been tried in the past with varying degrees of success. One was the placement in northern communities of highly motivated and innovative resource people drawn from society at large. Unfortunately, this kind of resource person commonly becomes oriented so as to identify totally with the society in which he or she is functioning and loses the valuable and necessary capability to effectively interface with the institutional society. What is lacking in this instance is the functional knowledge of the institution and an understanding of, or commitment to, the long-term mandate of the institution.

Another system that has been tried is the task force approach where dynamic people are brought together for a discrete period of time to undertake a project or program. Unfortunately, in this case too, continuity of contact with the native society is lost. The Northern Pilot Project of the Department of Communications which ran for a two year period between 1972 and 1974 is a case in point. During the two year period that it functioned, it achieved some important milestones such as establishing native-controlled inter-community communications systems, community broadcast stations, trail radio system and video tape recording projects, among others. It evaluated impact and made recommendations for technical, economic, institutional and social arrangements to facilitate development but in the end, one day it existed and functioned, and the next day it was gone. The stimulus provided during the project gathered momentum as the people attempted to integrate the Northern Pilot Project facilities into their society and the requirement for assistance and guidance peaked long after the Northern Pilot Project had been disbanded. Fortunately in this case another form of interface was available to carry on with the process; it might be described as the "middle management" interface position. This kind of interface position commonly goes unrecognized but can be a valuable institutional resource.

Middle management personnel are in a position where contact with, and an understanding of, the real world of the north is firm but where they are high enough in the hierarchy of the institution to act as an interface with the somewhat more remote policy and decision-making levels. In addition to this, they are part of the line structure of the organization and can ensure continuity of contact with the native society as it develops and at the same time be productive within the mandate of the institution. In a technically-oriented structure, such as the one in which I funtion, the existing line staff, with a background in technology, systems operation, program management and day-to-day contact with the northern society, can conveniently and economically be developed to provide the interface function through a program of training in the social sciences. It is not uncommon for institutional staff to be provided training in the technical field and then sent out to work primarily with people rathern than equipment. An effectively developed line staff is capable of explaining the institution to the society in which it works, the society to the institution, technology to social oriented stuctures and social concerns to technically-oriented structures.

Unfortunately, it is not uncommon for a purely technically oriented person to indicate that to him hardware development is nothing more than an engineering problem and how the hardware relates to people is someone else's concern. Human concern must, of course, be a part of the telecommunications development process from beginning to end.

In the Canadian communication service environment there is a close relationship between private enterprise and government. Public telecommunication services are provided to a great extent by private enterprise, with government acting as a regulatory body, and there are both federally and provincially-regulated telecommunication service carrier agencies. Crown corporations, ie., publicly-owned corporations are also involved in some service categories. Limited possibility exists for a user to either purchase communications services from a carrier or in certain instances to establish private commercial communication facilities. Since the primary concern of government is to meet the needs and desires of the people it serves, and the primary concern of the business-oriented communications service supplier is economic survival in a competitive market place, private enterprise marketing initiatives, together with government's concern for the effects of the communication product on society, can form a well-balanced arrangement that is normally capable of ensuring that the most acceptable and cost-effective communication services are available to society. In the case of the north, however, severe economic problems emerge which require the development of economic enabling devices. The vast distance involved, the small size of communities and the limited market available tend to make northern communications a money-losing proposition for the carriers.

Between 1950 and 1954 I was a Radio Operator in the central Arctic and it would be useful, I think, to identify the telecommunication development process that has taken place in that area between then and now. If we look at communication development in Canada's north historically, within the context of the needs of society and the economic constraints of providing service, we can establish a base line in the early 1950's from which to measure progress and identify significant development interactions. This point in time is appropriate because a stable but primitive communication service was in place and improvements could not be made pending the development of necessary technology. Communication facilities existing at that time had only secondary impact on the indigenous population. There were government-operated radio stations at some locations where radiograms could be sent and received, and this was supplemented by private high frequency radio facilities for private commercial use. The Inuit, with minor exceptions, were nomadic and any benefits from electronic communications were largely indirect, in the form of the administrative effects of the various law enforcement, religious and commercial organizations which made use of communications in fulfilling their individual mandates. The name for a Radio Operator in the Caribou Eskimo dialect of Inuktitut was "Naaleqtee" which I understood at the time to mean "the man who listens" and it likely developed from observing the crazy "Kabloona", or person from the south, who sits all day in a warm wooden house with big metal earmuffs on, listening to strange noises. Quamanittuap Naalautaa is the name of the present day Baker Lake Radio Society and since naalautaa means "the radio belonging to all the people" it would appear that the term "the man who listens" has been adopted as the root word for radio in the dialect. The point is, that to the indigenous population, radio was generally beyond their normal daily experience; it was something owned, controlled and used by Kabloona.

The northern native population began to shift from the land to settlements in the latter part of the 1950s, primarily as a result of starvation on the land brought about by changed caribou migration patterns, but once the move started a host of social development factors emerged to accelerate the shift. The availability of social services in the community and the loss of children from the land during the greatest part of the year so that they could attend school were dominant factors. These same social services created a greater need for administrative traffic between the remote Arctic communities and the south, and the 1960s ushered in a short period of development that produced a network of single sideband high frequency radio stations homing on terminals with phone patch interconnect capabilities into the switched network of the south.

The indigenous population by this time was discovering the value of communications in their daily lives and, while the radio telephone system was established primarily as an administrative link to the south, the facilities were available during off-peak times for use by the general population. They were used in this way primarily for inter-community communication within the north, but the system had the usual propagation and circuit loading problems of a high frequency facility, which were compounded in this setting because of the auroral zone. Broadcast coverage in the area was by skywave propagation and was generally irrelevant to the indigenous society since programming in their native language was all but non-existent. The situation regarding service to communities in the north remained quite static during most of the 1960s because of the high cost of terrestrial facilities capable of improving the existing service. Considerable resources were, however, expended for military systems in the north. While there was very little immediate impact on the indigenous population, such military systems, using high cost troposcatter techniques, gradually evolved into a back-bone civil trunking system serving certain areas. One of the major effects of the military systems from a social point of view was that they demonstrated what could be done if resources were available, and they also served as an example of the communication disparity that existed in relation to service available to members of the southern society in the north and the indigenous society of the north.

The 1970s ushered in a period of drastic change in the north from both a social development and a telecommunication development point of view. The Department of Communications was established in 1969 around a radio regulations nucleus that split off from the predominantly transportation-oriented Department of Transport, and this administration change facilitated a re-thinking of the telecommunication regulatory environment. A much greater emphasis on the social aspect of communications emerged and one of the first undertakings of the new department was to carry out a somewhat massive study known as the Telecommission Study. Study 8(c) of the Tele-commission report dealt with the north and, among other things, it documented user dissatisfaction and concluded that communication improvements in the North were needed at an early date. Canada's first domestic satellite "Anik" was on the drawing board at this time and the stage appeared set for a cure-all application of this new technolgoy. However, the financial limitations of the time resulted in application plans to serve the northern society which were very conservative. At a communications conference held in September of 1970 in Yellowknife, Northwest Territories, representatives of the northern society recognized those service limitations and their negative response to Anik was, I think, a bit of a shock to the southern institutional society. Another important aspect of this early social interaction was a beginning of realization by the south that a different value system existed in the north and what was perceived by the south as good for the north was not necessarily viewed as such by the indigenous population.

From this point in time on, there has been a continuous series of actions and reactions between the two societies which has significantly influenced the way in which telecommunication development has occurred in the north. Time does not permit me to detail the complete process, or the wide range of communications services that have been and are continuing to be developed. The important point is that the interactive process is teaching the institutional society to respond to the real world needs of the indigenous northern society. Minimum service standards for northern communities, institutional arrangements for consultation and response, and financial arrangements to allow development where economic viability does not exist, are some of the things that have resulted from this process. There are, of course, problems still to be resolved such as the impact of southern broadcasting on cultures of the north and a lack of trail radio systems for communication beyond the community to people on the land, but we are coming closer to meeting communication standards acceptable to both the north and the south. The predominantly south to north communication links of the past are becoming truly two-way communication links. The voice of the northern society is being heard in the south ever more frequently and with greater clarity.

LES PROBLEMES TECHNIQUES PROPRES A LA PLANIFICATION
ET AU DEVELOPPEMENT DES SYSTEMES DE TELECOMMUNICATION
DANS LES ENDROITS ISOLES DU CANADA

PIERRE JADOUL
CANADA

Mesdames
Mesdemoiselles
Messieurs

Le territoire dont je vais vous entretenir, appelé plus communément le Grand Nord, se distingue à plusieurs titres parmi lesquels j'aimerais particulièrement retenir les plus sensibles pour le point de vue des communications: à savoir d'une part sont étendue, l'immensité du territoire à couvrir crée des problèmes de logistique et d'opération hors du commun; d'autre part, alliées à cette caractéristique géographique, les conditions climatiques exceptionnelles qui y règnent ne font qu'amplifier les obstacles à surmonter.

Ainsi par ces quelques mots d'introduction, je voudrais clairement mettre en relief les problèmes principaux qui sont omniprésents dans nos décisions de planification.

L'histoire des télécommunications dans le Nord Canadien est relativement récente et a environ une trentaine d'années. Elle a connu au cours des premières années de 1970 une profonde transformation et accélération avec la venue des communications spatiales.

Le réseau de Bell Canada dont je vous parlerai aujourd'hui ne donne toutefois qu'une image incomplète car il ne couvre que la partie est de l'Artique, soit le Nouveau-Québec et l'est des Territoires du Nord-Ouest.

Nous desservons actuellement 13 municipalités du Nouveau-Québec et 22 des Territoires du Nord-Ouest; tous nos abonnés nordiques jouissent des services téléphoniques local et interurbain, à l'exception de deux villages non encore électrifiés.

Quant à la partie occidentale du Nord Canadien, plus développée et plus populeuse avec des villes comme Yellowknife et Whitehorse, elle tombe sous la responsabilité des télécommunications du Canadien National.

D'autre part, le Labrador dont Bell Canada avait la responsabilité jusqu'en janvier 1974, est maintenant desservi par Newfoundland Telephone, tandis que quelques autres sociétés se partagent le territoire du Moyen-Nord au Québec, en Ontario et dans les Provinces Centrales.

J'aimerais maintenant aborder plus spécifiquement quelques points qui ont un impact sensible sur la planification de nos installations et la méconnaissance de ces particularités rendrait la réalisation sinon impossible du moins très hasardeuse.

Maintenir un réseau téléphonique dans un territoire grand comme l'Europe où l'on ne trouve qu'une trentaine de circonscriptions comptant 3,800 abonnés au total, est une tâche qui comporte, vous vous en doutez bien, de nombreux problèmes: éloignement des grands centres, distances considérables entre chacune des localités, difficultés de transport et d'approvisionnement, coûts de l'ordre de 50% supérieur à ceux du Sud, climat, sol, langue, la brièveté de l'été, l'absence de routes et de chemins de fer...

Pour ce faire, une équipe de spécialistes de Bell Canada préposée à l'installation et à l'entretien du réseau est cantonnée à Frobisher Bay dans les Territoires du Nord-Ouest, et fait continuellement la navette à travers tout le territoire au moyen d'un avion Twin Otter spécialement aménagé.

Quand nos techniciens partent en tournée, ils doivent apporter avec eux une grande quantité de matériel et ils ne savent jamais le temps qu'elle durera à cause du climat très aléatoire qui retient souvent les avions au sol pendant plusieurs jours.

Dans le Nord Canadien, on assiste à des tempêtes si violentes qu'il n'est pas rare de voir des villages demeurer inaccessibles et coupés du reste du monde pendant de longues périodes de temps.

Les voyages y sont toujours risqués: les vols s'effectuent au radiophare, communément appelé "Wireless Beacon" en termes d'aviation, et les pistes d'atterrissage sont souvent rudimentaires.

En soirée, atterrissage et décollage à la lueur des phares de quelques motoneiges (chenillettes) sont monnaie courante.

Les visites dans chaque localité étant forcément assez espacées, nos hommes y trouvent régulièrement une somme de travail imprévue, ce qui rend difficile la planification des horaires.

Afin de diminuer les frais d'exploitation et afin de préparer une relève autochtone, nous avons assigné en permanence un technicien dans les trois principaux postes du territoire; de plus, nous avons embauché, dans plusieurs villages, des hommes de service locaux qui voient à l'entretien des centraux et au réparations mineures.

Quant au réseau de câble, la courte saison d'été laisse peu de temps à sa construction et à sa rénovation dans les villages. On doit évidemment tirer parti de l'équipement lourd disponible sur place.

Dans le Nord, les câbles sont toujours aériens ou en surface. Toutes les tentatives de réseau enfoui se sont soldées par des échecs à cause des trop grands mouvements du sol provoqués par le permagel.

Comme tous les autres édifices dans le Grand Nord, nos centraux téléphoniques, la plupart du temps des remorques, doivent être érigés sur pilotis pour éviter que le sol ne dégèle à leur contact, ce qui les ferait littéralement s'enfoncer dans un marécage.

Pour la même raison, les poteaux de support des câbles téléphoniques doivent souvent être installés dans des caissons rocheux.

Les questions attachées au transport de nos matériels et à leur installation affectent considérablement tant les échéanciers du parachèvement de nos projets que les prévisions budgétaires et ceci dépendant que l'on choisisse la voie aérienne ou maritime.

L'expédition par avion bien que cela soit la solution la plus onéreuse, autorise des réactions rapides et se trouve de plus en plus employée.

La voie maritime que nous utilisons pour nos transports lourds par contre comporte ses propres vicissitudes et c'est ainsi que les départs pour le Grand Nord ont lieu généralement au mois de juillet. Tout retard dans la préparation de l'équipement pour l'expédition signifie un contretemps général dans la planification de réalisation de plusieurs mois, voire même d'une année. En outre, il est arrivé que des navires dussent rebrousser chemin juste au moment d'atteindre un village, parce ce que la baie n'avait pas été dégagée par les glaces.

D'ailleurs, peu de villages disposent d'installations portuaires adéquates. Le matériel électronique délicat supporte mal le transbordement sur les péniches et le débarquement sur la grève, d'où il peut être tiré sur des terrains rocailleux par des tracteurs ou à force de bras.

J'aimerais maintenant laisser de côté les aspects physiques et climatiques des Territoires du Grand Nord pour nous tourner particulièrement vers les abonnés que nous desservons.

En effet, à ces problèmes viennent s'ajouter quelques difficultés ayant trait à la langue et aux habitudes de vie des populations locales, difficultés que nous devons tenter de surmonter afin d'offrir à l'abonné un service sans cesse amélioré.

Pour ce faire, depuis près de deux ans, le service Commercial, soit celui qui transige avec les abonnés Inuit et Nordiques, est maintenant localisé à Frobisher Bay, dans les Territoires du Nord-Ouest.

Un Directeur-adjoint et des préposées au service Inuit nous permettent maintenant d'offrir un service trilingue, soit en inuttitut, en anglais et en français. Egalement, pour permettre à nos abonnés ne parlant que l'inuttitut d'avoir accès à un service d'information, nous planifions d'implanter à Frobisher Bay en 1980, l'assistance-annuaire.

De plus, nous croyons qu'avec le mise en service parallèle de la composition interurbaine directe et de l'enregistrement automatique des numéros prévue pour le début 1980, nos abonnés jouiront alors de services équivalents à ceux du sud et l'établissement de communications entre abonnés sans l'intervention des téléphonistes devrait diminuer grandement les difficultés qui existent par le fait de la barrière des langues. Seuls les appels spéciaux, soit ceux nécessitant l'aide du téléphoniste devront passer par lui.

Actuellement, les téléphonistes d'Ottawa répondent aux appels provenant des localités desservies par satellite, à l'exception de ceux de Frobisher Bay.

Des téléphonistes Inuit sont toutefois en poste à Frobisher Bay pour répondre aux appels originant de cette ville ainsi qu'aux appels-radio des localités alimentées par la radio à haute fréquence.

De plus, comme il est très difficile de recruter des téléphonistes autochtones à Ottawa, ce sont celles de Frobisher Bay qui les assistent quand elles sont en communication avec un abonné unilingue de langue inuttitut.

Cette préoccupation de mieux servir notre clientèle dans sa langue maternelle s'est également traduite par une version mensuelle du compte téléphonique en inuttitut, par une campagne d'information ainimée par notre Directeur-adjoint Inuk dans tous les villages et par la publication d'un annuaire en inuttitut.

La langue n'est pourtant pas la seule contrainte, il nous faut aussi savoir composer avec le mode de vie des autochtones.

Par exemple, l'appel de la nature, si normal pour les gens de ces contrées, doit être tenu en considération dans la planification du travail.

Le nomadisme est un autre phénomène dont il ne faut pas s'alarmer mais qui complique singulièrement les prévisions. Les fluctuations de population entre les localités sont parfois dues aux impératifs des saisons de chasse ou des migrations de gibier.

Il faut dire toutefois que les Inuit n'ont pas le monopole du phénomène: on a vu naître ou grossir des villages parce que les blancs y ont ouvert une mine ou ont décidé d'y opérer une régionalisation administrative.

Maintenant, j'aimerais en quelques mots vous décrire les équipements de Bell Canada en place et ceux que nous projetons d'installer dans un proche avenir.

Comme je vous l'ai dit au début de ma causerie, tous les habitants de l'est des T.N.O. et du Nouveau-Québec jouissent du service téléphonique local et interurbain.

La majorité des villages, 23 sur 35, est desservie par le satellite ANIK, quant aux autres localités, soit 12, les communications interurbaines sont assurées par un système de radio H.F. dont la base principale est située à Frobisher Bay. Il y a lieu de noter que jusqu'en 1972, date du lancement du premier satellite ANIK, la radio H.F. était la seule technologie disponible.

Avec la radio H.F. dans le nord est reliée une foule d'inconvénients: la non-confidentialité des appels, l'impossibilité d'appeler 24 heures par jour, les difficultés de transmission et de réception, l'affaiblissement par intermittence des communications à cause des aurores boréales, la transmission unidirectionnelle, l'impossibilité d'acheminer des messages urgents hors des heures prévues, problèmes de recruter des opérateurs.

D'ici 1979, tous les villages, y compris le plus septentrional, Grise Fiord sur l'île d'Ellesmere, jouiront des avantages des communications par satellite.

Nos centraux sont dotés d'équipement pas-à-pas traditionel dont l'entretien est simple et bien connu par nos spécialistes; pour ce qui est des communications interurbaines via satellite, elles sont d'aussi bonne qualité que celles du Sud qui utilisent des voies plus classiques comme le cable ou le lien hertzien, et si l'on fait exception du phénomène de l'écho auquel les interlocuteurs doivent s'habituer.

Graduellement à compter de 1980, nous envisageons de remplacer nos centraux pas-à-pas dans les villages par un nouveau autocommutateur électronique, et ce, afin d'améliorer le service à l'abonné, de diminuer nos frais d'exploitation et de procéder pour certains cas à des vérifications et restaurations rapides.

En effet, ce nouveau commutateur devrait nous permettre de contrôler, via un système de contrôle à distance, son bon fonctionnement et en outre d'effectuer, toujours à distance, une série de tests et vérifications aux fins d'obtenir un diagnostic lors de dérangement éventuel.

Ainsi, non seulement il y aura moyen de préciser la nature de la défaillance aux fins d'évaluer l'urgence de l'intervention de l'équipe d'entretien, mais également de par la conception modulaire de ce central téléphonique il nous sera possible de préparer précisément les pièces défectueuses à remplacer. De plus, toujours par le truchement du contrôle à distance, nous pourrons procéder à des branchements ou des débranchements de ligne d'abonné et il ne sera désormais plus nécessaire de se rendre dans un village pour débrancher un abonné qui part à la chasse pour quelques mois, par exemple, ou encore pour le raccorder de nouveau au réseau à l'automne.

Permettez-moi de vous faire part de quelques autres particularités dont nous devons tenir compte dans la planification dans le Nord.

Du fait des conditions des plus rigoureuses existant dans ces endroits, la continuité de l'alimentation en énergie électrique revêt une importance capitale; aussi chaque village est doté de générateurs diesel continuellement en état de prendre la relève en cas de défaillance de l'unité alors active. C'est ainsi que peut-être paradoxalement il existe moins d'interruption de longue durée dans le Grand Nord que dans le Sud. Toutefois, nos centraux téléphoniques sont équipés de batteries dotées d'une autonomie de huit heures environ, et ils sont, bien entendu, chauffés.

Certaines précautions doivent être prises pour éviter l'accumulation de neige et de glace sur les antennes de nos stations satellites, ce qui réduirait sensiblement la qualité de la transmission. C'est ainsi que nous devons prévoir des dispositifs de chauffage pour ces antennes.

Je ne peux vous parler des télécommunications dans le Nord sans mentionner Télésat.

Télésat Canada fut incorporée par une loi du Parlement en septembre 1969, dans le but d'établir et de gérer un système national de télécommunications par satellite.

Télésat est une société dont le capital-actions est partagé entre le gouvernement et les sociétés de télécommunications existantes.

Le 9 novembre 1972, le premier satellite fut lancé. On l'appella ANIK I, ce qui signifie frère en langue esquimaude.

Télésat a contribué profondément à modifier et à consolider l'importance des différents groupes ethniques dans les Territoires du Grand Nord et l'avénement de l'ère spatiale des communications a permis une association plus grande entre ces territoires et le reste du pays.

La gamme des stations terrestres est très vaste et compte deux types de stations, soit celles pour les routes à grandes capacités comme notre base de Frobisher Bay, et celles de faibles capacités, moins de 10 circuits en général. Ce dernier type représente la plupart de nos installations.

Bell Canada loue actuellement pour ses besoins du Nord quelque 150 circuits dans la catégorie "route à grand capacité" et environ 250 circuits dans la catégorie "route à faible capacité".

Des études sont en cours pour augmenter d'ici 1980 la capacité de la second catégorie en divisant en deux la bande de fréquence utilisée pour chaque circuit de transmission et de réception.

On peut également fonder quelques espoirs sur les prochaines générations de satellite qui non seulement joueront le rôle de station répétitrice mais possèderont en plus un pouvoir d'amplification. Ceci permettrait des communications directes Nord-Nord via le satellite et par le fait même allègerait les stations terrestres.

En terme de conclusion, il me semble qu'après avoir élaboré notre planification à établir plus particulièrement des infrastructures pour relier le Nord au Sud, notre prochaine direction de planification devra se tourner vers l'établissement de communications qui répondront à un besoin de renforcement des liens communautaires. Compte tenu du territoire et des grandes aspirations de nos abonnés nordiques, il s'agit en fait d'un autre défi à relever pour Bell Canada.

TELECOMMUNICATIONS ACTIVITIES OF THE INTER-AMERICAN DEVELOPMENT BANK

ROBERT F. GELLERMAN
INTER-AMERICAN DEVELOPMENT BANK

LENDING ACTIVITIES

The IDB's activities in telecommunications began in 1966 with the "Feasibility Study of Space and Terrestrial Telecommunications in South America", and the first loan was made in 1967. Up to the end of 1977, a total of $196.8 million had been lent on 13 projects. These projects are summarized in Table 1. At the end of 1977 the Bank's total lending was $11,944.6 million, as shown in Table 2.

Table 2

IDB Lending by Sector

(Cumulative to December 1977)

Sector	Amount (millions)	Per cent
Directly Productive		
Agriculture & Fishing	$ 2,745.8	23.0
Industry & Mining	1,939.3	16.2
Economic Infrastructure		
Energy	2,710.8	22.7
Transportation	1,589.9	13.3
Telecommunications	196.8	1.6
Social Infrastructure		
Public Health	1,179.5	9.9
Urban Development	537.9	4.5
Education	527.2	4.4
Others		
Tourism	125.5	1.0
Pre-investment	189.7	1.6
Export Financing	202.2	1.7
Total	$11,944.6	100.0

RURAL DEVELOPMENT

In recent years there has been a growing awareness that the benefits of economic development activities, while substantial, were having little effect on the poorest people, who tend to be concentrated in the rural areas. In addition, the long-term trends of population growth and the rising domestic demand for food and other farm products in those countries required expansion of agricultural production. Consequently, the IDB for several years has been placing increased emphasis on rural and agriculural development projects.

In September 1974 a seminar on rural telecommunications was held in Quito, Ecuador by the ITU, and attended by representatives of most of the telecommunications operating administrations in Latin America. The following year, at its meeting in Rio de Janeiro, CITEL[1] passed a resolution requesting its members to put increased attention on rural telecommunications and requesting the IDB to give favourable consideration to applications for loans for such projects.

After an intensive study, the IDB decided in 1976 to accept applications for a limited number of loans to finance rural telephone projects. The first one to be approved was an application from Colombia, followed by loans to Costa Rica and Ecuador.

COLOMBIA

Eighty per cent of Colombia's telephone service is concentrated in the nation's six largest cities which account for only 30 per cent of the population. Moreover, 97 per cent of the 200,000 new telephone lines added during the period 1970-75 were installed in the three largest cities.

To extend the benefits of such service to other areas, the Empresa Nacional de Telecomunicaciones (TELECOM) drafted a Community Rural Telephone Plan, under which it will install public telephones in 4,400 towns. The first phase of this

[1] The Interamerican Telecommunications Committee of the OAS.

program, estimated to cost $54.8 million will be financed by a $29 million loan from the IDB and by US$25.8 million in Colombian Pesos from TELECOM's revenues. The IDB loan, approved in December 1976, has a thirty-year amortization period and an interest rate of 2%.

The project will be carried out in 21 of the country's 29 departments and will provide public telephone service in 2,200 rural communities. It will benefit an estimated 4,300,000 persons in and near those communities, or 47 per cent of Colombia's rural population. In a typical community, a single telephone will be installed in a public place and will be connected to the nearest telephone exchange by means of VHF radio, cable, open wire or carrier over those facilities.

COSTA RICA

To accelerate the development of its rural areas, the Costa Rican Government in 1971 initiated a program to install public telephones in rural communities. As a result, by 1977 about 400 of those communities had access to the telephone system. However, some 700,000 inhabitants of the rural areas still lacked such access. In 1977 the IDB approved a $12.2 million loan to help bring telephone service to about 245,000 of these rural residents. The project, estimated to cost a total of $25.2 million, will consist of:

- The installation of small telephone exchanges with a total of 8,800 lines in 56 communities with an average population of 4,600 persons, located throughout the country. Forty-six of these communities now lack telephone service, while the equipment in the remaining ten communities is inadequate and will be replaced. The project includes the necessary transmission equipment to connect with the existing long distance network.

- The installation of 500 rural public telephones in small rural communities. These telephones will be used to communicate with production centres and larger rural communities through the telephone exchanges being installed in this project as well as through other existing exchanges. The connection to the nearest exchange will be by means of VHF radio, cable, wire line or carrier.

- The installation of 800 public telephones in rural production centres such as cooperatives, small farms, farm settlements, hospitals and schools.

This loan is for a term of thirty years at an interest rate of 2%.

ECUADOR

In a 1972 study carried out in Ecuador, a ten-year plan was made for improvement of telecommunications in the rural areas. Under this plan, 400 rural communities would be connected to the national network over the period 1973-82. Half of this program, or 200 communities, were included in the official national plan for the period 1973-77. By the end of the period only 40 communities had actually been connected because of funding limitations. The national plan for the period 1978-83 includes an additional 200 rural communities. The Instituto Ecuatoriano de Telecomunicaciones applied to the IDB for a loan, and in April of 1978 the Bank approved a loan for $9.6 million to cover the foreign exchange costs of a project estimated to cost a total of $17.6 million. The loan has an amortization period of 40 years and an interest rate of 2%. This project will permit connection of 382 communities to the national network by 1982, and in that way the goals of the original ten year plan and of the two five-year plans will be met. In the meantime, an objective has been established to provide at least a public telephone in the 114 cantons and 714 rural parishes[1] by 1993.

The presently funded project will provide telephone exchanges in 128 communities with a total of 12,000 lines, and public telephones in an additional 254 rural communties. As in the two projects previously mentioned, these rural public telephones will be connected to the nearest exchange by cable, wire line, carrier, VHF radio, or in a few cases by HF radio.

It has been estimated that this project will benefit 500,000 people, or about 25% of the total rural population of Ecuador.

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[1] Equivalent to county seats and townships

POLICIES AND WORKING CRITERIA

In considering applications for rural telecommunications loans, the Bank's policy requires the following special criteria to be used:

a) The project should be consistent with and complementary to other current activities for rural development in the region concerned and accordingly constitute an element of support in the regional development plans.

b) The project should constitute the lowest-cost effective solution.

c) It should be limited to the establishment of a minimum telecommunication system linking isolated areas and centres of consumption and service.

d) It should be limited, within the service areas, to meeting the needs of the productive sectors and essential public services.

e) It should exclude residential or household service, except for the installation of a small number of facilities to be operated as public telephones for common use by the rural community at large.

In analyzing the projects approved so far a number of problems have arisen, and with each successive project we have learned a little more about solving them. In the first place, the rural location of these projects, the low income level of the beneficiaries, and the low financial return on investment combine to make these projects candidates for the use of concessionary loan funds. These funds are intended to be used for projects with a high social benefit content and favouring the low-income groups. The justification for the use of these funds for projects in agriculture, sanitation, health and education is obvious to almost everyone, but the justifications for a telecommunications project are not so obvious. The investigations now being started by the CCITT Specialized Autonomous Group GAS 5 on the benefits of telecommunications should help in this regard. The Bank's activities should be as consistent as possible in the different sectors. For example, in a given location, if an electrification project is classified as rural, a telephone project should also be a rural project. For this purpose, we have established the following working criteria for selection of locations to be included in an IDB-financed rural telecommunications project.

Rural Public Telephones - Communities of at least 100 population. The number of rural public telephones in a community should not exceed one per hundred population.

Small Telephone Exchanges - The localities served should have a population of under 10,000. The density should not exceed five telephones per hundred population. The initial installed capacity should not exceed 300 lines. In addition to the preceeding requirements, the following aspects should be taken into consideration:

a) The requirements of other programs for socio-economic development in rural areas, such as health, education and social security.

b) The availability in the community of other services and installations, such as:

- Government offices, police, fire stations;
- Hospitals, clinics, health centres, doctors and paramedics;
- All-weather roads, railroad stations, airports, ports;
- Banks, post and telegraph offices, transport companies;
- Primary, secondary, technical and university extension schools;
- Electric energy, public water and sewers.

c) Isolation with respect to social and commercial centres.

d) Places for which, because of the location, the additional cost of providing service is low, such as, for example, a community located near a cable required to provide service to another community.

These criteria may be changed as we gain more experience with rural telecommunications projects.

PRESENTATION AND ANALYSIS OF PROJECTS

In analyzing telecommunications projects submitted for financing by the Bank we have in the past evaluated the direct financial benefits, and only made a comment on the economic benefits to the effect that they existed and were substantial but were not measured. Projects in non-revenue producing sectors such as roads, however, have traditionally been evaluated on the basis of their economic benefits. Rural telecommunications projects occupy an intermediate position, in that they produce some revenues, but frequently not enough to cover all costs and produce the customary return on investment. This shortfall is caused partly by the higher unit cost of providing rural service and represents an internal subsidy, which forces the analyst to examine a number of other aspects in greater depth than might otherwise be necessary. In addition to the internal subsidy, the indirect or economic benefits are evaluated. In the three projects we have analyzed to date we have concentrated on the savings in transportation costs brought about by use of the telephone. Then, since a low-return investment is being made, the impact of the project on the over-all financial results of the operating enterprise must be evaluated to assure that the financial viability of the enterprise is not endangered.

Ideally, to show that the project is consistent with other rural development activities, it should be included as a part of an integrated rural development program. Unfortunately these programs rarely mention telecommunications, and the telephone company is often forced to provide service to support the program from its own resources. It is helpful to have the rural telecommunication program explicitly included in the formal national planning document. It is also useful to show a summary by sector of all development activities in the region under consideration, as this will frequently point up omissions or over-emphasis on certain sectors. In analyzing the Costa Rican rural telephone project, we found that the IDB alone had lent \$164 million for 21 rural development projects of almost every imaginable type as shown in Table 3. Placed in this context, the need for telecommunications in the rural area is easier to demonstrate.

Table 3

IDB Loans in the Rural Sector of Costa Rica

(Through December 1977)

Sector	Amount $ Millions	Per cent
Transportation	60	34.1
Agriculture	40	22.7
Health & Sanitation	26	14.8
Education	18	10.2
Electrification	14	8.0
Telecommunications	12	6.8
Pre-investment	6	3.4
	176	100.0

EX-POST EVALUATION

So that it can monitor the effectiveness of its operations, the Bank carries out ex-post evaluations of a representative number of the projects it finances. The rural telecommunications projects represent a new area of activity, so we have included in each loan made so far a requirement to gather data for eventual ex-post evaluations.

With each successive project we have become more specific on the data required, and in the most recent one have requested the following data:

Rural Public Telephones

a) Monthly summaries of number of main telephones in service, total volume of use and total revenue.

b) Annual survey for a two week period of sample locations showing name of community, population served, distribution of population by time or distance from telephone, distance to next nearest public telephone, distance to nearest exchange, waiting time, purpose of calls, destination of calls, time or distance from caller's home to telephone, duration and cost of calls sent and received.

Rural Exchanges

a) Monthly summaries of number of exchanges in service, number of main telephones in service, volume of usage, revenue broken down into monthly service charge, local, long distance, and installation fees.

b) Annual survey for a two week period of sample exchanges showing local and long distance usage broken down by origin and destination, as well as data shown in (a) above.

c) A one-time survey of subscribers indicating number in family, occupation by head of household, years of schooling and income.

These data are to be collected during the execution of the project and for five years after completion.

We expect that the information thus collected as well as that developed by other organizations will enable the IDB to apply the funds available to it for telecommunications projects in more effective ways to foster the development of Latin America.

Table 1

INTER-AMERICAN DEVELOPMENT BANK - TELECOMMUNICATIONS LOANS

(through April 1978)

Country	Executing Agency	Loan Amount	Total Project	Year	Description
Bolivia	ENTEL	$15,750,000	$19,300,000	1972	Provided a long-distance transmission network between the cities of La Paz, Oruro, Cochabamba and Santa Cruz by means of a Microwave radio system with a capacity of 960 voice channels, as well as semi-automatic long distance telephone switchboards, a telex switching system, HF radio-telephone and telegraph service from La Paz to thirteen cities, equipment buildings and technical assistance in engineering, administration, financial and accounting reform.
Brazil	CESP	$19,000,000	-	1967	Part of a larger electric energy project. The Telecommunications subproject provided a Microwave system for telemetering and operational and administrative telephone and teletype traffic required for the generation and transmission of electric energy in the State of Sao Paulo.
Brazil	TELEBAHIA	$26,800,000	$75,300,000	1969	Provided 20,000 additional telephone lines in the city of Salvador, and a total of 20,500 telephone lines in 48 communities in the interior of the State of Bahia, and a Microwave system providing long distance telephone service in 84 communities.
Central America	COMTELCA	$ 3,000,000	$14,500,000	1967	(Via the Central American Bank for Economic Integration). Sub-loans to each of the five Central American countries financed partially the Microwave and switching system which links the telephone networks of those countries and provides connections to Mexico, Panama and beyond.
Chile	ENTEL	$ 7,300,000	$15,100,000	1967	Financed the extension of the long distance telephone network by means of a Microwave system between Temuco, Puerto Montt and the Island of Chiloe in the South-Central part of Chile, as well as technical cooperation in financial and accounting reform.
Chile	ENTEL	$35,500,000	$67,300,000	1975	Financed the expansion of capacity of the existing Northern and Southern Microwave routes, the construction of new Microwave routes and of VHF and UHF feeder radio systems connecting to the Microwave routes. Also includes the establishment of a communication link between Santiago and Punta Arenas in the extreme southern portion of Chile by means of a satellite station in Punta Arenas and a second antenna at the existing satellite station near Santiago.
Colombia	TELECOM	$29,000,000	$54,800,000	1976	Financed the foreign exchange cost and a part of the local currency cost of the construction of public telephones in 2,200 rural communities. Service will be provided over wire lines, cables, multiple-access radio systems, VHF single-channel radio-systems and HF radio. This project represents the first half of a program to provide a single public telephone in each community of over 100 population.
Costa Rica	ICE	$12,200,000	$25,200,000	1977	Financed the cost of the construction of 56 telephone exchanges totalling 8,800 lines and 1,300 public telephones located in rural communities.
Ecuador	IETEL	$ 9,600,000	$17,600,000	1978	Financed the construction of 128 telephone exchanges totalling 12,000 lines and 254 public telephones located in rural communities.
Honduras	HONDUTEL	$14,700,000	$34,200,000	1975	Financed the expansion of the urban telephone cable networks in Tegucigalpa, San Pedro Sula and other cities. The complementary telephone switching equipment additions are being financed by the Export-Import Banks of the U.S. and Japan as well as by private banks.
Nicaragua	TELCOR	$ 2,500,000	$ 3,500,000	1967	(Via the Central American Bank for Economic Integration). Financed the construction of a Microwave system linking the telephone exchanges in the principal cities of Nicaragua.
Nicaragua	TELCOR	$ 1,600,000	-	1973	Financed the repair of earthquake damage.
Peru	ENTEL	$ 1,050,000	-	1970	Financed the repair of earthquake damage.
Uruguay	ANTEL	$28,400,000	$48,050,000	1975	Financed the construction of a Microwave system providing an integrated national long distance network, expansion of the urban telephone system in Montevideo, and ship-to-shore communications.

EVALUATION OF TELEPHONE PROJECTS IN LESS DEVELOPED COUNTRIES

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Introduction: Some Relevant Characteristics of Less Developed Countries

This paper addresses the problem of determining the appropriate size and composition of telecommunications investment programs in less developed countries (LDCs) with special reference to an objective of supplying telephone facilities in remote or economically deprived areas. For LDCs the general level of economic development is usually reflected in the magnitude of per capita income, and in most cases lower per capita income is associated with a skewed distribution of income, both within and between urban and rural areas.[2] The phenomena of low average income and a skewed income distribution suggest that the problems of providing telephone access to low-income groups - and specifically to low-income rural communities - are especially complex. Ability and/or willingness to pay for the full costs of service may not be demonstrated, and thus there is no simple test of project justification.

In many instances investment must be based primarily on unquantifiable economic or social objectives. One such objective, which is frequently observed in LDCs, is the goal of stemming rural-to-urban population movement. Whether or not the provision of telephones and other infrastructures in villages and small towns actually helps to stem such movements - or even whether to do so is desirable - are issues which will not be debated here, but it is certainly the case that many governments see the improvement of public services, including telecommunications, as legitimate means of assisting in the achievement of this goal.

Another characteristic of LDCs, particularly where there is a substantial subsistence sector, and where the industrial base is weak, is the ever present problem of raising funds for public sector purposes. The shadow value placed upon public funds in LDCs is often considerable, 3/ reflecting a central government administrative structure that is financially deprived, and unable to act as an effective instrument for carrying out a range of government objectives. In this regard, LDCs are caught in a vicious circle: the lack of a substantial tax base partly

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2 Shail Jain, Size Distribution of Income, a compilation of data, World Bank, Washington, D. C. 1975.

3 L. Squire and H. G. van der Tak, Economic Analysis of Projects, Baltimore and London, the Johns Hopkins University Press, 1975.

results in weak public institutions, including internal revenue authorities which are not equipped to propose and administer the necessarily complex tax structures. Hence, the large income transfers required to promote significant rural development programs are typically beyond the fiscal capacity of most LDCs.

In light of this, it appears that public enterprises such as telecommunications authorities, which can levy charges on beneficiaries, and which by means of their pricing and investment programs have the ability to influence the type and location of economic activity, have a potential role in the conduct of public policy that extends well beyond the financial and technical horizons which normally circumscribe telecommunications authorities. Indeed, the telecommunications sector may be the vehicle for the achievement of government policies which, because of inadequate government fiscal and administrative machinery, may not be achievable by other means.

Policy with regard to rural telecommunications is illustrative of this general principle, but in this regard two important points must be made. First, the need to distinguish between rural and urban areas is matched by the need to distinguish between higher-income business, government, and residential telephone subscribers on the one hand, and lower-income business and casual public telephone users on the other, irrespective of their location. Thus, with regard to providing access to service by means of public call offices, backward rural areas and low-income urban squatter settlements present similar economic and financial problems on the demand side, even though the technical facilities and costs of providing service may be very different. The second point is that the issues involved in providing telephone service in rural areas of developing countries cannot be dealt with in isolation from the rest of the sector. Policies adopted relating to the provision of rural telecommunications facilities have financial, technical, managerial, and economic implications for the rest of the sector, and for the national economy as a whole. This paper, therefore, focuses first on the broad investment and resource-allocation issues in the sector, outlining the implications of these issues for rural telecommunication policies.

The Telecommunications Investment Decision

Analysis of the trade-offs between the various qualitative and quantitative development objectives of an LDC, and the allocation of resources which follows, involves a peculiar set of problems as far as investment in telecommunications is concerned. When measured in terms of financial returns, investments in national telecommunications programs (although not necessarily the rural component) are usually an outstanding success. Thus, conservative estimates of the internal financial rate of return on the latest dozen telecommunications programs which were partly financed by the World Bank show a range of between 13 percent and 22 percent. Were economic efficiency the only criterion, such evidence would typically be sufficient to justify rapid expansion of the sector. However, numerous instances can be observed in which, despite such evidence, national planning authorities determine that needs elsewhere should command priority. Such decisions can often be explained by the view that telecommunications investments, while profitable in a financial sense, confer direct benefits only upon a relatively narrow - and privileged - sector of the community. Such opinions, however, are usually based upon intuition rather than upon substantive analysis, and in fact the poorer the country, the greater the relative importance of government and business telecommunications needs. Clearly, the ultimate incidence of the benefits of such government and business usage cannot be determined by casual observation.

Any precise scientific allocation of funds between competing sectors in LDCs is, of course, precluded by the difficulty of measuring the benefits which stem from alternative investments. With regard to the telecommunications sector the solution to the benefit measurement problem does not appear to lie in the aggregate international comparison of input-output tables, or in the analysis of relationships between GNP and telephone availability or usage, although statistical measure of such relationships may have a useful descriptive role.[1] Rather, it appears that there is no real alternative to a case-by-case microeconomic approach; in order to address the peculiar problems encountered by the telecommunications sector in achieving an

[1] See for example, Telecommunications Economic Studies, GAS 5 Manual, International Telecommunication Union, Geneva, 1976; Bebee, E. L. and E.J.W. Gilling, "Telecommunications and Development", Telecommunications Journal, Vol. 43, 1976, pp.537-543; and Dickenson, C.R., Telecommunications in Developing Countries: The Relation to the Economy and the Society, P.U. Report No. PUN 32, Energy, Water and Telecommunications Department, The World Bank, Washington, D. C. 1977

optimum rate and mix of expansion, the economic and social benefits of investments in the sector require more detailed country-specific analysis than is usually given to them.

Problems of Benefit Measurement

Estimation within countries of the economic benefits of investments in the telecommunications sector has relied primarily upon two approaches. The first of these, involving conventional econometric demand analysis, attempts to isolate the response of subscribers to actual changes or variations in the price of the service they obtain. The other approach attempts to impute the demand curve for telecommunications services by direct observation of how and for what purpose telecommunications are used and what expenditures are actually incurred. Both approaches are used in attempts to quantify the "consumer surplus" arising from telecommunications investments, this concept being roughly defined as the difference between the value of service as perceived by a telephone user and the lesser measurable amount which he actually pays.

Conventional demand analysis In view of the wealth of data on telephone prices and traffic, it is not suprising that numerous attempts have been made to apply standard econometric demand analysis to the problem of determining price elasticities,[2] and by inference, the consumer surplus implicit in various pricing schemes. Unfortunately, there are several reasons why such price-change or price-differential exercises tend to be unsuccessful. First, cross-sectional comparisons of price-consumption relationships can generally be ruled out on grounds of the nonhomogeneity of telephone calls and telephone users, since they are so location-specific. Time series analysis also has particular difficulties in an LDC context, and is usually rendered infeasible by (a) a history of unsatisfied demand which implies that telephone usage is dominated by service availability and quality considerations, and which often results in increases in price being accompanied by increases in telephone usage, since price increases often are introduced only after service quality has been improved; and (b) the presence of the large consumer surplus that is assumed to result from providing access to service to a person or community for the first time. These shortcomings are, of course,

2 See for example, Dobell, A.R. et al., "Telephone Communications in Canada: Demand, Production, and Investment Decisions", The Bell Journal of Economics and Management Science, Spring 1972.

compounded by the general difficulties associated with making predictions from historical evidence, and by the fact that it is usually only feasible to attempt to estimate short-term elasticities. Long-term price elasticity is a more useful concept, but attempts at measurement are invariably swamped statistically by a large number of collinear variables.

Direct benefit measurement Attempts have also been made to impute the demand curve for telephone service by estimation of the various forms of other expenditures which are associated with inadequate telecommunications facilities. Among these are the examination of cost savings when compared with alternative means of communication, the commercial losses resulting from inadequate communications facilities, the black market or other private market indicators of willingness to pay, and so on.[1] In general it can be said that while such exercises may or may not be statistically valid for the particular comparisons which are being made, it is rare that this kind of information does much more than reinforce one's intuition that in LDCs there is indeed signficant consumer surplus associated with the provision of telecommunications facilities. For example, the difference in the quality of service supplied by telecommunications as compared with alternative means of communication is usually so great that the value of generated traffic dominates the benefit calculation; cost saving therefore becomes a somewhat irrelevant concept. Studies showing the commercial benefits accruing to particular sectors of the economy, such as the benefits to tourism because hotel and airline bookings can be confirmed, are likely to be so sector-specific that economy and regionwide generalizations cannot be made. The same applies to the analysis of black market or private market indicators of willingness to pay; in addition, given the nature of such transactions, reliable data are hard to obtain.

Some Examples of Benefit Estimation

Some of the difficulties encountered in benefit identification and measurement are illustrated below in the context of efforts that have recently been made in three different developing

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[1] See for example, Goddard, J.B. and R. Pye, "Telecommunications and Office Location", Regional Studies, 1977; Howe, J.D.G.F., "Valuing Time Savings in Developing Countries", Journal of Transport Economics and Policy, May 1976; and Wellenius, Björn, "Hidden Residential Telephone Connections Demand in the Presence of Severe Supply Shortages", IEEE Transactions on Communications Technology, June 1969.

countries.[1] The first example relates to a rural public call office program in a Latin American country. In this example, both conventional demand analysis (i.e., a price-change approach) and direct benefit estimation of alternative expenditures were used. The second example is from a Middle Eastern country where another variant of the alternative expenditure approach was tried. The third example is in a different Latin American country where a modification of the price-change approach is illustrated.

<u>Rural public call office (PCO) program</u> Estimates of the consumer surplus resulting from calls made from rural PCOs in a Latin American country were found to vary widely depending on the estimation technique used and on the assumptions adopted. Estimates derived from a price-change approach (i.e., using conventional demand analysis) were based on measures of the short-run price elasticity of demand for rural PCO telephone elasticity estimate was based on observed changes in the quantity of calls attempted in a number of rural villages before and after a 25 percent tariff increase, and was found to be in the neighbourhood of -0.5, i.e, a village which generated an average of 100 call impulses per day prior to the 25 percent increase in price, would generate approximately 87.5 pulses per day for the several months immediately following the price increase. Hence, before the price increase telephone users[2] would have been willing to pay a price of at least 15 cents for each of the first 87 pulses, but in fact, were being asked to pay a price of only 12 cents at that time. As a result, they had incurred a consumer surplus of at least 262.5 cents (3 x 87.5).

Given this, it can be concluded that the benefits which telephone users in the village derived each day from using the telephone were at least equal to (a) their revealed willingness to pay the market price (12 cents per pulse x 100 pulses - 1,200 cents), and (b) the consumer surplus of 262.5 cents which they received on the first 87 impulses. Hence, this price-change estimate of consumer surplus increases the measurable amount of rural telephone benefits by almost 22 percent. This is a conservative estimate for two reasons: (a) there is no reason to believe that total consumer surplus is captured for the first 87 impulses, and (b) there is no quantification of consumer surplus for calls between

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1 Although for purposes of confidentiality the countries must remain unnamed, the circumstances described and the data presented are thought to be factual.

2 Cents are used for illustrative purposes only, and do not represent the actual unit of local currency.

87.5 and 100 impulses. Furthermore, since the price elasticity for only a small segment of the demand curve is estimated, no allowance is made for the fact that the demand curve probably becomes more inelastic the fewer the number of calls which are made.

The second approach used to examine consumer surplus for rural PCO usage was based upon the notion that people who live close to a PCO and make more use of it than those living further away obtain a consumer surplus for at least some portion of their calls. An estimate was made by analyzing the expenditures in terms of both time and transport that all telephone users incurred in traveling to a telephone, and then comparing the distribution of costs with the distribution of calls.

Unfortunately, it was found that, even concentrating efforts on one small group of rural villages, the assumptions which had to be made were so arbitrary that there could be little confidence in the results of the analysis. Given data limitations no adequate means was found to control for the different employment, income and social characteristics of those living within and outside the villages; almost by definition there is a systematic bias built into the analysis. Further, there are uncertainties in determining the value of time required to journey to make a phone call, and in sorting out the multiple purposes of some of the trips during which a call was made.

Table 1 summarizes the results of the consumer surplus exercises which were carried out for one of the villages. Two estimates for the direct benefit-expenditure approach are presented and are based on two different sets of assumptions, which are noted in the table. The estimates of consumer surplus are seen to be highly sensitive to the assumptions made, and as a result there is little reason to have confidence in the overall accuracy of the outcome. The implication is that if the results of this kind of exercise, which analyzes in depth small, reasonably homogenous communities, are unreliable, such an approach used to evaluate a regional or national telecommunications program serving a vast array of different industrial, commercial, government and residential users, is even less likely to succeed.

A Middle Eastern country An exercise carried out for a national telecommunications project in a Middle Eastern country made use of a variant of the expenditure approach, although this time unrelated to travel costs. This exercise was based on the fact that some telephone subscribers were incurring higher costs for telephone service than were revealed in official telephone tariff schedules. These additional costs were of two types corresponding both to call charges and monthly rentals.

Official call charges underestimated the actual costs of making calls since, given a high percentage of call failures and interruptions, peak period delays while waiting for dial tones, and the necessity to repeat sentences because of noise on the line, the otherwise productive time of employed persons was wasted when attempting to make a telephone call. An estimate of the value of that wasted time was made using the following assumptions. (a) The average working urban caller earned a wage equal to an estimated $6.00 per week in 1976,[1] and assuming he works an average of 45 hours per week, his time is worth approximately $0.00222 per working minute. (b) The average time spent during business hours waiting for a dial tone and trying to make a call which, for technical or traffic congestion reasons is unsuccessful, (or for recalling when the connection terminates in mid conversation) is at least 1.5 minutes per unsuccessful call attempt. (c) Ninety-five percent of all calls made during business hours are business or government related.

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1 Based on available information this was considered to be a conservative estimate. The currency units are expressed in $'s for presentational purposes only.

Table 1: THREE ALTERNATIVE ESTIMATES OF RURAL TELEPHONE CONSUMER SURPLUS FOR A VILLAGE IN A LATIN AMERICAN COUNTRY

	Expenditure Method High Estimate (Currency)	Expenditure Method Low Estimate (Currency)[d]	Price-Change Method Estimate
1) Average call charge	4.41	4.41	-
2) Average transportation cost per call[a]	19.02	2.54	-
3) Average travel time in hours	.59	.59	-
4) Average monthly income of caller	422.90	422.90	-
5) Average number of hours worked during a week	39.31	39.31	-
6) Opportunity cost of time[b]	1.51	.38	-
7) Consumer surplus per call[c]	20.53	2.92	-
8) Ratio of consumer surplus per call to average call charge	4.65	.66	.22

a) Of the 404 calls used to tabulate the information in this table, only 54 of the callers were able to offer information on transportation costs. It was therefore assumed that for the high estimate, transportation costs for the missing observations are equal to the average of those responding, and for the low estimate it was assumed that the nonrespondents incurred zero transportation cost.

b) For the high estimate it was assumed that the value of time for all callers was equal to the average income for that time in the village, i.e.,

$$(6) = (3) \times (4) / (5) \times 4.2 .$$

For the low estimate it was assumed that many of the calls were made during periods when real resource costs in terms of time were minimal and therefore the low estimate was arbitrarily set equal to one-fourth of the high estimate.

c/ (7) = (2) + (6)

d/ Units of local currency.

Given these assumptions, which were thought to reasonably reflect the situation in the country, and the facts that (a) unsuccessful calls due to technical faults or traffic congestion during prime business hours were estimated to be approximately 75 percent of all local call attempts made in the capital city and 55 percent in the second largest city; (b) that approximately 1,820,000 and 560,000 calls are completed respectively in the two cities during the six peak hours per working day when networks are highly congested; and (c) that an unsuccessful call attempt rate during peak business hours of 25 percent would be considered good; an estimate was made of the value of time wasted through unsuccessful local call attempts in the two cities. Reliable estimates were not available for the proportion of unsuccessful calls in other cities, or for the long distance network, so no attempt was made to quantify the total national consumer willingness to incur the costs of time wasted trying to make telephone calls.

A second attempt to estimate a portion of consumer surplus reflected the fact that some telephone consumers in the country also revealed a willingness to incur a telephone-related cost greater than that reflected in the official telephone tariff schedule by paying higher monthly rental charges, or incurring higher costs each month just to have a telephone. Local businessmen and middle- and upper-income foreigners sometimes obtained telephones by renting furnished offices or residences in which, legally, the telephone could be transferred as one of the furnishings. It was common in local newspapers to see apartment or office advertisements in which one of the few prominent attributes listed was the presence of a telephone.

Estimates of the extent of the monthly rent differentials for representative offices and apartments which were identical except for the existence of a telephone showed a range of between \$50 and \$150 per month. These estimates were somewhat imprecise due partly to the variety of other factors involved in finding identical facilities, and partly due to sampling problems. It was also found that rental facilities which had a telephone that was only one of several extensions on one line, or rental facilities located in areas with very high daytime telephone traffic congestion tended to command less of a premium than facilities with private or semi-private lines, or in exchange areas where congestion is less of a problem. It was further observed that the larger and more luxurious apartments or business offices tended to command the largest telephone rental premiums since presumably higher-income businessmen and larger business firms with their more complex communication problems tend to categorize a telephone as more of a necessity. Given these findings, an estimate of consumer surplus for the monthly rental of a telephone was made using the following assumptions:

a) the demand curve for telephone rentals is downward sloping and is shaped in such a way that a relatively small proportion of the total population is effectively willing to pay high monthly rentals for telephone service ($50), while the majority of population would be effectively willing to pay only much lower telephone rental charges; as such the demand curve is represented as being convex to the origin of the price and quantity axis; mathematically, the demand curve was specified as a rectangular hyperbola with an elasticity of minus one which is thought to be a conservative estimate;

b) two points on that demand curve are - 4,000 telephones (less than one percent of total connections) at a price of $51.50 per month (the official rental fee for automatic message rate exchanges of $1.50 per month plus $50 representing a typical rent differential payment)[1] and 745,000 telephones (the approximate number of telephones at the end of 1976 plus the number of people on the official waiting list requesting to be allowed to pay at least $1.50 per month for the presence of a telephone) at the most common official rental price of $1.50 per month.

Computing the area under the demand curve above a monthly price of $1.50 and below a monthly price of $51.50 and between the quantities zero and 745,000 telephones, and dividing by total telephones, gives an average of $4.21 per telephone per month, or $50.52 per telephone per year. Hence, for purposes of benefit estimation, the value of renting a telephone may be taken to be an average of $50.52 per year more than the average rental actually paid to the telephone company.[2]

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1 The $50 per month rent differential was considered to be reasonably representative for modest one-or two-bedroom second- or third-floor walk-up apartments or offices with three-party lines occupied by visiting or expatriate businessmen and upper-middle income local businessmen.

2 If the demand curve for telephone rentals was assumed to be linear instead of convex to the origin, the consumer surplus per telephone would be $25.13 per month or $301.56 per year.

Given the above estimate of (a) part of the costs incurred in making a telephone call which consumers willingly pay (offical call charge plus time wasted), and (b) the yearly value of having a telephone connection (average monthly telephone rental charge plus estimate of rent differential consumer surplus) based on the observed willingness of consumers to pay, a new stream of project benefits was estimated. Using this revised benefits stream and the stream of project costs appropriately shadow priced, the economic rate of return on the project was estimated to be a minimum of 23 percent as compared with the initial internal financial rate of return on the project of 10 percent. 3/

<u>A Latin American country</u> The third consumer surplus exercise demonstrates a variant of the price-change approach. In this case real telephone tariffs have fallen through time. In the Latin American country involved, there were long waiting lists of potential telephone subscribers, and because telephone tariffs remained unchanged during a period of general price inflation, consumers had in the recent past been asked to pay considerably higher prices in real terms for telecommunications services, and had demonstrated a willingness to do so. Thus, a partial estimate of consumer surplus could be made by tabulating the prices in real terms which existing consumers had actually demonstrated a willingness to pay at the time in the past when they acquired telephone service, and by assuming that in this constrained supply situation new consumers will be similar to the average existing consumer. Since the rate of increase in the national telecommunications investment program roughly corresponded to the increase in per capita GNP, the assumption that new telephone subscribers will have similar characteristics to existing ones was considered to be acceptable.

In this country, with one minor exception, telecommunications tariffs had not changed since 1964. Over the 1964-77 period, however, domestic consumer price inflation of approximately 80 percent had taken place. As a result, those subscribers who were connected in 1964 had demonstrated in real terms that they were willing to pay at least 80 percent more for a lower quality and more limited access telephone service than current subscribers were being asked to pay. To estimate the prices in real terms

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3 Ten percent was the initial rate of return on the project at the time of appraisal. However, before the new investment program was commenced, substantial tariff increases were implemented.

which all existing telephone subscribers had demonstrated a willingness to pay during the period between 1964 and 1977, the average price paid in real terms, and the quantity of services supplied was taken to represent a point on the telecommunications supply curve at the end of each year. As such it reflected a point somewhat below the demand curves which existed in the past since even at the higher historic real tariff levels, excess demand (waiting lists and traffic congestion) existed at each past point in time. Given the historic real price-quantity tabulations, a weighted average price which was paid by present consumers at the point in time when they joined the network was calculated. Given the assumptions that new subscribers also would be willing to pay (in terms of 1977 prices) what present subscribers have in the past on average demonstrated a willingness to pay, the quantifiable rate of return on the program was 36 percent. In contrast, the initial internal financial rate of return in the absence of the consumer surplus exercise was estimated at 16 percent. It should be noted that these estimates do not explicitly take into account the fact that newer subscribers receive a better quality of service (less traffic congestion and noise) and an improved quantity of service (a much larger number of connected subscribers who can be contacted by telephone) than did existing subscribers when they joined the network.

Necessary Supplemental Analysis

The foregoing examples illustrate some of the approaches and the accompanying difficulties of evaluating a portion of the economic benefits of telecommunications programs as perceived by the beneficiaries. Even if we could accurately estimate such benefits, however, this would only solve part of the problem, for particularly in LDCs the willingness to pay of individual subscribers may not be indicative of the true economic benefits to society that may result. For example, the introduction of a PCO in an area in which there is a large rural unemployment may facilitate improved marketing by several farmers; this in turn may lead to increased employment, and a local multiplier effect that creates net benefits far in excess of the value of service as perceived by the few telephone users. Analysis of such effects is extremely complex: even in areas in which one would suppose the impact of investments would be more dramatic, such as rural electrification, we know of no case in which multiplier effects have been successfully quantified.[1]

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1 For an in depth analysis of a particular case see, Dennis Anderson, Costs and Benefits of Rural Electrification - A Case Study in El Salvador, RES 5, Energy, Water and Telecommunications Department, The World Bank, February 1975.

Another problem, of course, is that many of the goals of telecommunications programs are not subject to quantification in economic or monetary terms. In instances such as these, it is necessary to supplement the financial and economic analysis by collecting qualitative or descriptive information about telephone users and telephone usage. Such information can be used to verify if the project is reaching the high-priority target groups and if the investment is being used for government program-specific purposes such as promoting regional health clinics; facilitating the provision of basic needs by water supply and nutrition agencies; assisting emergency and security programs; helping to foster national unity; etc. Several countries have begun to undertake surveys designed to provide such information and the results in many cases are surprisingly similar. For example, Table 2 shows highly summarized results of three surveys taken in countries which are thousands of miles distant from one another.

Table 2: REASONS FOR PCO TELEPHONE USAGE

	Calls at Village or Small Town Public Call Office			Subscriber Application for Telephone
Purpose of Call	South Asian Country[a] (percent) (1)	Latin American Country (percent) (2)	Country in Melanesia (percent) (3)	Country in Melanesia[b] (percent) (4)
Emergency, health	5[c]	6	5[c]	22
Business, agriculture, public service	72.5	36	20	42
Maintain contact with relatives or friends	22.5	58	75	36
	100	100	100	100

a Data for the South Asian Country are for the most recent call made by users of the PCO. The towns in which the sample PCOs in this country were located generally had a population of over 5,000 and are therefore considerably larger than the PCO towns and villages in the other two countries for which data are presented.

b Data are only for the 82 percent of the sample group which responded to the survey.

c Emergencies only.

The first three columns show the reasons for calls made at public call offices. In all instances emergency or health-related calls were a surprisingly high five to six percent. The relatively high usage of PCOs for business and public service purposes in the South Asian country is probably due to the fact that the sample towns there were quite large, usually exceeding 5,000 in population, and as such these towns presumably had a relatively large group of commercial and government administrative interests which, of course, had no access to subscriber telephones. A comparison of columns 3 and 4 is also illuminating. In the Melanesian country, while only five percent of PCO calls were for emergency reasons, 22 percent of those survey respondents registering on telephone subscriber waiting lists stated that the reason they wanted a telephone was so that they could make emergency calls. A reasonable interpretation of this is that the consumer surplus (or value) associated with emergency, and to a lesser extent, business calls, is much higher than that associated with calls to relatives or friends even though in the Melanesian and Latin American countries, calls to relatives and friends are the ones most frequently made.

The Feedback to Pricing Policy

A characteristic of telecommunications facilities in LDCs is a massive backlog in unsatisfied demand reflected in large waiting lists for service and extensive business hour traffic congestion. In contrast, in most developed countries telecommunications services are supplied within a reasonably short time to anyone who is willing to pay some publicly regulated average of the financial costs of connection and calls. In the developed-country case, the problems of achieving an efficient telecommunications pricing and investment policy are well known. Hence, the application of marginal cost pricing, which works reasonably well for other utilities such as electric power or water supply, is rather complicated for telephone systems. Two major problems are the financial losses which in many cases would result from setting price equal to marginal system cost, and the presence of external benefits arising either from connections to a network or from actual calls, which implies that marginal social cost (the theoretical basis for pricing) is unknown, but, if it were, would probably point to a price somewhat less than marginal system cost.

Fortunately, in developed countries where the supply of telecommunications services roughly equals demand, it is possible to reconcile theory with practice in that a two-part tariff can be devised which is a reasonable compromise between financial and economic efficiency objectives; one possibility being a fixed monthly charge that does not vary with telephone usage plus a charge per call equal to marginal system cost. To some extent the externality problem is reduced by virtue of the fact that other forms of communication have similar characteristics, e.g., the recipient of letters does not pay; face-to-face communication is usually at the expense of the traveler, and so on. Hence, a "second best" theory suggests that in determining optimal pricing of telecommunications services the externality issue is less dominant than generally believed; marginal system cost is therefore a reasonable compromise for pricing.[1]

In developing countries the presence of daytime traffic congestion and waiting lists suggest that the marginal <u>opportunity</u> cost (in terms of frustrating the demands of others) of making calls or being connected to the network is in excess of the marginal <u>system</u> cost of so doing. In such an instance, where at existing prices, demand for service exceeds the available supply, the choice lies between rationing by price, by some conscious administrative device, or simply by default. In most LDCs, existing administrative forms of rationing, such as attribution of priority to certain selected groups, tend to be arbitrary and cumbersome, and they invite management irregularities. Even such an apparently non-discriminatory form of rationing as queuing, or meeting demands in order of application, usually is too rigid to allow an economy with any degree of dynamism to function efficiently. On the other hand, the use of price to help allocate the limited supply of telecommunications services has the critical advantage of leaving the decision as to the importance of telecommunications service relative to other goods and services in the hands of the

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1 For a further discussion of these issues and for an example of the estimation of marginal system costs, see Saunders, Robert J. and Jeremy J. Warford, "Telecommunications Pricing and Investment in Developing Countries", <u>Proceedings of the International Tele-Communications Exposition (INTELCOM 77)</u>, Vol. 1, Horizon House International, October 1977, and Munasinghe, Mohan, Robert J. Saunders and Jeremy J. Warford, "The Cost Structure of Telecommunications Services and Pricing Policy in Developing Countries", <u>Communications 78, Proceedings of a Conference on Communications Equipment and Systems</u>, Conference Publication No. 162, The Institution of Electrical Engineers, London, April 1978.

beneficiaries themselves, and it helps encourage highly valued uses of telecommunications to replace those that are relatively less valuable to beneficiaries.

The externality problem also seems to be less important in the developing-country context. With certain exceptions, it seems to be a reasonable assumption that for most uses of telephones, there is a close direct correlation between the value placed upon subscriber connection to a network by an individual or firm and the magnitude of the external benefits that result, so that a market clearing pricing policy for connection and rental allocates priorities fairly efficiently. Further, since in the short term there are many instances where excess demand exists, there seems to be no feasible alternative to price rationing (including peak period call charge pricing) in attempting to deal with daytime traffic congestion. Finally, in many developing countries where the shadow value of public sector funds is greater than one, an additional advantage of raising price to ration demand for telephone services is that it mobilizes financial resources which can either be used for expansion of the telephone system in both rural and urban areas or, should such expansion still be artificially limited through government policy, the revenue can be utilized for general government purposes.

Clearly, however, just as benefit analysis should in principle go beyond the concept of value of service as perceived by the subscriber, price rationing is not a panacea. Hence, there are a number of cases in which exceptions to the high entry fee or monthly rental may be required; education, health, police, and other emergency services could be favoured with lower connection fees and rentals, and possibly on income distributional or regional development grounds, higher system connection fees and rentals might be set for the larger cities than for smaller towns and rural communities. Subsidization of public call offices, wherever they are located, might also be justified. This, of course, is currently done in several countries which have instituted significant subscriber connection fee requirements.

Implications for Project Evaluation

Analysis of pricing policy for telecommunications in LDCs should be conducted in a very different way from the traditional public utility approach employed in a developed country. Generally, there are four levels or stages of tariff policy analysis.

1) The financial approach, some variant of which is typically used in developed countries, in which the objective is to assure the financial viability of the utility with as little political trouble as possible. It implies, inter alia, charging prices significantly higher than costs to allegedly higher value uses such as business and long distance calls.

2) A slightly broader approach, which is not inconsistent with the above, which uses utility financial viability as a constraint, but in the interest of economic efficiency seeks where possible to equate prices with marginal system cost. This is probably sufficient for most purposes in a developed country context.

3) A still broader approach, which applies where there is unsatisfied demand. The financial viability of the telecommunications entity remains a constraint, but price is equated to a rough market clearing price estimate of marginal social cost, e.g., reflecting congestion costs in call charges and excess demand for connections.

4) The fourth approach, which specifically analyzes the scope for divergence between price and identifiable marginal social cost in order to achieve a number of national development objectives, or to be consistent with a number of publicly ordained constraints.

While stage four is obviously the one which is the key to realizing the full potential of telecommunications investment in LDCs for achieving broader government goals such as rural or regional development, telephone pricing and investment policies and national government investment policies are rarely analyzed together. Those concerned with rural or regional development or agricultural extension issues generally focus on a cost-benefit approach in which somewhat arbitrary estimates (both qualitative and quantitative) of expected benefits are derived. In turn telecommunications pricing and investment policy is largely dictated by traditional utility financial criteria.

In practice a broader approach is needed. As a minimum in developing countries, national decision makers should attempt to be aware of the economic costs of all feasible alternative courses of action. For telecommunications, this implies the use of shadow values in costing increments to systems and attempting to estimate the economic and social costs of congestion, unsatisfied demand, and inadequate penetration into rural or provincial areas. These costs should then be weighed against the perceived economic and social benefits which a feasible investment program would be expected to generate. Such benefits should include the shadow-priced value of public sector funds which might be generated by using telecommunications tariffs to ration limited capacity.

The most useful evidence that the decision maker will usually have at his disposal will be observations of subscriber willingness to pay, supplemented by qualitative information about subscriber and PCO user characteristics and system usage. Systematic generation of this type of data is clearly required. The first step is on the pricing side where efforts should be made to derive a tariff structure reflecting economic and social costs which will force subscribers to make their preferences known. At the same time, telecommunications authorities should endeavour to learn more about the nature of telecommunications usage, the characteristics and communications needs of existing and potential users, and the specific government objectives and programs which telecommunications can most efficiently serve.

It is our view that the result of a stage four type of analysis in those developing countries in which there are large telephone waiting lists and system traffic congestion during daytime business hours will be to point to a pricing and investment strategy which includes relatively high connection fees and monthly rentals[1] for urban area subscribers, and accompanying high busy hour call charges. The resulting increase in revenue could assist in financing increased expansion of subscriber telephones in urban areas, and help finance a significant "public access" program designed to provide public call offices in urban slums, unserved towns, and remote provincial villages. Additionally,

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1 Ideally, monthly rentals should be the primary means for attempting to allocate telephones to high value users since rentals can influence existing subscribers as well as new ones. Politically, however, it is usually much easier to increase access charges to those who are demanding connections, than rental charges to those who already have service.

if government priorities dictate, some of the surplus revenue might be made available to government for general expenditure purposes. Of course it is of major importance that the departure from a strict market test which this strategy suggests should be justified by extensive supplementary qualitative analysis.

METHODOLOGICAL ISSUES INVOLVED IN ASSESSING THE ECONOMIC IMPACT OF TELECOMMUNICATIONS WITH SPECIAL REFERENCE TO ISOLATED AND UNDERPRIVILEGED AREAS

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This paper is based in large part on a recent study undertaken for the Department of Communications, Ottawa, Canada by B. Lesser and L. Osberg entitled, The Importance of Telecommunications to Regional Economic Development (Halifax: Government Studies Programme, Dalhousie University, 1978)

The purpose of this paper is to examine various methodological issues involved in assessing the importance of telecommunications to economic development, especially in remote and underprivileged areas. The paper proceeds by first examining various characteristics of telecommunications and its potential role in development with the purpose of establishing the general methodological framework which it is recommended must be set up in order for study of the question to take place. Following this there is a discussion of some specific methods of testing.

Introduction

There is a growing, albeit still small, literature which examines the role of telecommunications in economic development. Most of this literature maintains that telecommunications is an important component of a country's infrastructure and plays a major role in assisting the growth and development of an economy. Authors have pointed to the high positive correlation between gross domestic product/capita and telephone density (measured by telephones per 100 population) and argued that because high standards of living are accompanied by high levels of accessibility to a telecommunications network, investment in telecommunications offers a means for countries with a below average standard of living to achieve faster rates of growth and development. This same argument can be, and has been, applied to regions or areas within countries as well as to countries as a whole. Thus there are arguments made that telecommunications may assist in the growth of rural areas versus urban areas or that it may assist in the growth of more broadly defined regions of a country which have a standard of living below the national average. In this paper, when discussion takes place concerning remote or underprivileged areas, except when otherwise noted, the phrase will be assumed to encompass all of the above situations i.e., the case of developing nations taken as single entities, the case of major regions within a country, either a developing nation or a developed nation, or sub-areas within major regions such as rural areas.

There are three comments to make on the prevailing view of telecommunications in the development process:

1) Conceptually, the argument has a great deal of appeal. Economic disparities, whether they exist between nations, or between parts of a given nation, are essentially a problem arising from the spatial distribution of economic activity. As such telecommunications offers itself as a potential means of reducing economic disparities by providing a vehicle for overcoming the disadvantages posed by distance and for linking remote or underprivileged regions to more developed, central regions;

2) There is virtually no hard empirical evidence available on how substantive is the impact of telecommunications on economic development, i.e., the magnitude of the benefits derived from telecommunications is still virtually unknown; and

3) There is an obvious need to establish some strong empirical evidence on the impact of telecommunications not only in a general sense to lend understanding to our knowledge of the growth process but more pragmatically, from a policy point of view, because planners and governments must make decisions on how much and what kind of telecommunications system to provide. Especially for developing countries, the high capital-intensiveness of telecommunications makes telecommunications investment costly in a total resource sense and, given the import-intensity of telecommunications equipment, for the developing nation the cost becomes even more crucial because of foreign exchange constraints. Nor is this question of the impact of telecommunications much less pressing for developed nations who might seek to use telecommunications to redress regional economic disparities.

There is, thus, reason to believe that telecommunications may be important to growth, strong reason for wanting to know if such belief is well-founded and virtually no presently available evidence to provide any answers. There is clearly a need for major work to be done on measuring the impact or role of telecommunications in economic development. It is the purpose of this paper to discuss some of the methodological issues to be confronted in such an undertaking.

On Establishing a General Framework

One of the first issues that must be addressed is precisely what it is that is to be measured in undertaking an assessment of the impact of telecommunications on economic development. There are two categories of benefits which may be derived from telecommunications:

1) the direct benefits representing the direct impact on gross national product or gross regional product from expenditures on telecommunications and;

2) the indirect benefits representing the incremental effect on the efficiency or profitability produced by telecommunications for the users of telecommunications, incremental being defined relative to the efficiency or profitability position of users operating without telecommunications.

The direct benefits, I would suggest, are essentially irrelevant unless the expenditure or employment multipliers attached to telecommunications spending differ from those attached to other types of spending. Otherwise it is the indirect benefits which must be the basis for attaching special significance and priority to telecommunications investment. Thus to measure the benefits of telecommunications to economic development means measuring the impact produced on the users of telecommunications in terms of their improved efficiency and/or profitability and the implications of that for the spatial organization of economic activity.

A second issue I would like to say something about has to do with certain characteristics of telecommunications.

First is the fact that telecommunications exhibits what economists call externalities. Externalities are benefits or costs which are captured by, or imposed on, a party other than the immediate producers or consumers of a good or service. In the case of telecommunications, these externalities represent benefits which accrue to persons or economic units other than the immediate subscribers and take one of two forms. First, the potential calling capability of every user is enhanced when new users are added to the system just as the value of the system is enhanced for any new user - the greater is the size of the existing system when he joins. Second, the two way nature of telecommunications means that benefits are derived not only by persons making calls but also by persons receiving calls.

The presence of such externalities in the telecommunications system means that between two countries or two regions of a country, investment in telecommunications plant in one may confer significant benefit on the other.

Thus if we have two regions or two countries, A and B, and we link them with a telecommunications network, and if now, the telecommunications system in A, the relatively underprivileged area, is expanded and upgraded over its previous level, the effect that this produces may be to enhance B's ability to penetrate A's market to a greater extent than previously. If we are measuring benefits in terms of increased production, then the benefits may show up primarily in B, the relatively prosperous region. The effect which we might easily find is that telecommunications acts to reinforce that traditional framework of spatial organization rather than to act against it.

The presence of these externalities also brings out another problem, namely, that a simple estimation of the demand for telecommunications cannot be taken as a proxy for benefits. In other words assuming that we could estimate a demand schedule, which in itself may be exceptionally difficult especially for developing nations where there are major supply constraints, we would not be able to use that demand schedule to generate measures of consumer surplus which could then be used as a proxy for benefits, so long as there are these externalities. Externalities, by definition, are effects not captured by the price system and hence would not be reflected in the demand schedule.

This problem of externalities also makes difficult the job of assessing the benefits of investment in telecommunications in a given region. As noted above, new investment in one region may in fact confer benefits on another region. By the same token, the total benefits derived from telecommunications in one region may not come entirely from the plant investment in that region.

A second characteristic of telecommunications to emphasize is that telecommunications is a highly heterogeneous good, there being differences in types of users, types of use, and types of system hardware.

There are various functions or uses which telecommunications performs which broadly defined may be classified as social, security, and business functions. The business function of telecommunications is likely to be the most important of these for growth purposes since this represents what may be termed "the productive sector". The other users may not be irrelevant, however, since these classifications are not mutually exclusive categories, particularly when looked at by type of user. Residential subscribers, for example, utilize telecommunications most in its social function but a residential market may also be extremely important to various types of business use. To take another example, the availability of the social function might influence the ability of business to attract labour to a particular region or area. And so on.

Telecommunications is also differentiable by type of information flow transmitted. The type of information conveyed may be voice, data, facsimile, or video, although the latter is not in general use in any country at the moment. Each of these types of information may confer different benefits and it could be important to distinguish between them in attempting a measurement of benefits. Beyond this, however, this breakdown has implications for system hardware or rather, for the technology embodied in system hardware. For example, step exchanges cannot be used for data transmission because there is too much extraneous noise introduced into the signal. If video is a possibility, then a broadband transmission network is required.

Because telecommunications is not a homogeneous good, in measuring the benefits of telecommunications there is a need to differentiate the benefits gained by different types of users, to differentiate the benefits generated by the type of information flow being sent, and to incorporate an understanding of the system technology into these assessments.

A third issue to consider concerns the causative role of telecommunications in economic growth. Potentially telecommunications may play an important role in economic development without playing a causal role. In other words, the role which is played may be merely an accommodating one. If the latter is the case, then the role of the planner is twofold: first, he must satisfy himself as to the priority to attach to telecommunications investment versus other projects competing for a country's scarce resources and second, he must estimate demand and then set about filling it, doing so on some priority basis if the total resource commitment made does not allow for all demand to be satisfied. These tasks are, of course, not simple ones, and would require a great deal of empirical investigation. The problem would be different however, if telecommunications is presumed to have a causal role. In this case, to generate the maximum development impact of telecommunications could imply the provisioning of plant in advance of demand. Such a decision would increase the opportunity cost of telecommunications investment considerably, especially for developing countries. Hence it is a proposition which requires careful analysis if it is to be approached. Not only does it mean that more care and precision be taken with the estimation of expected benefits but also it requires a far more detailed understanding of the linkages exhibited between telecommunications and other sectors of the economy. For example, we are prone to think of telecommunications as a substitute for travel, i.e. transportation. And clearly, in many instances, it will be. Equally plausible, however, is the argument that telecommunications is complementary to transportation. For instance, one can use telecommunications to order goods but one still needs a transportation network to ship them. This notion of complementarity between telecommunications and other infrastructure components (the same argument made for transportation might also be made for education or health care delivery) may in turn mean that the economic development benefits of telecommunications are to be mainly realized only in combination with other infrastructure components. A corollary hypothesis might be that there is some minimum threshold level of each such infrastructure element which must be realized before the benefits of any one element can be fully maximized and that to expand one element, say transportation, beyond its threshold while leaving some other, say telecommunications, below its threshhold, will produce a minimal, or zero, impact on growth.

One of the difficulties with trying to assess whether or not the role of telecommunications in the growth process is a causal or accommodating one is that there is no readily available data to use for direct testing. The work that has been done on the relationship between telephone density and GDP/capita tells us nothing about the direction of causality. The experience of developed nations, at least in North America, is that service is provided on demand. Thus we do not get a situation where supply is provisioned sufficiently ahead of time to allow for any testing of the causative role of telecommunications in such a case. Developing nations almost universally suffer from chronic supply constraints where even expressed demand (not to mention suppressed demand) may go unsatisfied for relatively long periods.

Finally, in addition to the question of plant investment, the other areas to consider in terms of setting up an overall methodological framework to study the impact of telecommunications are the price that is charged, attitudes toward the use of, and/or awareness of the usefulness of telecommunications, and the ability to innovate in making use of the system in ways especially designed for specific industries.

The amount charged for telecommunications is going to influence the demand for telecommunications both in terms of the number of subscribers and the intensity of use per subscriber. To price telecommunications on the basis of relative marginal cost which would be the traditional prescription of economics is to ignore the externalities noted above. To price so as to fully recover all costs for certain groups of users may mean, potentially, foregoing many of the indirect benefits of telecommunications, because such a scheme could raise prices so high as to inhibit demand. In other words, some degree of price subsidization may be called for. The question is, "how much if any?". The answer to this can only be provided by knowing the elasticity of substitution between telecommunications and other information-transfer modes, such as mail or face-to-face meetings. Knowing the elasticity of substitution will tell us not only which areas might potentially realize the greatest benefits from increased telecommunications use but also would permit a determination of the price for telecommunications which would make such substitution cost-effective for business. Knowing this price would in turn allow for a determination of the amount of required subsidy, if any.

The question of attitudes and awareness may also be important in considering the impact of telecommunications. It is possible that one could find a country with as much plant investment as might be required for years to come and a price that made the use of telecommunications cost-effective wherever possible but where either businesses did not want to fully use the system or did not know what uses they might make of the system. The fact that most businesses still do not recognize information flows as a factor of production ccomparable to labour and capital, the fact that businesses still tend to agglomerate in urban centres even though telecommunications technology has now removed this necessity for substantial parts of the firm, and the rapid advances in telecommunications technology of recent years which have created new options for use but which may also have left many businesses unaware of what the telecommunications system can do for them - these all suggest that attitude and awareness factors may be important influences on the impact actually exerted by telecommunications.

The ability to innovate in making use of the telecommunications system may be a further influence on the economic benefits derived from the telecommunications system which is potentially independent of any incremental plant investment. Various industries are of a character that requires little use of telecommunications offered in the conventional manner. Agriculture would be one such industry. Telecommunications of a conventional form, i.e. hand sets used for voice conversations, would be a very minor part of the production function of farm units. But the same physical plant used for conventional telecommunications use could be adapted to provide a market information and farming instruction/information system which might have a large impact on farm efficiency and profitability.

Tourism is another example where specialized adaptation of the telecommunications network is beginning to be used in the form of centralized reservation systems. Such systems are currently operating in parts of Canada, the United States and Europe.

Related to this point about specialized adaptation of an existing plant to uses peculiar to the industry involved is the influence of peripheral equipment or terminal devices on the benefits of telecommunications. Investment in special terminal equipment such as computer terminals and/or the technology of such devices may be another influence on the benefits of telecommunications which is independent of any investment in the transmission/switching network.

A Recommended Framework for Assessment

The above discussion leads to a number of conclusions as to the general methodological framework recommended for use in assessing the economic impact of telecommunications. These are:

1) The role of telecommunications as an intermediate good must be clearly recognized. This means that direct tests of the impact of telecommunications on macro-economic indicators are inappropriate to try and unlikely to yield any useable results. Study must be made on a micro-economic level of the benefits derived by individual users or groups of users and then these results translated to a macro level.

2) The externalities present in telecommunications and the heterogeneity of telecommunications as a good make it difficult, if not impossible, to focus attention exclusively on plant investment in any single region or to treat that plant investment as a proxy for a single homogeneous consumption item for purposes of estimating benefits or impact. Short of a method being devised to measure the externalities of telecommunications, the only obvious way of coming at this problem is again from the perspective of the user of the system and from that point working backwards to the physical plant investmentitself. The heterogeneity problem also implies approaching the question from the perspective of the user and working backwards to the physical plant and its technology.

3) The causal versus accommodating role of telecommunications in the growth process is of crucial importance to the question of how far in advance of demand physical investment should be provisioned. The general lack of any significant sample of areas where plant investment has been made in advance of demand makes it impossible to directly test this proposition. One way of approaching the problem would be to study specific users of telecommunications in respect of the "essential-necessity" character of telecommunications to the user in question. This would at least indicate whether the firm or industry could operate, where it does, without the telecommunications network. If the answer to this question is that it could not, then although the entire benefit of that industry to the economic well being of the region in which it is operating could not be considered as the benefit of telecommunications, it will be true that the benefit would be lost without the telecommunications system.

4) The complementarity between telecommunications and other infrastructure components cannot be tested by merely looking for the dual presence of each since the two events might be quite independent of one another. Rather this complementarity hypothesis can only be tested by specific study of the degree of interdependence in use by specific users.

5) The influence of price on the benefits to be realized from telecommunications depends on an evaluation of the price of telecommunications as an information-transfer mode relative to the price of other information-transfer modes. This in turn requires knowing not only the nominal cost of telecommunications and other information-transfer modes but also the real costs taking account of differences such as the speed of communication, the use of personnel time, and the degree of personal contact. In effect, one needs to know how information flows enter into the production function of the firm or parts of the firm and what the elasticity of substitution is between different information-transfer modes. This knowledge would permit a determination of the cost-effectiveness of telecommunications, the potential for relocation of firms or parts of firms to remote or under-privileged areas, and the optimal pricing strategy to employ. Obviously, because the production function of each industry and the role of telecommunications in such

production functions will differ from one industry to another or from one firm to another, once again the conclusion is that study of this question must be at a micro level by user or type of user.

6) Attitudes to telecommunications use, if negative, or awareness of system capability, if incomplete, may hamper, or defeat, any attempt to utilize telecommunications as a development tool. The fact that people want telephones does not imply that they will necessarily maximize their use of the telephone once they have it. Actual usage must be compared against potential usage and an objective determination of the cost-effectiveness of such potential usage. Attitude surveys may also be conducted to test subscribers', especially business subscribers', perception of telecommunications and its uses.

7) Specialized adaptations of telecommunications by specific firms or industries, or the influence of peripheral equipment attachments as opposed to the transmission/switching network itself, can only be studied on an individual basis both by examining the benefits derived where such adaptations have already occurred and by studying specific industries to establish the potential for special use and conceiving what the nature of such uses might be.

All of these conclusions produce the recommendation that analysis of the impact of telecommunications, at least within the present state of knowledge, must first proceed at a micro-economic level with study of specific users and in the context of specific hypotheses such as that concerning the "essential-necessity" character of telecommunications; or the complementarity of telecommunications and transportation; or the efficiency/profitability gains from specialized application of telecommunications. Only after such individual case studies is it likely to become feasible to turn to a consideration of the macro-economic impact of telecommunications.

<u>Methods or Techniques of Measurement</u>

The general framework just recommended, with its emphasis on assessment of benefits, or impact, at the level of the individual firm, industry, or sector of the economy, makes any "ex ante" detailed specification of methods obviously difficult.

What follows here is neither a definitive nor an exhaustive discussion of methods but rather a discussion of some methods that might be profitably employed in addressing some of the considerations that have been outlined above. Before discussing these more specific methods, however, two general observations need to be made:

1) Statistical observation, by itself, is of no major practical value for the problem at hand. Finding two or more variables that show a high correlation with one another does not constitute a method for measuring benefits. Methods employed must proceed from a sound "a priori" base and hence must involve either the test of a specific hypothesis based on economic theory or the building of a causal model which can explain the role of telecommunications. In other words, it is important for the logic of the exercise to determine the arithmetic and not the arithmetic to determine the logic.

2) Wherever possible, the method employed should be one which generates a specific quantified measure of benefits or impact. Methods designed merely to assess the nature of the relationship of telecommunications to individual sectors and/or the economy as a whole are not irrelevant by any means and may be quite important for establishing the validity of certain "a priori" hypotheses which might be advanced. Ultimately, however, what is most desirable is a specific measure of benefit or impact by firm, industry, or sector, with respect to location, efficiency, and/or profitability. This can then be coupled with appropriately specified expenditure and employment multipliers to generate a measure of the aggregate economic impact of telecommunications on a region or a country. This implies that we want to operate within the general framework of cost/benefit analysis.

Having made these two general comments, the following points might be made on more specific tests:

1) One of the conclusions generated above was that it is important to know how telecommunications inputs to the firm's production function. In order to carry out such an exercise it would be necessary to undertake detailed

study of information flows in a firm and the "real" costs of such flows in terms of time, effort and results. In other words, it would be necessary to carry out what might be described as an "information audit". The specific methodology involved in such an exercise will not be detailed here. There is already literature available which describes experiments which have taken place along these lines. The two basic thrusts of the exercise would be to (a) measure information flows into and out of the economic unit being considered and (b) measure changes in the productivity of this economic unit which would result from altering the mode of handling these information flows. From such an exercise would come both a measure of the elasticity of substitution between telecommunications and other information transfer modes and the overall role played by information flows in the firm's production function.

An important corollary of this point is that this exercise should be conducted not merely for whole firms but also for parts of firms. Decentralization of units within firms may be quite feasible using telecommunications and could be an important way of adding employment to more isolated areas of a country or indeed to more isolated countries in the case of multinational firms.

2) The question of the "essential necessity" character of telecommunications might be tested also within the framework of the information audit described above. Knowing the volume and character of information flows to the firm, and the elasticity of substitution between different information transfer modes, will allow a determination not only of whether and where telecommunications can be substituted for other modes but, also, of whether and where other modes can be substituted for telecommunications.

3) One method of proceeding from a determination of the input of telecommunications to the firm's production function and the "essential necessity" character of this input towards a measure of the economic benefits of telecommunications to the firm would be to employ a counter-factual approach and assess the impact on the selected business of having to operate without the use of telecommunications. This would generate an estimate of the benefits being derived by that firm from the existing telecommunications plant. Such a study done over a large enough cross section

of telecommunications users could lead to the generation of an aggregate measure for the region or economy as a whole.

The counterfactual method would involve a calculation of the additional cost of conveying the information actually carried by the telecommunications sector for the firm in question by the least expensive alternative means. Such results when aggregated for the economy at large would yield an estimate of what might be termed "the social savings" of telecommunications and would represent the extra resources that are "freed" up for other uses by the telecommunications sector as it exists and is used. This would amount to measuring the contribution of the telecommunications network to the national or regional income.

4) A method for testing the impact of expansion of the telecommunications network would also follow from the information gathered in the information audit. Based on a determination of the production function taking account of information flows as an input and the elasticity of subsitution between information transfer modes, it would be possible to determine the cost-effectiveness to the firm of using more telecommunications and to test the sensitivity of the results to the price of telecommunications which is assumed. By working backwards, the incremental network investment required to provide the projected level and type of service being assumed could be determined. By working forwards, the benefits at the firm or industry level could be translated to the level of the region or nation as a whole.

Implications for Developing Nations

Much of the above discussion is based on the premise that the country or region being examined already has a relatively developed telecommunications sector in place. Clearly this is an assumption which does not hold for most developing nations. Hence, it is implicit in the above discussion that much of the testing envisaged would be carried out in the developed countries and the results then applied to the developing nations. The question then arises, "How appropriate is such a method of procedure likely to be?".

In answer to this question I would suggest that such a method of procedure can be very fruitful so long as apppropriate caution is taken to allow for the differences between the developed country situation and that of the developing nation. Today's world in which developing nations are looking to provision a complete and high quality telecommunications system is different from the world of thirty and forty years ago when many developed countries were first looking at achieving the same result. The technology of telecommunications has become vastly different as have the uses to which the system might be put, the skill levels required of the labour force employed in the telecommunications sector, and the costs of telecommunications. Also there may be major differences in industry structure and in ways of doing business. Most importantly, the priorities of developing countries may be quite different from those of developed nations, today or in the past.

The results generated for developed countries from the methods suggested here could not, therefore, be applied directly, in quantitative terms, to developing nations. But they could serve, qualitatively, as a guide to the impact which telecommunications could be expected to exert on the economy and the manner in which telecommunications could be expected to generate, and/or accommodate, development, as development proceeds.

At the same time, the methods which have been outlined above could be tried directly in developing countries. While the state of development of the telecommunications sector could be expected to have some influence on the results generated by direct use of these methods, direct testing might nonetheless provide an indication of some of the benefits currently being received from whatever telecommunications sector is present, and provide a basis for assessing potential benefits from expansion of the system. Additionally, from work of this type, indications would be provided of the compatibility of developed country experience with developing country experience. This could provide important evidence on the ability to apply, to developing nations, the testing results achieved for developed nations.

Conclusions

Telecommunication suggests itself as a potentially important vehicle for influencing the development patterns of less developed regions of a country or of less developed nations, taken as a whole. This potential has, however, still to be quantitatively established. It is suggested here that what is needed, to at least begin this task of quantitative measurement, is a series of in-depth studies at the level of individual firms, industries or sectors of the economy of the role played by telecommunications in the functioning of those entities. Attention should start with the users of the telecommunications system and work forward to generalizing these results to the macro-economic level and backward to the system iself, in terms of required technology, capacity and prices. In particular, it is argued that principal attention must be focussed on measurement of information flows as these enter the firm's production function and a determination of the elasticity of substitution between telecommunications and other information-transfer modes. The technique of an "information audit" is suggested for accomplishing this task. With such information in hand, it will then be possible to test various hypotheses regarding the role of telecommunications such as the "essential-necessity" character of telecommunications, the role of the price of telecommunications in influencing the trade-off between telecommunications and other information-transfer modes, the social savings generated from telecommunications investment, and so on.

It must be acknowledged that work of the type proposed in this paper would not be easy and that, obviously, it would be far too formidable a task to undertake such studies for each firm in the economy. This however would not be necessary if the firms or industries to be studied are selected in the right manner. If each of the firms or industries studied are representative of a group of firms in the economy with similar characteristics or a type of telecommunications use that is to be found across different firms or industries, then generalizations will be possible. As more understanding of the role of telecommunications to the business, or productive sector, is gained, other methods which allow us to operate at a more macro level might also emerge. The methods outlined here are not advanced as a panacea for all ills; they are by no means a complete answer to the problems of assessing the impact of telecommunications on economic development. One of the major deficiences under which telecommunications planners are presently labouring, however, is the lack of any fundamental understanding of the role telecommunications play in the economy and the ways in which telecommunications policy might be used to assist in achieving a country's development goals. Any efforts that help to eliminate this deficiency will be of assistance to all nations.

NOTES:

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1. On the role of telecommunications in economic development:

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ECONOMIC AND SOCIAL DEVELOPMENT BENEFITS OF RURAL TELECOMMUNICATIONS

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This paper was prepared with the assistance of Douglas Goldschmidt of Stanford University. The paper is based on a larger report in preparation under an agreement with the International Telecommunication Union. The financial support of the ITU for the preparation of this paper is gratefully acknowledged.

PREFACE

> "The purpose of this joint ITU/OECD study is to analyze the direct and especially the indirect benefits of national investments in telecommunications and to show the way in which a telecommunication system can contribute to economic development."

William B. Pierce and
Nicolas Jequier,
ITU Telecommunication Journal,
November, 1977

Keewatin Communications was commissioned by the ITU to prepare a paper as part of the above study, details of which can be provided by Mr. William Pierce who is attending this conference.

The purpose of the paper commissioned by the ITU as part of the above study is to review the literature on the socio-economic benefits of telecommunications and to outline research plans to provide more definitive information on the role of telecommunications in development.

Telecommunications here includes narrowband point-to-point communications, i.e., basic telephone service and other services that could be offered using a telephone channel.

The attached paper for this conference consists of excerpts from the longer paper. The topics we have selected for inclusion in this paper are intended to stimulate discussion.

PART ONE

FUNCTIONS OF COMMUNICATIONS

The paper for the ITU reviews over 100 documents on the role of communications in development. It is frequently asserted that telecommunications ought to receive more attention as an essential infrastructure, but little evidence is cited. Some of the anecdotal evidence will be given below.

GAS-5 views telecommunications primarily as a means of diminishing the costs of time and travel:

> Telecommunication is, in a sense, a substitute for presence. Its availability allows the user to overcome some of the disadvantages of distance. As the next best thing to being there, telecommunications can substitute for travel with an associated saving in time, cost and personnel. As a substitute for the mails, telecommunications can act to save time and to speed up a decision-making process. As a means of access to information, telecommunications can allow quick and frequent access, by managers and other users in a remote area, to the pools of information and talented advisers found in large population centres. In the future there are even greater prospects of substituting traditional forms of infrastructure with specific types of telecommunication infrastructure. (1972, XII: 5)

These benefits are manifested in several ways.

Among the functions of telecommunications reviewed by the ITU in the GAS-5 studies are:

1. Importance for secondary manufacturing and the tertiary (government, finance and services) sector;

2. Substitution for travel; potential energy savings;

3. Decentralization of business and industry through capability to transfer information quickly and accurately;

4. Benefits to consumers in providing information and facilitating accurate ordering and delivery of goods;

5. Maintenance and expansion of tourism which in turn expands the service sector;

6. Increased efficiency and geographic coverage for government administration and delivery of services;

7. Organizational impacts on agricultural production through improvements in ordering and delivery of supplies and equipment, more timely access to services and increased availability of marketing information.

The GAS-5 studies suffer two major deficiences. First, most of the discussion is non-empirical - while the hypotheses about what telecommunications may do for an economy seem reasonable, there are insufficient data at present to validate any of them.

Second and more important for this paper, the research and writing are almost exclusively oriented towards the urban, industrialized nations. The little reference made to rural development is directed primarily at fairly well developed agricultural sectors, and certainly has little to offer peasant-based agricultural sectors. In large part, this results from lack of any experience with rural telecommunications in the LDCs. However, the GAS-5 reports consistently indicate a bias towards capital-industry oriented economies. Clearly, a major redirection in research is necessary to further both planning and development of telecommunications in the extremely problematic rural sectors of LDCs.

I. Case Studies of Rural Telecommunications and Development from North America

Several case studies conducted in Alaska and the Canadian Arctic of communities with newly-installed or vastly improved telephone service have indicated some socio-economic changes arising from telecommunications which may prove suggestive for future research.

A. Health and Education

The ATS-1 satellite demonstration project in Alaska first indicated the potential impact of telecommunications on health and on education. Experimentation on ATS-1, an audio-only satellite, was inaugurated in 1971 with twenty-five earth stations. Each of the twenty-five sites had a receiver/transmitter located in a readily accessible location (e.g. a community hall), operated by a native health aide with only basic medical training.

The Public Health Service concentrated its efforts in the Tanana Region of interior Alaska, which has the worst communication in the state due to severe atmospheric problems which restrict radio transmission. This health problem allowed, for the first time, reliable communications between the Public Health Service's community health clinics, which are staffed by health aides, with hospital staffs having doctors and nurses.

The satellite allowed for consultation between the health aides and a doctor at the regional Tanana Hospital, using one shared audio channel. Thus, while one health aide was conferring with a doctor about a specific case, other health aides could listen and pick up pointers about treatment of similar cases. Hudson and Parker (1973) found that the number of patients treated with a doctor's advice during the first year on ATS-1 more than tripled. However, the ATS-1 system did not show itself to be cost-effective in reducing hospital admissions, at least during the study period, probably because while some people could now be treated in their home communities, others were identified as requiring hospitalization who were missed before.

In northern Canada isolated communities have also found the telephone important for health care. For example, Angling Lake, a small Cree village in northern Ontario which has just received a toll station, has no health worker, and uses the telephone to contact nurses at the clinic in the larger village of Big Trout Lake. In a letter to the Canadian Radio-Television and Telecommunications Commission (letter dated April 19, 1978), the village noted:

> It is obvious that the telephone service would make a great difference here, especially in time of medical emergency when we might have to call out for help night or day.

> The phone lived up to all our expectations for approximately two weeks and then went out of order. We notified Bell immediately but to this date no one from Bell has repaired the phone. Since our one pay telephone has ceased functioning we have had three medical emergencies, and in each case a telephone would have been invaluable.

B. Educational Administration

The educational program of the ATS-1 was essentially of two types - educational programming to schools and communities, and administrative. The educational program had a mixed success largely due to problems of programming and community organization. The administrative part, however, which essentially provided reliable telephone-like communications, was very successful:

> In the past, generator failures, furnace blow-outs, or deficiencies in instructional materials would cause the whole school to shut down while a written message was mailed out. With the satellite radio, teaching conditions were greatly improved and teachers would call for immediate emergency parts during the critical winter months. The communications links between the schools and the area administration supported and encouraged the efficient operations of the schools.
>
> (Parker, Walter B., 1972)

The recent installation of commercial earth stations by the state of Alaska and RCA Alaska Communications in over 100 villages has extended communications throughout rural Alaska. Each village has one dedicated audio channel for health communication, based on the successful ATS-1 model. While there is a lack of any substantive data on the impact of this extended communication system, Goldschmidt (1978) conducted a series of limited case studies to indicate some of the effects the new rural telecommunications service had on social and economic life.

C. Substitution for Travel

Improved communications has made certain forms of travel, often hazardous and expensive in the Alaskan bush, unnecessary. For example, during the construction of the Shishmareff High School, construction supervisors often had to fly to either Teller or Nome in order to call their suppliers. Such transportation, which is purely substitutable by communications, will be replaced as the satellite earth stations become fully operational. This does not imply however, that improved communication will necessarily lead to decreased rural transportation demand. Hudson (1974) has noted that improved communication in the Canadian Arctic led to increased travel as communications helped to promote greater economic activity. This phenomenon seems to have occurred in Atka.

D. Participation: Access to Services

Atka is a community of approximately 88 people located on an island in the Aleutian Chain just east of Adak. This native (Aleut) village subsists generally off fishing, and more recently, from the limited employment generated by a coast guard docking facility. The community has no air-strip. Prior to its receiving a satellite earth station, all communications with the outside took place via the mail which was exchanged once a month when a mail barge visited Atka from Adak. Such slow communication made application for government grants in aid virtually impossible - the turnaround time between the Anchorage attorneys and the villages was simply too long for timely application. Further, business trips by members of the village to Anchorage for meetings at the Native Corporation used to require payments of $900 per person just for per diem expenses, as the villagers would have had to spend at least one month in Anchorage (to wait for the mail barge to return to Atka).

With the satellite earth station, daily transactions with the Anchorage office of the Aleut League, the organization representing Atka in most of its government dealings, have helped generate increased government grants in aid programs to Atka. The turnaround time for grant applications, including the simple act of notifying the village that grants are available, has been reduced from a minimum of one month to just a few minutes.

Also, the possibility of instantaneous communications has permitted more timely ordering of supplies, educational materials, and health goods which are shipped in on the mail barge.

The increase in activity in Atka has, interestingly, been accompanied by a demand by the villagers for a landing strip. There is evidently sentiment within the village that travel should no longer be dependent on the mail barge (see Goldschmidt, 1978).

It is important to note here however, that the increase in economic and political activities in villages like Atka in Alaska was not caused by the introduction of telephone service. Rather, a series of changes in Alaskan life arising from the activity around the Alaska Native Lands Claim Act, which involved extensive organization of the Alaskan natives and which has given a fairly large sum of money to the natives and the native organizations, are the primary causes of the changes witnessed in Atka. The telephone link expedited these changes and probably allowed certain changes to occur which might not otherwise have occurred given the poor communications in existence prior to satellite service. However, the telephone as a facilitator of social change must be distinguished from the telephone as the cause of social change.

E. <u>Business</u>

There is other evidence that improved telecommunications may help change the conduct of business. Interviews by Goldschmidt (1978) in Shishmareff, Teller, King Salmon, King Cover, and Unalaska, Alaska, indicated that improved, or new, telephone service, improved the ability of businesses, especially stores, to contact suppliers and customers. In regard to supplies in particular, urgently required items, like spare parts, can be ordered on a timely basis with telephone service. Also businesses like guide services have found it easier to contact clients to make arrangements - this has evidently increased business.

An interesting case of how improved communications affects business is provided by the Vita packing plant in Unalaska. Due to extreme congestion on the two VHF circuits feeding into Unalaska up until November 1976, telephones could not be used for frequent contacts with the rest of the world. As a result, the Vita packing plan, which packs fish and crab for shipment to Seattle, operated virtually as an autonomous plant. Its contacts with Seattle were primarily historical - what was shipped and when. Even this communication was unreliable as often bad weather hindered the shipment of the mail.

With the introduction of the satellite earth station, which virtually eliminated congestion, this condition changed. The Unalaska plant now maintains frequent contact with its Seattle headquarters (several times a day). As a result, the plant is now more responsive to customer demand - if a customer places an order in Seattle, this can be conveyed instantly to Unalaska and acted upon. In the past shipments were made to Seattle in the hope that they would match demand. Also, if prices in New York for a particular product, say Tanner Crab, increase, then Unalaska can change its fishing operations to take advantage of this information. This has resulted in improved efficiency of the plant, better customer relations as specific orders are filled, and a shift in managerial control making the Unalaska plant a satellite, rather than an autonomous plant as in the past.

F. Quality of Life

It appears that introducing telephone service has improved the quality of life in remote villages. The existence of private line and toll circuits to the villages has allowed the continuation of regular consultations between village health aides and medical centres initiated during the ATS-1 project. It has also allowed easier contact between village residents and medical services. For example, the amount of time women on the Aleutian Chain must spend in Anchorage receiving pre and post-natal care has been reduced from two months to one month - the women can remain with their families longer and consult with the Anchorage Native Medical Center by telephone.

The existence of toll service allows continued contact among native families which have been dispersed due to exigencies of boarding schools, employment, health, and the like. More importantly, this extended contact with families and friends acts to provide a constant flow of information to the villages.

The introduction of exchange telephone service has also had beneficial effects on village life in Alaska. During the winter telephones have generally made it easier to determine where people are, and in the case of Wales, a mile-long village, whether hunting parties have returned. It also allows the transaction of local business without having to go outside and visit the person it is necessary to contact. This is no small advantage even if the village is relatively small.

G. Similar Findings in Canada

These admittedly anecdotal, and in some ways environmentally specific, findings in Alaska have received support from information developed by the Inuit Tapirisat of Canada (the national Eskimo Brotherhood) in reference to a people generally below the poverty level and at least partially dependent on traditional pursuits of hunting, fishing, and trapping. The Inuit Tapirisat of Canada has argued that communication in the isolated northern villages is a life and death matter in an intervention before the Canadian Radio-Television and Telecommunications Commission about the quality of service in their region. In 1977 the CRTC sat for thirty-five hours in four northern communities where they heard some fifty-four intervenors representing over half the Inuit population complaining about the telephone service and explaining the importance of communications for emergencies, delivery of medical and legal services, and maintaining contact between dispersed families and friends. Billing data in this regard are significant - in 1976 the average toll revenue per main station in the eastern Arctic was $400, or 2.6 times as much as for Bell Canada territory as a whole.

Among Cree and Ojibway communities in northern Ontario usage is similar. A satellite and microwave system was installed by Bell Canada to provide service to most of these isolated Indian communities (no roads or rail - fly-in access only) in 1976 and 1977. In 1977 the average toll revenue per main station in these remote communities was $448.

Regional Development

The communication system is considered important for regional development by the Indian people of northern Ontario who cited communication as their top priority for many years. In a region where travel is so difficult and expensive, the telephone allows leaders to plan, discuss priorities, and coordinate strategies. Previously, the Chiefs had no way of coordinating their planning until they arrived at meetings with government or commercial agencies - this clearly placed these agencies at a strategic advantage.

The telephone system can be a vital tool to enable people to participate in their own development. However, as already noted above, it appears that certain preconditions must exist: there must be some level of local organizational structure, and there must be some perceived community of interest with other parts of the region or subregion. For example, Chiefs who represent their communities and share common concerns about the development of their region will use communications as an organizing tool regardless of their education or their ability to speak English. But, unstructured village groups who have little awareness of common concerns with other communities are likely to use the telephone purely for social communication between family members and friends (see Hudson, 1974). Following is a table showing the various purposes for which an intra-regional two-way radio system owned by the native people was used. The data show that in fact the system was used to a significant extent for native business and contact with government agencies, rather than simply for interpersonal messages between friends and relatives (Hudson, 1974).

TABLE 1

Uses of Native Two-way Radio Communications System in Northern Ontario

(percent of completed originating calls)

Content Categories	Base Station	Remote Community
Aircraft or mail	9.6%	5.9%
Business	36.4	34.7
Hospital	4.4	5.1
Personal matters	18.5	34.8
Radio operation	26.3	5.1
Weather	4.2	11.9
Unknown	0	2.5
	100.0%	100.0%

At the time of the project (1972-74) the Inuit (Eskimo) region of the central Arctic was far less organized than the remote Indian region of Ontario. The Inuit had recently settled in government-provided settlements and had family ties with other settlements, but there was little organizational or institutional development. Their use of the two-way radio system reflected these conditions, with a much higher percentage of calls for personal matters or simply "news" or gossip:

TABLE 2

Uses of Native Two-way Radio Communication System in Central Arctic

Summary of Entire System: April 1973

Content Categories	% of Total Calls
Aircraft or mail	1.4
Business	11.4
News or general information	48.5
Personal matters	32.9
Radio operation	4.2
Weather	1.6
	100.0%

It is suggested that an examination of the institutional structures and leadership characteristics of developing regions can enable planners to predict initial developmental applications of a telecommunications system.

The case studies, while referring in large part to circumstances which may not be fully replicable in other developing areas, do suggest that given certain organizational prerequisites, telecommunications may have a series of effects on rural development in terms of health, education, business output, the conduct and structure of business and the like. These organizational prerequisites must be emphasized - the changes in economic and social life noted in the case studies all occurred because there were <u>institutional</u> capabilities to utilize the new telecommunications capacity.

It is probable that more rigorous and intensive time-series studies will have to be conducted on the relation of telecommunications investments and rural development before any conclusive information becomes available. Various international and national agencies have indicated interest in the generation of such studies as one source of data for use in planning new telecommunications systems and for establishing prices. It should be clear that studies of the effects of telecommunications on rural development will involve unusually difficult problems both of theory and methodology. However, without at least some exploratory studies in this area, we will be left without sufficient information for the planning decisions concerning rural development.

II. Access

The national telephone density (or number of main stations per hundred inhabitants) gives no indication of distribution of telephones throughout the population. It is likely that the phones are clustered in urban areas, with rural areas having little or no service. Within urban areas, telephones are likely to be available only to higher income residents and businesses/institutions. Even the proximity of the instrument, however, does not guarantee functional access: if there is a breakdown anywhere in the system, the circuits are overloaded, or if the transmission quality is excessively poor, the telephone might as well not exist. Therefore, data on quality of service in various subregions is required to give a meaningful picture of telephone distribution.

A. <u>An Access Index</u>

In order to overcome these statistical problems, an index of access is proposed. The components of this index include: (based on Hudson, 1974; Hudson and Parker, 1975)

1. Physical Distance: The actual average distance customers must travel to use the telephone... (e.g., from the home to a store or community office where the public telephone is located).

   Note:

   In order to minimize this distance, telephone utilities in industrialized countries have sought high penetration of households as well as businesses. However, in developing regions, the relevant unit may be the community rather than the household or office. For example, in Alaska and northern Canada, communication planners have used the isolated community as the unit of analysis. The State of Alaska has plans to provide at least one telephone to each permanent community of 25 inhabitants or more. Similarly, Prasada proposed that increased attention be given to community telephones. In urban areas, subdistricts may also be chosen as the planning unit so that there is at least one telephone within a specified walking distance of each resident. With the higher density of urban populations, a consideration must also be given to the population density, so that additional criteria based on population may also be required.

2. Cost: The average cost to the user of making the most common types of calls; this cost should also be expressed as a function of average income in the community or region. Note that several types of data are required to get a meaningful indicator of cost to the user. It is not enough to simply know the price of a local call. The price must be related to the income of the users. Telephone pricing statistics that compare the cost of a local call from one country to another have little meaning unless they take into

account the income of various user groups within each country. An Ethiopian may pay only 8¢ per call, while an American pays 10¢ to 20¢, but that 8¢ represents a much greater proportion of the Ethiopian's disposable income.

In rural areas, the local call may not be the appropriate unit for consideration, if most rural calls are long distance, requiring some toll charge or flat rate in excess of a local urban call. Here some basic traffic data will be needed to show the major calling patterns of communities of interest which should be taken as the basis of the cost calculation (e.g., the price of a three-minute call to the nearest market town or administrative center).

3. Quality of Service: A telephone system is only as reliable as its weakest link. If for any reason the telephone instrument does not function, it might as well not exist.

The leader of Angling Lake, an isolated Cree village in remote northwestern Ontario, Canada, points out that while a telephone was recently installed in his community, his people effectively have no access to it because it does not work:

> Why build an expensive microwave system of towers to bring telephone service into an isolated community like Angling Lake, and then fail to maintain the single pay phone that is the end result of the whole project?

Telephone utilities keep statistics on quality of service generally compiled in annual surveys, including:

- blockage rates on toll trunks;
- mean time to get dial tone;
- outage hours per trunk per year;
- mean time between trouble report and repair completion.

It is again important to note that it must be possible to break such statistics down by subregions to get a meaningful indication of access to service. For example, the aggregate statistics on quality of service kept by Bell Canada for Ontario, the most populous and industrialized province in Canada, do not reveal quality of service problems in the small isolated northern communities.

4. <u>Socio-Cultural Factors</u>: A working telephone in a village or urban neighbourhood still may not be accessible if the local people are unaware of its existence or apprehensive about using it. Factors which may enter into this socio-cultural distance include:

<u>Location of the telephone</u>: A phone in a local store or post office may be accessible to virtually the whole population because everyone is familiar with these locations. However, a telephone located in a police station or government office may be inaccessible to people who are apprehensive about entering such "official" places.

<u>Awareness and skill</u>: The public must be aware that the telephone exists, where it is located, and how and when it may be used.

The public must have the basic skills necessary to use the equipment (e.g. a radio telephone will not be accessible to the public if they are not aware of how to operate it; a modern dial phone will not be accessible to people who do not know how to find a number and dial it).

<u>Assistance:</u> Any of the above problems can be overcome if the customers can be assisted by operators/local agents who speak their own language and are willing to explain telephone procedures. The most modern dial pay phone may be inaccessible if the only source of information is a telephone directory that the customer cannot read and an operator who cannot speak the customer's language or will not take the time to explain procedures.

B. Access: An Example (A Case Study)

An Indian leader in northern Canada summarized access problems when explaining why his people made little use of the existing radio telephone facilities in the area:

> It's not because we didn't have radios. We had them... But most times the local people didn't have the financial resources to make use of them, or else they belong to different government departments....or even the churches.... But they weren't accessible to the people themselves. They were used either by the clergymen or by the doctors and nurses or, in the case of Bell Telephone, we just didn't have the funds to make long distance calls.
>
> (Quoted in Hudson, 1974)

In 1972, the Canadian Department of Communications sponsored the Northern Pilot Project to provide a range of communication facilities to northern native communities. One component of the project was a high frequency two-way radio system for communication within the remote regions because native people had complained that commercial and private systems then available were not designed to allow communication within the regions, but solely between northern villages and southern commercial/administrative centers.

The Northern Pilot Project attempted to account for access factors in its implementation in the following ways:

- Local councils were briefed on the facilities and made the decision to participate in the project;
- Communities were given responsibility for radio site selections;
- There was no cost for calls to the individual users;
- Native-speaking residents were taught to operate and maintain the equipment. Skills were passed on to others in the community.

If access to facilities for communication with other remote northern communities had in fact increased, the following would be expected for the year following the installation of the intra-regional system:

1. The combined traffic volume of the commercial and project systems in year 2 would exceed the year 1 commercial Bell traffic volume;
2. The distribution of calls in the combined commercial and project Bell and NPP systems in year 2 would differ from the year 1 commercial Bell traffic distribution, with a greater proportion of calls going to other remote communities in year 2.

An analysis of traffic data for communities within the Indian and Inuit remote regions supported these hypotheses. The total Year 2 traffic volume on commercial plus project systems was signficantly greater than the Year 1 traffic on the commercial system alone. In addition, the distribution of calls in Year 2 in both regions differed signficantly from the distribution in Year 1, with a greater percentage of calls going to other remote communities in the subregion ($p. \leq .05$ for northern Ontario; $p. \leq .001$ for the central Arctic) (Hudson, 1974).

PART TWO

MEASURING EXTERNAL BENEFITS OF RURAL TELECOMMUNICATIONS

Techniques are relatively well-established for measuring the internal rate of return on investment in telecommunications infrastructure. In the case of rural telecommunications proposed for locations where reliable communications do not now exist, there are some difficulties in obtaining reasonable estimates of demand. In the absence of current services there is no prior growth curve to extrapolate from. The poverty of rural areas is usually evident - leading to conservative estimates of effective economic demand, which may in fact be serious underestimates. On the supply side, recent technological changes may make it more difficult to accurately estimate the least cost technical solution for meeting that unknown demand. But these internal rate of return questions are not our primary concern. Instead, our topic concerns external economic and social benefits over and above the internal return. If signficant external benefits can be documented, they would justify investment by national governments (and international development agencies) in rural telecommunications capacity beyond that which can be justified on the basis of internal rate of return.

External economic and social benefits do not flow directly from the existence of telecommunications infrastructure. They depend on how much the facilities are used by whom for what purposes. This significant complementarity makes it risky to present simplistic hypotheses about automatic economic benefits. If the capacity is used primarily for social gossip there may be consumer value without stimulation of economic productivity gains. If the system is used to make possible a rural health care system based on local rural village health workers consulting by telephone with more highly trained health workers elsewhere, then social benefits may result. If the system is used to permit farmers to produce and deliver crops with the greatest economic demand to the right marketplace at the right time, then economic benefits will result. If non-farm rural enterprises taking advantage of lower rural labor rates can be conducted efficiently only in locations with reliable telephone access to markets and sources of supply, then the potential economic benefits will be blocked in locations without such communication capability. Because of these complementarities in which telecommunications may be necessary, but not sufficient, for economic and social development benefits, the problems of definitive measurement of benefits is difficult. Desired beneficial results may occur only at times and locations where other development policies are concurrently applied (e.g., availability of credit or other investment incentives, plans for improved social service delivery systems, etc.).

Because of these and other difficulties there is very little solid evidence of external benefits or well-documented statements of the conditions under which external benefits will be obtained. (These problems are not unique to telecommunications and also apply to other infrastructure investments such as transportation and electrification.) Nevertheless, there is a great need for more definitive measurement of external benefits to support rural telecommunications investment decisions, and consequently that difficult measurement task should be undertaken.

Analysis of historical data, whether by time series or by cross-sectional correlations of telecommunications and economic indicators may be quite suggestive. We have ample statistical evidence of the correlation. But more definitive evidence of the cause and effect connections between the two is likely to require a prospective field study with appropriate measures before and after installation of capacity, compared with before and after measures in comparable communities that do not yet have telecommunications facilities installed. Measures of communication and economic activity will be required with communities or districts as the unit of analysis, because aggregate national statistics are unlikely to permit the necessary causal inferences. And data on the concurrent productive or social service activities in those communities or districts will be necessary to provide the evidence concerning necessary complementary activities.

I. <u>The Hypotheses to be Tested</u>

A. <u>Telecommunications permits improved cost-effectiveness of rural social service delivery</u>

In countries where a political and economic commitment has been made to provide rural social service delivery (e.g., health care, education, agricultural extension services), a key policy question concerns the cost-effectiveness of alternate ways of providing rural services. Locating highly or moderately trained professional or paraprofessional workers in rural locations may be unfeasible because of the high initial training costs, the continuing salary costs of highly or moderately trained personnel and the bureaucratic overhead costs (including communication and transportation) of managing a large, geographically dispersed organization. Even if a sufficient number of highly trained personnel were available and budgets were sufficient to pay their salaries, it still might be very difficult to induce them to live and work in rural locations. If untrained or minimally trained rural workers are utilized on either a volunteer or nominally paid basis, then the management and supervision requirements and continuing education requirements will be greatly increased.

In the absence of good telecommunications infrastructure, the travel and professional labor costs associated with management, supervision and continuing education may be prohibitively expensive. But without such supervision and continued training, programs may be significantly less effective. The consequences may be a low quality of rural education, unavailability of agricultural extension information to subsistence farmers, and poor or non-existent rural health care. With reliable rural telecommunications, telephony or audio conference circuits may be used to provide supervision and assistant to rural workers. Instructional radio programs such as the "radio mathematics" project in Nicaragua may be delivered to rural schools, permitting less well-trained teachers or education aides to supervise classes receiving high quality instruction. Timely feedback from the schools to project managers may be essential to the success of such projects. Rural health workers may be able to consult with better trained medical workers affiliated with district hospitals or clinics, and consequently be able to provide better local health care. These kinds of applications may be possible only in locations with reliable telecommunications.

In the absence of general purpose telecommunications, rural health care programs in various parts of the world (e.g., Nicaragua, Guatemala, Sudan, Ghana) use or propose two-way radio systems dedicated to health applications. The costs of such a dedicated communication system may be a significant fraction of the rural health care budget. Once such a system is in place, pressures to use it for other purposes may be hard to resist if it is the only voice communication link to and from a rural community. Once installed, it may be difficult for a health or other social service agency to recruit and maintain the technical staff needed for adequate technical maintenance of the equipment.

The basic hypothesis is that savings in training costs, labor costs and transportation costs may make it possible for rural social service agencies to allocate sufficient budgets to telecommunications services. The trade-off analysis involving communication versus other costs may in fact indicate that rural programs may be affordable only in locations where telecommunications services can be procured. Dedicated single purpose systems may be economically out of reach for many social service programs, but such programs may easily afford shared use of a general purpose telecommunication system that can obtain revenues from other social service or directly economically productive enterprises, as well as consumer revenues.

It will take careful economic analysis to determine the actual or potential cost savings to social service agencies that access to reliable general purpose communication facilities make possible. And national policy decisions would be required to allocate such "savings" to telecommunications infrastructures, either as a capital transfer to subsidize partially the initial construction or through appropriate rate structures or utilization guarantees.

One of the few attempts to conduct such a social service cost-effectiveness analysis was that of a recent Stanford Ph.D. dissertation (Horley, 1976) which analyzed the case of rural education in Brazil. Because it depended on secondary data sources and hypothetical costs of communication alternatives (the proposed communication system was not in fact implemented), the data are not as convincing as a direct field study of real costs of social service delivery systems with and without telecommunications components.

B. <u>Telecommunication permits improved cost-benefits for rural economic activities</u>

The prevailing economic theory concludes that the optimal allocation of economic resources occurs when the two conditions of perfect competition and perfect information are met. In socialist economies the availability of information is even more important for efficient resource allocation because the flow of money may not constitute the same information signal that it does in a competitive economy. Rural areas that lack telecommunications infrastructure are thus at an information disadvantage (and consequently an economic disadvantage) relative to urban areas with both more developed telecommunications and lower cost transportation substitutes.

In the more specific case of rural agriculture, timely access to relevant information such as weather reports and prices and availability of necessary inputs (seeds, fertilizer, tools, credit, etc.) should make rural agricultural enterprise more efficient. Timely access to technical agricultural information, such as might be provided by an agricultural extension service, may also make agriculture more efficient. Telecommunication infrastructure may permit a network of local radio stations to be viable, where in the absence of such infrastructure, high powered radio stations may serve such a wide regional or national audience that detailed local information is precluded. (Purely local low-power radio stations may not be viable in the absence of infrastructure for network interconnection because of the high cost of local production of content. The option of having either a network feed or local programs may be required to provide both kinds of information economically.) Rural telephony or telex services may make locating and ordering supplies more efficient as well as introduce significant efficiencies into the marketing of the resulting produce.

In many developing countries rural population growth has led to a surplus of labor relative to the available agricultural land. If land were all redistributed "equitably" the resulting plots may be too small to be economically viable. Rural-urban migration patterns are putting great pressure on urban areas with insufficient jobs and insufficient urban services and infrastructure (e.g., water and sewage systems). Consequently, development of rural non-farm enterprise may be a necessary part of national economic development plans. The availability of an under-employed rural labor force at advantageous wage rates for whom new urban housing need not be provided, may provide incentives for rural enterprise, if reliable telecommunications were available to facilitate the coordination of necessary inputs and marketing activities. This is likely to be the case whether the rural enterprises are organized as cooperatives or as competing entrepreneurial activities. The Costa Rica program of public telephone installation at locations of rural enterprise would be an example of telecommunications infrastructure intended to stimulate such external economic benefits. It is unfortunate that there is not a publicly available evaluation study providing measures of the external economic benefits of the Costa Rica rural telephone system.

Measures of economic benefits or improved efficiency of existing agricultural or non-farm rural enterprise resulting from telecommunication investment may be small relative to the economic growth that could be produced through the development of new activities and new enterprises. Telecommunications infrastructure may be a necessary condition which, in conjunction with other policies and incentives, may permit such new economic growth to occur. Telecommunications may be the most important item of infrastructure (more important than transportation and electrification) needed to make possible rural economic growth (Parker, 1978). The argument is not that communication is sufficient, but that it is necessary. The availability of telecommunication services may then make more efficient (or even just make possible) the emergence of other factors necessary for economic growth.

These hypothetical arguments will remain just that unless one or more carefully conducted field studies provides a solid evaluation of the external economic benefits. Such a study would have to be conducted over a period of time (perhaps as long as five years) to measure economic changes. To control for alternate explanations, otherwise comparable communities lacking rural telecommunications would have to be compared. And observations of other concurrent conditions would be required to gain better evidence than we presently have concerning what other conditions must be present (or be created) in order for external economic benefits of telecommunication investment to occur.

C. Rural Telecommunication Permits More Equitable Distribution of Economic Benefits

Increasingly, national governments and international and bilateral development programs are insisting on greater social equity, including development of services aimed at helping people in rural areas. In a direct way, providing a rural component of national telecommunication development plans would meet this objective. Reducing inequities in the availability of social services (including telecommunications services) is easier to accomplish by including services for the disadvantaged as part of (or even the focus of) new services. The alternative of redistributing existing services is usually more difficult.

More important, perhaps, than the direct benefits of rural telecommunications (e.g., in jobs such as installers or operators) are the indirect consequences for distribution of economic benefits. Improved cost-effectiveness of social service delivery programs and facilitation of increased or more productive economic activity, as discussed in the two previous sections, would obviously contribute to this goal of reduced inequity.

In addition, the availability of reliable telecommunication linking rural to urban areas may make it easier for people in rural areas to make their needs and wishes known. As a result, rural people may be able to be more effective in claiming their fair share of national budgets. To the extent that government bureaucracies operate on the principle of "oiling the squeaky wheel", telecommunications infrastructure that permits national governments to better hear the squeaks of rural people may be beneficial to them.

Before the installation of a satellite ground station in Atka on the Aleutian chain in Alaska last year, communication was via a monthly sea-going barge. Now that they have reliable communication, they are able to demand (and get) state and federal government services they were entitled to, but couldn't previously obtain because of inevitable delays in learning of opportunities or preparing applications. The pace of development in that remote community has quickened since the advent of reliable long distance telephone service (Goldschmidt, 1978). The telephone was not the sole cause, but in conjunction with federal and state government programs for rural areas, the telephone permitted Atka to claim its share.

D. <u>The General Hypothesis Summarized:</u>

These hypotheses concerning external benefits of rural telecommunication investment are not simplistic linear causation hypotheses that predict quick and automatic economic growth to follow from installation of long distance telephone circuits in rural communities. <u>Rather, the general hypothesis is that telecommunications infrastructure plus a complementary social infrastructure (e.g., rural development programs or entrepreneurial activity) will together lead to more economic growth and more effective social service delivery than when either or both of the two basic conditions are absent.</u> One should not conclude from this hypothesis that telecommunications investment should be made only where the requisite social organization exists. This could doom rural areas to indefinite poverty, because in many cases the requisite social organization may be impossible in the absence of reliable communication links to interconnect its components.

Rather, the appropriate conclusion to draw is that rural telecommunication investment is most likely to be productive in circumstances where there are plans for concurrent or following social development programs or incentives for increased economic activity.

In parts of Latin America there are not sufficient radio frequencies available for a public VHF-based rural telephony system because rich hacienda owners, recognizing the economic value, have utilized the frequencies for private networks. In several countries two-way radio networks are installed or planned as part of a rural health care program at considerable expense, but without provision for general purpose public use of the resulting networks. In some countries the funds committed to such private networks, if paid to a public network, would be sufficient to make a public network economically viable. In other cases, funds that could be spent for utilization of telecommunication may be used less productively because they are insufficient to install a dedicated private network and no public rural communication network exists.

In Alaska, 100 remote communities now have public telephone service in part because the Alaska Area Native Health Service pays for one circuit for health uses. The second circuit, available for public telephony, has a lower revenue requirement than would be the case if the Health Service were not paying its share of the joint costs. Similar kinds of joint activities involving social service agencies and telecommunications entities may prove desirable in other parts of the world. Such joint activities may be easier to justify if there is solid evidence of external social or economic benefits.

II A Methodology for Measuring External Benefits: Quasi-Experiments in Field Settings

A. Before and After Measurements with Control Comparisons

Examination of the level of economic activity or quality of social service after installation of telecommunications facilities cannot answer adequately the question concerning what the level or quality would have been in the absence of telecommunications. Time series data permitting before and after comparisons can measure the change, but fail to answer the key causal question because many other factors are also influencing the economy at the same time. Static comparisons between communities with and without telecommunications are unsatisfactory in the absence of random assignment of telecommunications facilities because the unserved communities are certain to be different from those served in important respects that confound the result. After the fact "matching" of served and unserved communities will almost certainly introduce statistical artifacts (such as statistical regression toward the mean) that render the evidence quite equivocal. Retrospective studies drawing on historical records can sometimes be analyzed to compare, over time, different sets of communities which had communications facilities installed at different times (Parker, 1963). Such studies depend on the prior recording of key measurements using an appropriate unit of analysis - conditions that are unlikely to be met in studies of rural telecommunications.

What is required to avoid these pitfalls is a prospective study in which baseline measurements taken prior to installation of facilities are repeated at intervals after installation (e.g., from two to five years later). These measured changes then need to be compared to the changes taking place during the same time period in communities similar except for the installation of the new telecommunications facilities. This research design (before and after comparison with control groups) avoids the problems of plausible alternate explanations based on either community differences or time period. (The comparison of changes scores <u>across time</u> in both sets of communities controls for initial community differences. The comparison <u>between communities</u> controls for other factors going on in the same time period.) If it is possible to randomly assign some communities to early installation and others to late installation conditions, then it would be possible also to control for complicated interaction effects between communities and time periods. Detailed discussion of these kinds of research design features for experiments and quasi-experiments in field settings is presented in Cook and Campbell (1978).

To translate these abstractions into something more concrete, let's suppose we are planning a quasi-experimental study of the economic effects of the rural telephone system being implemented in Colombia with financial assistance from the Inter-American Development Bank and from the World Bank. The plan is to serve 2200 rural communities. Because of the nature of terrestrial telephony, for many clusters of communities the order of installation within the cluster is determined. When stringing wire on poles or extending existing microwave facilities, those communities nearest existing facilities are likely to be served first, with the more distant communities served possibly soon thereafter as each particular line is extended. But different "lines" or clusters will be begun at different times - because of shortages of supervisory labor and logistic support for concurrent installation. Therefore, it is theoretically possible to randomly assign some lines or clusters to early installation and others to late installation, thus setting up the condition for a true experiment. If 2200 communities are to be reached in, say, a five year period, then some will be early and some will be late in any event. The introduction of a "lottery" to determine which clusters of communities come first may be an equitable way to decide the priorities.

Whether or not such a randomization or lottery process is possible, some communities will be served before others, thus permitting a quasi-experimental comparison. Communities that won't be served until the latter part of the program can serve as the control comparisons (or baselines) against which to contrast the changes taking place in the same time period in the early installation communities.

Since measurements from all 2200 communities is likely to be economically prohibitive, a random selection process is likely to be required to select representative communities for detailed study.

B. Measurement of Key Variables

To obtain satisfactory evidence concerning the external benefits of rural telecommunications using the kind of research design proposed above, three kinds of variables need to be measured for each of the key time periods. The three kinds of variables are the communication variables, the organizational variables, and the economic variables.

1. Communication Variables

a) Physical availability and reliability of communication services

For each community it will be useful to know the number of public long distance telephone circuits available (if any), the percent of time they are available (reliability), and the availability of alternate communication channels, including postal service, telegraph, mass media channels, and transportation facilities that could be used to convey messages. The changes in these variables are a presumed cause of the projected economic and social benefits.

b) Utilization of communication services

The frequency of use of the available channels is a key measurement. Unused channels are unlikely to bring many social benefits. Changes in level of utilization (which may be dramatic if the prior lack of facilities suppressed demand) are presumably what leads to whatever benefits are obtained. Channel utilization measures also permit the discovery of congestion factors where access is restricted and future expansion of use inhibited by busy circuits or other network blockages.

c) The kind of use

The kind of use made of a system is likely to have a significant impact on the kinds of benefits. If most of the usage is for social calls the results are expected to be different than for business calls. Automatic recording of utilization statistics may be possible, but kind of use data is likely to depend on questionnaires, interviews or log data. Some interviews might be conducted by telephone, but a trip to each community in the study may be necessary to establish log-keeping procedures or to interview users to get data on what kinds of messages are being transmitted through the system. Gathering data by recording or listening in on a sample of calls might be tempting, but raises ethical questions concerning unwarranted invasion of privacy.

2. Organizational Variables

Since the research hypothesis predicts that benefits from telecommunications investment will occur when appropriate social organization is concurrently available, it will be important to obtain descriptions of the kinds of social organization present in different locations at different time periods. The size and location of various institutions and organizations (schools, health clinics, cooperatives, businesses, government offices, etc.) may be affected by the availability of communications services. They may also constitute a complementary variable, necessary for benefits of telecommunications to occur. Changes in these organizations or institutions over time and especially the emergence of new organizations should be noted.

In addition to such "institutional" measures, another kind of organization should be examined: the communication patterns measured by evidence concerning who talks to whom with what frequency. At the aggregate data level, geographically dispersed "communities of interest" can be measured by aggregate measures of the volume of calls connecting different communities. At the individual level, it may be useful to include interview items asking who was called (or communicated with by other means) with what frequency. Changes over time in the network of who talks to whom may provide significant clues to changing social organization. To be useful it may be necessary to distinguish calls or contacts by purpose of call (at least distinguishing business from social networks).

3. Economic Variables

Evidence of local or regional economic activity is the essential criterion variable necessary to demonstrate (or fail to demonstrate) external economic benefits of telecommunication investment. Aggregated national economic statistics would be unsatisfactory for the purpose: the unit of analysis for the economic variables needs to be at the same level as the communication and organizational variables, that is, the local rural community or district. Various measures may be attempted: agricultural output, tax collections, income surveys (asking income questions in interviews), employment surveys or records, credit and banking activity, etc. Different kinds of data are likely to be available at different levels of aggregation in different countries. Careful exploration of possibilities will be needed to uncover data sources and to arrange for their availability. If all else fails, economic questions asked of community residents can provide the basic data. That is, new data collection can substitute for analysis of records when the records don't exist or are unavailable.

To conduct the cost-effectiveness trade-off analyses concerning alternate ways of delivering social services to rural areas, budgets of such organizations will be needed for analysis. Unit costs for different levels and kinds of services need to be available in order to calculate what budgets would be required under different circumstances (e.g., with telephone supervision permitting less highly trained and paid staff to perform certain activities, or with communiction substituted for transportation in some service areas). Examination of actual shifts in budget allocations after the introduction of telecommunications would permit observations about the extent to which theoretical benefits were in fact realized.

C. Data Analysis and Reporting Procedures

A variety of statistical analysis procedures is likely to prove useful in summarizing, reporting and drawing causal inferences from the data of such a field study. Correlations, partial correlations, comparative time series, analysis of variance and other statistical procedures may be necessary to extract sufficient evidence to justify the necessarily expensive data collection.

Different analyses would be required for different policy purposes and audiences. Some of the data could be immediately useful as feedback to the telecommunications project implementers. Other analyses may be useful to national policy planners considering possible extensions to other parts of the same country. Yet other analyses and descriptive reports may be necessary to provide evidence by which planners in other countries could make judgements concerning the extent to which comparable results could be expected in their countries.

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WORKSHOP ON SPECIAL ASPECTS OF TELE-COMMUNICATIONS DEVELOPMENT IN ISOLATED AND UNDERPRIVILEDGED AREAS OF COUNTRIES
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