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TELE-COMMUNICATIONS IN THE SADCC REGION

General Analyses of Sector Policy and Evaluation of Four Projects

by
The Centre for
Development and Technology
University of Trondheim

SECTOR EVALUATION TELECOMMUNICATIONS

GENERAL ANALYSIS OF SECTOR POLICY

EVALUATION OF FOUR PROJECTS IN THE SADCC REGION

CONCLUSIONS AND RECOMMENDATIONS

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FINAL MAIN REPORT

PREFACE

The present telecommunications sector evaluation study has consisted of two phases. The first phase comprised the desk study resulting in an Inception Report, and the field work was done during the second phase. The results from both the desk study and the field work are presented in this *Main Report* and in a volume of *Annexes* in addition to a separate *Executive Summary*, which broadly covers the first and second Chapters of the Main Report.

The evaluation project was commissioned to **CDT, The Centre for Development and Technology, University of Trondheim,** and the following Team has undertaken the evaluation:

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Mr. Lomøy, the former head of CDT, took actively part in the evaluation until the end of phase 2. At that time, he got a position in NORAD and left the Team before the reports were completed. For practical reasons, Mrs. Muchelemba could not take part in the final editing process.

Mr. Hellenes has been responsible for editing the report.

Trondheim, March 1991.

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ABBREVIATIONS

(In the order the words appear in the text).

SADCC	-	The Southern African Development Coordination Conference
MDC	-	Ministry of Development Cooperation
NORAD	-	The Norwegian Agency for International Development
PTC	-	Post and Telecommunications Corporation Limited
SIDA	-	Swedish International Development Agency
PANAFTEL	-	Pan-African Telecommunications Network
GDP	-	Gross Domestic Product
GNP	-	Gross National Product
LDC	-	Lesser Developed Countries
ISDN	-	Integrated Services Digital Network
ITU	-	The International Telecommunications Union
CCIR	-	Comité Consultativ International de Radio
CCITT	-	Comité Consultativ de Telephone et Telegraphie
UNDP	-	United Nations Development Program
IBRD	-	The International Bank for Reconstruction and Development (World Bank)
IDA	-	The International Development Agency
UNESCO	-	The United Nations Educational, Scientific and Cultural Organization
IPDC	-	The International Program for the Development of Telecommunications
INTELSAT	-	The International Telecommunications Satellite Organization
INMARSAT	-	The International Maritime Satellite Organization
SATCC	-	Southern African Transport and Communications Commission
DELs	-	Direct exchange lines
OAU	-	Organization og African Unity
PATU	-	Pan-African Telecommunications Union
SATAC	-	Southern African Telecommunications Conference
PCO	-	Public Call Office
ITSC	-	International Telephone Switching Centre
Mbit/s	-	Megasbit per second
NOK	-	Norwegian krones
SEK	-	Swedish krones
NW ZAMBIA	-	The North-Western Province, Zambia
ZPTC	-	Zimbabwian Post and Telecommunications Corporation
ZKW	-	Zambian Kwacha
HF radio	-	High Frequency radio
ITT	-	International Telephone and Telegraph Corporation

GHz band	-	1000 million cycles per second band
MHz	-	Megahertz
MCR	-	Metaconta Rural Exchanges
PABX	-	Private Automatic Branch Exchange
UNIP	-	The political party in Zambia
RSA	-	The Republic of South Africa
BTC	-	Botswana Telecommunications Corporation
Vic Falls	-	Victoria Falls
MUX	-	Multiplexer
TDM	-	Telecomunicações De Moçambique
IRDP	-	Integrated Rural Development Programme

1 INTRODUCTION. NORWEGIAN AID OBJECTIVES AND TELECOMMUNICATIONS

1.1 Introduction

Norway has supported a number of telecommunications projects during the last decade (cf. Annex H). In the same period, the discussion about objectives and strategies for Norwegian development assistance has focused on concepts related to poverty alleviation, target group oriented aid in addition to economic growth. One of the purposes of the sector evaluation is to assess "the compatibility between the sector policies and the principal objectives of the Norwegian development assistance" (Terms of Reference, 3.10 iii).

The conclusions and recommendations of this study, will, among others, contain the following issues[1-1)]

* *Discussions on telecommunications sector policies in view of the general objectives of Norwegian development assistance.*

* *Discussions on telecommunications projects in the SADCC region in view of these objectives.*

In this introductory chapter the Team shall outline the objectives of Norwegian development aid as a background for the evaluation.

1.2 The general objectives of Norwegian development assistance

The most recent and comprehensive statements of the objectives of Norwegian development assistance are found in the two government white papers from 1984 (no 36) and 1986-87 (no 34).

[1-1)] Conclusions and recommendations in Chapter 2, 13, 14, and in Executive Summary.

While both papers agree on the overall objectives,

* *to contribute to lasting improvement in the economic, social and political conditions of the population in the developing countries*

* *to focus particularly on the needs of the poorest groups and countries*

* *to avoid creating dependence on continued aid,*

their perspective also differ in some respects.

The former (36) puts greater emphasis on a basic needs oriented strategy, while the latter (34) explicitly acknowledges the existence of several, in some respects competing, objectives. The major objectives, as stated in the last white paper, are

* *proper management of natural resources, nationally and internationally, to secure a sustainable development*

* *economic growth as a necessary precondition for improving living conditions*

* *improve living conditions of the poorest groups; in addition to assistance aimed at general economic growth, Norway should also give aid directly aimed at these groups. Particular emphasis is placed on improving the situation of women. This has been given additional strength by the adoption of a special strategy for assistance to women*

* *secure human rights*

* *promote peaceful coexistence between nations and regions.*

In addition, some other principles are stressed:

* *assistance should be based on the plans and priorities of the recipient countries*

* *assistance should be untied, and Norwegian suppliers should only be used when prices are internationally competitive. Use of Norwegian suppliers are accepted if they are not more than 10% above international market prices.*

The 1986-87 white paper explicitly discusses the relationship between economic growth and poverty alleviation. The white paper stresses that support aimed at increasing the general economic growth is a necessary, although not sufficient, condition for improving life for the target groups.

1.3 Objectives of Norwegian assistance to SADCC

The SADCC region has been a main recipient of Norwegian assistance to the telecommunications sector, funded from a separate grant for regional SADCC projects. Though the general objectives cited above are also valid for the SADCC support, this assistance also reflects a strong Norwegian support to the basic objectives of the SADCC cooperation. As spelled out in the Lusaka declaration, these are primarily to reduce the dependence on South Africa and to promote cooperation between the SADCC countries.

There is therefore a strong political dimension in the SADCC support, which may override the concern with the general objectives of Norwegian aid. Both SADCC's strategy in the initial years, and the Norwegian assistance to the cooperation, have focused heavily on major infrastructural activities (particularly within communication and energy) aimed at realizing the general objectives of the cooperation. In its content the assistance to SADCC has therefore come to differ from the main trust of Norwegian aid during the 80's.

SADCC's role in the projects has normally been limited to the investment phase. The operation of the services created is the re-

sponsibility of the individual countries. The emphasis has therefore been on investment projects, with less emphasis on strengthening the institutions that are responsible for the future operation of the projects. Even if some changes have occurred lately, SADCC projects probably still differ in this respect from bilateral projects.

1.4 Objectives of the Norwegian assistance to the telecommunications sector

There is no overall Norwegian strategy for the assistance to the telecommunications sector, spelling out the objectives of this assistance and priority areas for Norwegian support. The present study may provide some background for the preparation of such a strategy.

The objectives of the Norwegian sector assistance will therefore be discussed on the basis of the objectives of some of the projects supported by MDC during the last years, as spelled out in the project documents.

2 SUMMARY. CONCLUSIONS AND RECOMMENDATIONS

2.1 Short summary

In Chapter 3 are presented some methods for evaluating telecommunications projects and telecommunications as an infrastructure component in the development process. In Chapter 4 the Team discusses views on telecommunications in a socio-economic and cultural context. Chapter 5 gives a general review of international development in the telecommunications sector, and Chapter 6 outlines the telecommunications development i Africa and in the SADCC region. In Chapter 7 is given a short description of projects in the SADCC region supported by NORAD.

Chapter 8 outlines the Team's approach with regard to the evaluation of the selected projects, and Chapter 9, 10, 11, and 12 give a description and evaluation of these projects.

Conclusions and recommendations with regard to a sector policy are presented in Chapter 13, and Chapter 14 contains the Team's recommendations for future assistance to the SADCC region.

2.2 Telecommunications sector policy in general: Conclusions and recommendations[2-1)]

Our analyses, conclusions and recommendations are based on the basic assumption that the developing countries' long run objective is to develop into societies with a variety of industries being able to compete on the international market. We thus take it to be a basic precondition that the developing countries wish to, or have to, adopt to the prevailing trends of international economic development.

Furthermore, our conclusions and recommendations shall take into account the general objectives of Norwegian development assistance.

According to the above conditions, the Team finds it reasonable to state:

[2-1)] A more extensive discussion is given in Chapter 13.

* *Interregional telecommunications projects (international projects) are clearly profitable and vital for international trade, regional cooperation and international contacts in general, and the Team concludes that such projects should to be supported by NORAD. It is a fact that Norwegian companies have the technology and competence to assist in such projects.*

* *On the national level, Norway should be prepared to support "missing main links" in the national networks. Such projects are favourable economically, socially and, not the least, politically, and constitute a precondition for rural telecommunications development at a later stage. As in the case of interregional projects, Norwegian companies can contribute.*

The question of Norwegian support to telecommunications becomes more complicated when considering further expansion of the national networks. One has to evaluate the question of urban versus rural networks, of regions (areas) experiencing growth versus backwards regions, the question of supporting "growth poles" versus balanced growth in all regions and balanced growth in all parts of regions, and the question of which groups of people should benefit most.

We shall discuss the matter in view of two basically different strategies of development:

Strategy 1: *A strategy primarily aiming at equality with respect to development among regions (provinces, districts), among industries, and among social groups of the population*

Strategy 2: *A strategy aiming at a fast economic development in regions (areas) with the best growth potential.*

The principle of equality in strategy 1 is advantageous in order to avoid social disparity and political instability. However, resources are used in a very "scattered" way, which may hamper economic

growth. A balanced growth strategy may develop a rather large unproductive public bureaucracy, busy in planning and administering projects never implemented or implemented at a very slow pace. There are few incitaments for entrepreneurship and for mobilization of private resources, production, distribution and transport may not be cost-effective, and the working moral may be low.

The main advantage of strategy 2 is the focus on releasing productive resources, private capital, know-how and entrepreneurial skills. The largest disadvantage is a tendency to create and possibly enlarge inequalities among regions, industries and groups of people. High migration may also be a problem, creating slums and increased number of criminals in the bigger cities.

Experience from developing countries over the last decades shows that countries, which have mainly followed strategy 2, have had the highest economic growth. The economic benefits have been very unevenly distributed, however, both among regions (areas) and among groups of people.

Economic growth is a major objective of Norwegian development assistance. However, another important objective is to support projects improving conditions of the poorest and least resourceful groups. While the first objective is supported by strategy 2, the second objective seems to be better met by strategy 1.

* *In a long run perspective the strategies may be combined. Hence both the above mentioned objectives may be accounted for. By focusing on development of productive forces, particularly in areas with good growth potentials at the early stages of development, the economy may come faster to a "take-off". In a later stage, more attention could be paid to equity problems.*

For political/social/cultural reasons, however, all regions (provinces) should be involved in the growth process in some defined priority areas.

Traditionally, the estimated internal rate of return on investment is used as an economic criterion for evaluation of telecommunications projects. The incremental revenues generated by a new pro-

ject are estimated (as a proxy for benefits) and are compared with the investment, operating and maintenance costs over a certain time span.

Since the effects of telecommunications projects have a much broader perspective, however, the following conclusion is valid:

* *Although a network expansion in a given area may be implemented and operated at a loss for the telecommunications organization, the expansion may be favourable from a national economic point of view. In order to evaluate expansion projects in a broader context, cost/benefit analyses should be used. Expansion projects may be evaluated and chosen among according to the ratio of benefits to costs.*

The cost-benefit analysis reflects the economic potentials of an area and is as such a useful tool for giving priority to specific projects and to the development of growth poles.

As could be expected, cost/benefit-analyses undertaken in several developing countries indicate that the ratio benefit to costs is higher the more urbanized the area, and highest for the higher income groups. However, the ratio is positive also in many rural areas, indicating, among others, the existence of a huge unsatisfied demand, and the high costs of alternative forms of communication.

* *As a conclusion, we will state that in a long run perspective, NORAD should focus more on strategy 2 than strategy 1 in the first stages of development, primarily supporting the objective of economic growth. The main point is that such a policy will bring the country in question faster to a development stage, where it is economically feasible to start developing backward areas. When this stage has been reached, NORAD should support projects in such areas.*

* *NORAD should thus be willing to support telecommunications projects in urban areas, as well as in selected rural areas. When concentrating on rural are-*

as, support should be given on the basis of a cost/ benefit analysis,[2-2] *and as a part of an integrated rural development plan.*

* *Whether or not Norwegian firms should contribute in rural telecommunications projects is an open question. So far, Norwegian firms have little experience in this field.*

The above conclusions and recommendations are based on a long term perspective. In a more short term perspective and according to a policy giving more weight to other objectives than economic growth, the conclusions may be others.

A fast expansion of the telecommunications networks tends to create "bottlenecks" in the system, which may severely reduce operating capacities. Inadequate capacities result in huge numbers of unsuccessful calls, reducing the efficiency of private and public enterprises and organizations. Thus:

* *NORAD should be prepared to support projects eliminating such bottlenecks. The benefit/cost ratio is likely to be very high for such projects, and the gain is distributed to all areas and groups of people connected to the system.*

For rural telecommunications projects NORAD should apply "an integrated development approach". More generally, the question of "a sector approach" compared to "an integrated development approach" depends on the type of project considered. The Team draws the following conclusion:

* *All projects concerning rural telecommunications should be evaluated in a context of integrated development plans, and the more so in poor and remote districts. Main national links, and particularly international links, which are economically profitable*

[2-2] Some main aspects with regard to cost-benefit analysis are treated in Chapter 3.

and vital for developing the countries' economic potentials, do not need the same broad scope of evaluation.

The choice of appropriate technology is important for all development projects, and in particular for telecommunications projects where the technology content is so high, and where the choice will have strong impact on performance, costs and ease of operation.

It is not possible to define generally what appropriate technology is. However, as a general rule the latest technology should be applied, because of:

- *improved performance*
- *wider choice of equipment and stronger competition on the world market with a corresponding reduced cost*
- *easier operation and maintenance*

One particular question concerns digital versus analogue systems. The digital systems are basically more complex, but once they are properly developed, mass produced and with adequate operational experience, they are usually superior in performance, lower in cost and easier to operate and maintain.

The Team thus concludes:

* *As a general rule, digital technology should be preferred for future projects supported be NORAD.*

A critical element in rural systems is the supply of power. Since modern electronics can be constructed with a decreasing requirement of power, the renewable power sources become more attractive. Solar power generators are one of the possibilities. It must be emphasized, however, that the conditions must be suitable with regard to sunshine statistics. It may also be neccessary to use supplementary power sources, like wind generators.

* *Because of the cost-decreasing elements, solar power*

will be more attractive in the future in places with favourable sunshine statistics.

An important objective of Norwegian development aid is to secure a sustainable development, and to avoid creating dependence on continued aid. Telecommunications development has the following characteristics:

* *Since telecommunications are a highly developed, technologically advanced industry, with relatively few, quite large firms competing on the world market, most developing countries have to import a major part of investment facilities and spare parts. In such a respect, the developing countries will be dependent on developed countries in a long run perspective.*

  Furthermore, the telecommunications sector needs well educated and highly trained manpower, particularly in engineering, a fact which may create dependence on outside help for many years to come.

* *The marginal capital-output ratio in the telecommunications sector (the relation between new investment and expansion in output) is large compared to most other industries.*

  In many countries the foreign exchange component range between 50 and 60 percent of total investment requirements in the sector, for some countries even higher. As such, the telecommunications sector is rather foreign-exchange-intensive, and thus very much dependent on the balance of payment situation. However, as a result of improved and expanded telecommunications, foreign exchange requirements of a country may be reduced in other sectors of the economy.

  So far, there is no research indicating the net effects on the balance of payment.

Another aid objective is to contribute to lasting improvement in the economic, social and political conditions of the population in the respective developing country. Generally, the Team concludes:

* *Like other infrastructure investments telecommunications are important for the above objective.*

  Since telecommunications are a cost-declining industry, tending to become cheaper relative to other means of communication, the relative importance of the sector is increasing with respect to economic, social and political integration.

An objective of Norwegian aid concerns environmental issues. The main conclusion is:

* *To establish and operate telecommunications systems create few environmental problems.*

  To the extent telecommunications can substitute transport, or be a means for making better utilization of transport fleets, the sector contributes to reduced energy consumption. Misuse of cars is a widespread problem in many developing countries, very much caused by false or inaccurate information. The potential for saving transport seems to be rather big.

  Research both in developed and developing countries support this conclusion.

According to the Norwegian aid objectives, particular emphasis is placed on improving the situation for women.

In developing countries, the development of rural telecommunications is important for health and different aspects of family welfare. Traditionally, women have taken responsibility for these matters. Therefore, a strong focus on women's situation and welfare, would imply giving some priority to development of rural telecommunications.

With respect to telecommunications development, the Team will conclude the following:

* *Like in many other technologically oriented sectors, few women are employed in telecommunications. Planning authorities in ministries and in the telecommunications organizations have not put particular emphasis on this question. The question is one of attitudes, both on the part of men and women. NORAD could contribute by emphasizing the matter more strongly.*

  A fast development of rural telecommunications could contribute to improving conditions for women.

The stated Norwegian objectives also put emphasis on national plans and priorities. The following conclusions seem reasonable:

* *Telecommunications are not given the priority the sector deserves in national development plans and recurrent budgets.*

  Although having problems with qualified manpower, the telecommunications organizations are rather professional entities, whereas planning ministries often lack the competence needed to fully integrate the sector in the development plans.

  At provincial level, the Team experienced that there were no cooperation between the telecommunications sector and the Regional Planning Authorities with respect to planning. PTC did its own collection of essential stastitics in the North-Western Province, information which was available in the Regional Planning Office. Hence, telecommunications were not well integrated in the Provincial Development Plans.

Another key issue is the question of turn key projects compared to projects involving to a higher degree the Local Administrations in the planning and implementation process.

Turn key projects are usually most effective for system implementation with given performance and within a specified time. This is mainly because the responsibility is uniquely defined. The responsible contractor can direct its efforts to the "critical path" of the project, whether this is transportation, civil works or equipment installation.

The turn-key approach is not so easy to combine with strong involvement from the receiving side. Difficulties can therefore arise when the receiving organization shall take over the responsibility for operation and maintenance of the system.

It is also a disadvantage of turn-key projects that the learning element for system implementation is missing.

A general rule for the choice of project cannot be given, but turn-key projects are most attractive to solve unique problems for which a timely completion is important, such as removal of bottlenecks in the telecommunications system.

A stronger participation by the Administration is important for projects initiating activities for which the Administration will bear the long time responsibility, and where building up own competence is essential. It must, however, be emphasized that the Administration must have the necessary resources to accomplish their part, in terms of manpower and financial resources. This was a problem for the ZAM 100 project.

Norwegian companies have been strongly involved in the projects evaluated by the Team. According to Norwegian development policies, Norwegian firms may be involved in the aid projects if they are competetive in the world market. In general, the Team concludes:

> *It is very difficult to establish a competitive price level for delivery of telecommunications equipment, and particularly for equipment delivered and installed in developing countries.*

> *This is due to the fact that the telecommunications industry is considered as strategic in the wide sense in most industrialized countries, and therefore supported in different ways, through development contracts and protective procurement systems.*

Regarding deliveries to developing countries, there could be additional elements of support that distort the competitive situation.

Prior to the implementation of the REG 004 project, the combination EB NERA and Ericsson had been evaluated by SWEDTEL, the consultancy company of the Swedish Telecommunications Administration, as competitive on international level.

Also the offer from EB NERA / Ericsson for this project was examined by the Contract Revision Office of the Norwegian Defence Supply Command, and by independant telecommunications consultants.

The REG 020 project was initiated by an international invitation to tender by the PTC of Zambia. Companies from the United Kingdom, Japan and Germany in addition to EB NERA submitted their bids, and EB NERA was selected after a thorough evaluation of price, delivery time etc.

The REG 024 project was awarded EB NERA on the basis of direct negotiation. This approach was chosen based on previous experience with the company, both with respect to cost and with respect to the cooperative relations with the telecommunications administrations concerned. In addition the project would be closely monitored, economically and technically, by the telecommunications consultant of NORAD.

The ZAM 100 project, telephone exchanges to rural areas in Zambia, was an extension of an earlier delivery of 26 automatic exchanges by the Norwegian company STK, then a subsidiary of ITT, now STK Alcatel, financed by a World Bank loan. This should demonstrate the competitiveness of this supplier.

The conclusion to be drawn from this is that the suppliers used for these projects are competitive in price and equipment performance, and contact with the administrations involved indicate clearly that the companies are appreciated for their cooperative attitude.

2.3 Telecommunications policy in the SADCC region: Conclusions and recommendations

Telecommunications development is one of the priority areas within the SADCC regional cooperation, and considered to be one of the basic requirements for economic development in the region and for effective cooperation among the member states. The main aim of regional telecommunication development is to reduce the dependence on the Republic of South Africa as a transit point for intra-regional traffic and promote increased communication between the member states. The Southern African Transport and Communications Commission (SATCC) is therefore responsible for promoting projects with a regional impact such as the PANAFTEL microwave network, satelitte earth stations, international switching centres etc.

The telecommunications development within the SADCC region is based on the SATCC Ten-year Development Plan of January, 1987 which primarily consists of project listing country by country. The Plan is due for revision in 1991 and the new plan will be based on strategic planning, and each SADCC country is supposed to have a telecommunications master plan. SATCC's priority areas will include the completion of the "missing links" in the PANAFTEL network, to Namibia through Nghazi in Botwana and to Angola through the North-Western Province of Zambia.

As a matter of policy, SATCC's involvement in telecommunications development ends at the investment stage. The administration and management of the telecommunications projects fall under the responsibility of the national telecommunication authorities. With regard to manpower development in the telecommunication sector, basic training (i.e. at technician level) is a national responsibility, while the medium to high level training, technical training and management training, is proposed to be conducted on a regional basis.

At the national level, each SADCC country aims at providing telecommunications services to both urban and rural areas. Telecommunications development is included in the national development plans, as a subsector together with transport in most countries. There is generally a lack of integration between telecommunications

and other sectors both in the national plans, and more particularly so for planning at sub-national level. In several countries development of the local telecommunications network is linked to different types of growth centre strategies for regional/rural development.

Only **Zimbabwe** has a fully developed telecommunications master plan.

Most countries seem to have followed a strategy for telecommunications development with three stages

1. establishment of a national network covering the main centres of population and economic activities,

2. coverage of the whole country down to the level of provincial or district headquarters, and

3. emerging approaches to rural telecommunications.

The basic policy of the **Zambian** Government is to provide telecommunications services to support the productive sectors of the economy such as mining, manufacturing, agriculture, tourism, etc. Thus the existing telephone network covers all provincial capitals and almost all district centres throughout the country. Within rural telecommunications priority is given to commercial farming and other productive activities.

In **Botswana**, the Government policy is to provide telecommunication services to all urban areas and a telephone service facility to all rural communities or villages with at least 500 inhabitants using pay phones (public telephones). A strategy for rural telecommunications is under development.

In **Mozambique**, the sector strategy aims at interconnecting all provincial capitals to the national digital system while improving rural telecommunications simultaneously. Because of the security situation, Mozambique has great difficulties in establishing a reliable, terrestrial network.

The financial policy with regard to telecommunication development in all SADCC member states is based on the profitability of the entire telecommunications network which means complete cov-

erage of the cost (i.e. investment and operational costs). This policy allows for possible cross-subsidization between profitable (urban) and non-profitable (rural) areas, but without subsidies to the sector as a whole.

Because of its heavy reliance on imports, telecommunications has benefitted from the "over-evaluation" of local currencies in several countries and will be heavily affected by substantial increases in the costs of foreign exchange.

The 1980's has been a period of heavy investments in expansion and modernization of the telecommunications network in the region. As a result of this expansion, in combination with severe manpower and in some countries foreign exchange constraints, the capacity to operate and maintain the networks is now a major concern in several countries. During the same period there have been rapid changes in the technology used. This has dramatically improved the communications system in the region. Much of this expansion has been funded by donors, and implemented by foreign companies, as has been the case with the NORAD/SIDA funded projects.

The operation and maintenance of this expanded network is now a major challenge to the telecommunications authorities in the countries, but should also be of concern to the donors who have been involved in the expansion of the systems. This requires a strengthening of these telecommunications administrations, and more particularly their operations and maintenance functions, the latter both in terms of manpower and status within the institutions. Manpower and organizational development will therefore in the future be equally important issues in the development of the sector.

Both in Zimbabwe and Zambia, the PTCs have experienced a loss of qualified and experienced manpower during the 1980's, which in some respects have actually reduced their capacities.

The NORAD assistance has already to some extent moved in this direction, through the second phase of REG 020 in Zambia, and REG 043 in Zimbabwe.

An analysis of the manpower situation in the sector, and the preparation of both a regional strategy and national strategies for manpower development is one of the most urgent tasks, including

the development and coordination of training facilities within the region.

A major part of the Norwegian assistance to telecommunications in the SADCC region has been to international radio links forwarded for funding through SADCC, and funded from MDC's special grant for regional projects.

The radio links are, together with other types of international transport and communications, the most easily identifiable projects with a regional impact. This to a large extent explains the prevalence of such projects in the early years of the SADCC cooperation. So far it is perhaps also the area in which the SADCC cooperation has accomplished the best results. Without the SADCC cooperation, and the backing to this cooperation by donors like NORAD, some of the links would have taken much longer time to be realized.

As discussed in Chapters 9 and 10, there has been a tendency to move from an initial investment project orientation, gradually towards more concern for operation, maintenance and institutional support to the national telecommunications administrations. This touches a wider issue of the relationship between SADCC and the member countries, and, from the donor's perspective, the relationship between regional and bilateral assistance.

For SADCC, there is a need to focus more on clearifying the regional dimension in systems operation, e.g. the role of regional repair facilities and regional training facilities, and also define more clearly the criteria for "regionality" for a project/activity.

Today, Norway supports the Zambian and Zimbabwean PTCs with personnel, with funds allocated from the regional SADCC grant. This way of using the regional funds may have been a practical way for MDC and the recipient countries to find money for necessary follow-up of regional investment projects, for which it may not have been possible to find bilateral funding. However, the projects are for all purposes bilateral. The personnel is not working particularly with the maintenance of the international links or training with a regional orientation. MDC should therefore consider if it is natural to continue funding them from the regional grant. This is probably an issue which is of relevance not only for telecommunications projects, but also in other sectors.

On the basis of both the experiences from the evaluated projects, and a general assessment of the sector in the SADCC countries visited, the Team would outline five main options for further Norwegian assistance to telecommunications in the SADCC region. The options represent broad directions of future assistance rather than specific interventions.

The options are:

1) Support to new microwave links, to complete the terrestrial PANAFTEL network.

The major part of past assistance has been to such links, and the experience with the Norwegian equipment and the Norwegian company has in general been to the satisfaction of the recipient countries.

There are still "missing links" in the PANAFTEL network, and some of these links are a natural continuation of past Norwegian assistance. This applies in particular to the link Zambia-Angola, which is a continuation of REG 020, and the link Botswana-Namibia, once Namibia becomes independent, which is a continuation of the present commercial assistance to Botswana. Particularly the connection of an independent Namibia to the SADCC region, without transit through RSA, would seem to be a natural continuation of the past Norwegian support to both telecommunications and Namibia's struggle for independence.

Experience from Zambia and Zimbabwe indicates that support to investment projects of this type, easily leads to a broader involvement with the national telecommunications administrations, and a need to continue with other types of assistance. As part of the assessment of possible future investment projects, there is also a need for a realistic assessment of the capacities of these administrations, and the likely future needs for assistance to secure the operation and maintenance of the links.

2) Support to regional training and repair facilities.

The individual SADCC countries have too limited requirements for specialized manpower, both technical and managerial, to justify the establishment of advanced national training institutions. As a whole, the training needs in the SADCC region may be sufficient for the establishment of regional training facilities, rather than relying on overseas training. The same argument applies for repair facilities, since the market in the individual countries may be too limited.

The establishment of regional institutions, both for training and repairs, requires careful planning to identify the needs and in order to agree on how and where the needs should be met. It also requires clearification of responsibilities with respect to the operation of such regional institutions, and a strong commitment from the individual countries (where the facility is not located) to make use of the facilities. For training, the language problem may be a problem when including Mozambique and Angola in such arrangements.

From NORAD's perspective, this would have the advantage of continuing the regional perspective of the telecommunications assistance, while at the same time orienting it more towards operation and maintenance.

3) Support to the national telecommunications administrations to strengthen their capacity to operate and maintain the existing networks.

The SADCC countries have implemented ambitious investment programmes, leading to rapid expansion of their telecommunications networks during the 1980's. Generally, the development of the organizations and their capacities to operate and maintain the expanded networks, have not kept pace with the system expansion. This applies particularly in the field of manpower development, but also development of maintenance

routines, and strengthening of the organizations in the field of maintenance. The economic situation in some of the countries, with an acute scarcity of foreign exchange for necessary imports, also makes the import of spares, vehicles for maintaining the vast networks etc. a major constraint.

Depending on the specific situation in the country, there is a need for import support to spares, for support to training and manpower development, for technical assistance and management support particularly in the field of maintenance.

Such assistance should be based on a broad assessment of the organizations in question, based on a perspective of institution building and should be integrated parts of plans for organizational development supported by the organizations themselves. This requires a much closer dialogue with both the telecommunications administrations and their parent ministries than has so far been the case, and a more active, and thus demanding, role for NORAD, both during planning and follow-up of the assistance. It also implies a continuation of the process of "bilateralization" of the telecommunications support, and may raise the question of use of bilateral rather than regional funds.

4) Support to the development of rural telecommunications.

The countries, with the exception of Mozambique, have or will shortly have a telecommunications network covering most of the countries down to the level of district headquarters. This is a necessary precondition for a future development of a rural telecommunication system. Development of rural communications is a priority area, and some countries are preparing more elaborate strategies for this development, including technological options and strategies for funding. This strategy implies a further expansion of the telecommunications networks, into more remote areas, and thus a

further addition to the already existing maintenance problems. Since rural telecommunications normally need to be subsidised, it will also influence the financial position of the sector as a whole.

Development of rural telecommunications can be primarily oriented towards high potential areas for commercial production (commercial farmers and other producers), able to pay quite high costs for installation and operation of a network. This seems to be the strategy in Zambia. It can also be more oriented towards rural service institutions like health centres, payphones in rural areas etc., which would mean users less able to pay the costs of the system, and thus more need for subsidies.

An advantage for NORAD with this option is that it makes it easier to orient the support towards poorer sections of the societies. Such an orientation would, however, need subsidies.

This option also implies a more bilateral orientation of the support, and it would be difficult to maintain the present pattern of funding from the SADCC grant. It would therefore require that NORAD and the recipient countries agree on including the telecommunications sector under the bilateral country programmes.

Assistance to rural telecommunications requires a careful analysis of the relationship between telecommunications and other sectors in the area in question. To realize the potential benefits from telecommunications, there will often be a need for supplementary assistance to other sectors. This option can therefore best be considered in areas where NORAD is involved in other sectors, e.g. through integrated rural development programmes, or in cooperation with other donors involved in rural development in the area.

Because of the need for a more multisectorial ap-

proach, the option should, if considered relevant, preferably be implemented on a pilot basis As for option 3) it will require a stronger involvement from NORAD in project planning and implementation, more so since there are no experienced Norwegian companies, with an experience similar to EB NERA's for microwave links, to rely upon. It is also uncertain if the pattern of using Norwegian equipment will be possible with this option.

5) Support to capacity adjustment in the existing national networks.

Unbalance in capacity in the networks may represent serious bottlenecks, implying very bad utilization of the systems. Selective investments with respect to capacity adjustment are likely to have huge immediate effects on overall system performance.

Capacity adjustments may be needed with respect to links and exchanges, both main and local exchanges.

Having outlined the options, there is a need also to develop criteria for prioritizing between the options. The priorities will have to depend upon the policy guidelines outlined in Chapter 14.3, and take into account the differences between the countries.

On the basis of the analysis of the situation in the SADCC countries presented in the present evaluation, the Team would generally recommend that **priority is given to option 2 and 3**, i.e. assistance aimed at strengthening the national telecommunications administrations' capacity to operate and maintain the existing network.

Two main factors support this conclusion:

* *the rapid system expansion during the last decade, and the absence of a parallel development of the institutional capacities*

* *the critical economic situation in several SADCC countries, and the general policy in these countries*

of giving priority to rehabilitation and maintenance of existing infrastructure as part of the economic recovery programmes.

Thus both the situation within the sector, and the general situation in the countries support the conclusion.

Regional and bilateral assistance could be used in a complementary manner in a strategy for creating a more sustainable telecommunication network. Such a strategy would, however, require a stronger involvement from NORAD, and in particular the NORAD representations in the respective countries, both in the sector in general and in the individual projects.

The above conclusions and recommendations seem to be the most relevant ones in a short term context. To increase the countries capacity to plan and run their telecommunications systems projects is vital **before**, or at least **along with** further expansion of the networks. In a long term perspective, however, options 1, 4 and 5 should also be considered.

The strategy should also take into account the contributions from other donor countries in order that different projects supplement each other.

3 MACROECONOMIC AND MICROECONOMIC METHODS FOR ANALYSING THE BENEFITS OF TELECOMMUNICATIONS INVESTMENT

3.1 Introduction

In this chapter we shall very shortly describe some of the methods available for making quantitative analyses of the importance and the benefits of the telecommunications sector. To make in-depth-analyses is a time-consuming process and lack of reliable data makes it rather difficult to actually take fully use of the methods in question.

We find it useful, however, to comment on some of the methods available, as a "background" for the project evaluation process, and as a background for evaluating concrete projects.

3.2 Aggregate correlation analysis

Measure of availability and use of telecommunications systems compared with measures of aggregate economic activity, such as gross domestic product (GDP), are the most used type of empirical analysis.

Like electricity, telecommunications infrastructure is an input to a productive process. The view that telecommunications are a factor of production has led to empirical work where the analyst has assessed the effect of telecommunications at the macroeconomic level and at the country level using statistical correlation or regression analyses. Most analyses have involved a macroeconomic country level model with only one equation. The parameters of the model have been estimated from data on the provision or use of telecommunications, and from one or more indicators of the level of country-wide economic activity. The analyses in question include both cross-section studies and time series studies. In the first case, the focus has been on comparing different countries and regions at a single point in time, and in the latter case the variables are traced over time for a single country or region.

In the earlier studies, the models used were very simple, relat-

ing telephone lines per 100 persons to GDP or other indicators representing proxy measures for the wealth of a country. These studies are naive in the sense that they are very crude and that too ambitious conclusions have often been drawn as if some causal relationship have been proven. As could be expected, a high degree of correlation is shown between the variables. In some studies a so-called telecommunications "utilization factor" has been used, defined as the number of telephones per 100,000 US dollars of GDP. In all these studies the conclusion has been that highly developed countries have a high density of telephones and that less developed countries have a low density of this means of communication. Hence, such studies do not make any new contributions to understanding the role of telecommunications in the development process.[3-1]

Analyses of the above type are subject to limitations. The relations between telecommunications and different kinds of economic activities are far too complex to be represented by a single equation model. In cross-section analyses, the highly developed countries at the upper end of the telephone density range are compared with the developing countries at the lowest end of the telephone density spectrum without taking into account that developed countries tend to have efficient and reliable automatic telephone service, coverage throughout the country and almost no waiting lists and waiting time, whereas most developing countries have limited national coverage, a large unsatisfied demand, major call traffic congestion both on local and long distance networks.

Using GDP per capita to predict telephone density assumes that a change in overall economic activity results in a change in telephones. Many analyses have been of this kind. Other studies treat telecommunications as a production input and try to measure the effect on economic activity in a particular sector, for example, the relation between the use of telex and tourism. The authors of such studies sometimes seem to claim a causal relationship.[3-2)]

[3-1)] Examples of such studies:

A. Jipp, "Wealth of Nations and Telephone Density". Telecommunications Journal, July 1963.

CCITT, "Economic Studies at the National Level in the field of Telecommunications", Geneva, ITU, 1968.

[3-2)] P. G. Yatrakis, "Determinants of the Demand for International Telecommunications", Telecommunications Journal, vol. 39 (1972).

* *The aggregate statistical model approach has so far contributed very little to clearify the importance of telecommunications in the process of economic growth. The analyses could possibly be improved by using more sofisticated techniques, such as more complex econometric models.*

3.3 Structural economic analysis

A sometimes manageable way of making a disaggregation is to examine the association between telecommunications infrastructure and economic activity in various sectors, a sort of structural economic analysis.

It seems reasonable to assume that telecommunications, as an input to production processes, are not equally important to all productive sectors of the economy. While the primary sector makes relatively little use of telecommunications, the tertiary sector is the most intensive user. The secondary sector lies somewhere in between. [3-3)]

Many studies support these assumptions both in developed and developing countries.[3-4)]

The importance of sector structure can be illustrated by the economic development in France. For many years, up to the 1970s, telecommunications developed much slower in France than in most other advanced industrial countries. This fact had no adverse effect on rate of growth, however, which, in real terms, was more than 6 percent from 1955 to 1970. During this period, a particular strong growth occurred in the primary and secondary sectors, while the tertiary sector growth clustered in a few dominant centers. From the

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[3-3)] The primary sector includes agriculture, fishing, forestry and mining. The secondary sector contains construction and manufacturing, and the tertiary sector commerce, communication, transport and other services.

[3-4)] Example of study:
United Nations: "International Comparisons of Inter-Industry Data", Industrial Planning and Programming Series, no.2 (New York, 1969).

1970s the telecommunications sector was heavily expanded because of a shift in the growth structure emphasizing communication-intensive sectors and according to a wish to increase the regional dispersion of economic activity.

To the extent that the benefit potential of telecommunications services is sector specific, the analysis should be disaggregated if available data exists. A first step in disaggregating could be to consider how much of the output of the telecommunications sector is used by final consumers, private households or private agencies, and how much is sold as intermediate goods in the primary, secondary and tertiary sectors.

When making cross-country comparisons, another serious problem exists, since prices across countries vary widely and in some cases bear little relation to costs. Another serious problem is the fact that the raw data often are subject to big inaccuracies. But the most serious problem as to cross-country comparisons stems from the fact that in developing countries there are typically acute and persistent shortages in the supply of telecommunications services, and in many instances the quality of service is poor.

* *A major problem with input-output studies is that data is not always readily available. And although a country may have a fairly up to date input-output table, telecommunications are almost never treated as a sector by itself, but include other kinds of communication such as postal services. This is a serious deficiency since their input requirements, particularly capital and labour, are very different as is the nature of the demands for their output. In many cases, the service sector is treated as a single group.*

3.4 Information economic analysis

The objective of the so-called information sector analysis is to identify the extent and the importance of information-related processes of controlling, coordinating, monitoring, recording and organizing pro-

ductive activities. These kinds of analyses are based on theories concerning economics of information, decision theory and modern organization theory. Theories of this type are interesting as communication emerges as a very crucial factor in the performance of both individual economic units and of markets. Good communication can, among others, be used to reduce uncertainty, increasing the probability of better decisions. Good telecommunications may also have a big impact on the innovation process and the spread of new processes, techniques and methods.

* *Information economic analyses have not been undertaken in developing countries. Research in developed countries[3-5] suggests that information-related activities account for almost half of GNP, and that such activities have grown faster than GNP. The relative importance of information is expected to increase also in developing countries.*

3.5 Microeconomic analysis of benefits

The benefits of a specific telecommunications project or investment programme can hardly be identified and measured by the models and analyses suggested above.

Cost-benefit analysis can be used to help determine:

- *the amount of resources that should be devoted to the telecommunications sector*

- *the best way to use resources within the sector itself*

[3-5] Example:
J. W. Halina, "Communications and the Economy: A North American Perspective", International Social Science Journal, vol. 32 (1980).

- *the proportions of investment to be allocated to:*
  - *local versus long distance facilities*
  - *urban versus rural networks*
  - *public call offices versus subscriber telephones.*

Generally, economic theory prescribes that investment in every sector should be increased until all projects have been financed that yield rates of return in excess of the opportunity cost of capital.

The telecommunications situation in most developing countries seems to be characterized by a huge unsatisfied demand, and, therefore, telecommunications expansion does meet the above economic criterion in most cases.

Two kinds of information should be reviewed when examining the effects of a particular project or programme.

First, the investment and the associated operation and maintenance costs should be compared with the estimated benefits to the users of telephone, telex and other services. The calculations should be based on the users willingness to pay for the services, perhaps based on their willingness to incur costs to travel to where services are available, to purchase or rent connections from intermediaries, or to incur higher communications costs in the absence of telecommunications services.

Secondly, information should be gathered about the characteristics of the beneficiaries of the improved and expanded services in order to qualitatively analyse these data in light of the countries' development plans and programs.

Traditional analyses of telecommunications investment use estimated internal rate of return on investment as an economic criterion. The incremental revenues generated by the new projects are estimated (as a proxy for benefits) and are compared with the investment, operating and maintenance costs over a certain time span.

In a cost/benefit analysis several adjustments are made. First, the prices used for the inputs in the projects should be reconsidered to compensate for any distortions in the price system. (The use of shadow prices).

Secondly, benefits will usually be higher than revenues, because of at least three reasons:

1. Subscribers and users of public call telephones may value the service far more than they are required to pay for it. (Consumer surplus).

2. New telephone subscribers not only incur benefits for themselves. They increase the benefits of being connected to the system for those who are already connected. (Subscriber-related externalities).

3. The willingness to pay a given price to make a telephone call reflects only a minimum estimate of the benefits incurred by the caller and does not reflect the benefits of the calee. (Call-related externalities).

Three methods have been used to try to measure consumer surplus (Point 1 above):

a. Methods based on observing the consumption effects of price changes. (Price-change methods).

b. Methods based on evaluating the cost of a given communication activity - the use of telecommunications is compared to the best alternative means of communication. (Best-alternative methods).

c. Methods which aim at estimating more completely the costs that telecommunications users actually incur when communicating. (Expenditure methods).

The subscriber-related externalities and the call-related externalities (point 2 and 3 above) are important but very difficult to assess in practice.

** As could be expected, cost/benefit-analyses[3-6] made in several developing countries indicate that the ratio*

[3-6] Examples of such analyses:
Robert J. Saunders and Jeremy J. Warford, "Evaluation of Telephone Projects in Less Developed Countries", Telecommunications Journal, vol. 46, (Jan. 1979)
G. C. Chu and C. Srivisal: "Cost-benefit Analysis as a Guide for Investment in Telecommunications: A Study in Rural Thailand", World Telecommunications Forum, 1986.

benefit to costs is higher the more urbanized the area, and highest for the higher income groups. However, the ratio is positive also in many rural areas, indicating, among others, the large unsatisfied demand and high costs of alternative forms of communication.

3.6 Conclusions

So far, the macroeconomic methods have given little insight into the role of telecommunications in the development process.

In countries, which have adequate input-output tables, input-output analysis is a suitable tool for analyzing the consequences for the telecommunications sector of changes in production in other sectors.

Information economic analyses are very difficult to undertake, because of lack of reliable data.

Microeconomic analysis of benefits (cost-benefit analysis) is the most used method, and the method is suitable for analyzing concrete projects. However, the method is time-consuming, as it has to be based on thorough investigations about preferences, benefits and communication alternatives for a representative number of actual or potential subscribers.

A simplified cost-benefit analysis could have been used in connection with two of the projects in the present evaluation. Arguments on the matter are given in Chapter 8 and Chapter 13.

4 AN ANALYSIS OF THE ROLE OF TELECOMMUNICATIONS IN THE SOCIO-ECONOMIC AND CULTURAL DEVELOPMENT OF THE DEVELOPING WORLD

4.1 Different views on telecommunications development

Broadly, views on telecommunications development fall into three categories:

Category 1: Investment in telecommunications should be held far below the level indicated by the market forces. [4-1)]

Some advocates for this view put emphasis on the fact that it is difficult to measure the economic effects of telecommunications investment. Others claim that although telecommunications do serve economic and social needs, it does so in an undesirable way. The main point of view is that telephony development is for the elite groups and is to the benefit of the modern and urban areas of society. In such a process, economic opportunity is concentrated in urban settings, which, in turn, may enhance urban migration. Some critics put forward that such a development process, tending to create bigger inequalities, may lead to political instability.

Critics with respect to introduction of new technologies to the LDC's often are of the opinion that these new technologies are inappropriate to the economic, social and cultural conditions prevailing in these countries. They argue that these technologies are expensive, that they are difficult to maintain (for a number of reasons), that they fall short of expected performance, and they fail to benefit the needier segments of the population.

[4-1)] Indicated by demand (taking, among others, into account potential subscribers on waiting lists) at prevailing prices for the services.

Category 2: Telecommunications investment should be in line with demand indicated by the market forces.

Advocates for this market-response strategy maintain that the telecommunications system should be developed by autonomous operating entities behaving like commercial enterprises with access to capital markets for investment funds. The operating entities should be subject to some governmental control, however, to ensure access to basic services, for example by providing minimum telephone access to the provincial areas.

Broadly speaking, this view is held by The International Telecommunications Unions (ITU) and The Consultative Committee on Telephone and Telegraph (CCITT). These organisations claim that telecommunications systems are an important part of the national economic infrastructure bringing about widespread benefits. One argument is that many developing countries have failed to recognize the full benefits of telecommunications resulting in chronic underinvestment in the sector..

Category 3: Telecommunications systems should be expanded more rapidly and in a wider context than indicated by the market forces.

This view is taken by the activist technology-oriented group. The main argument is that telecommunications are a prime means to achieve a variety of economic, social and cultural goals. Vital in this respect is the expansion of telecommunications to rural areas to cover basic needs of the population. A telecommunications system expanding in accordance with the market forces will not necessarily meet these ends. A comprehen-

sive coverage of telecommunications to remote areas, and areas where people are poor and often live scattered, is rather expensive and tariffs would be quite high in order to cover real costs. Some advocates for this view therefore propose, not only that the profitable section of the sector should subsidize telecommunications in the rural areas, but that governments should subsidize the telecommunications sector as a whole.

4.2 Possible positive and negative effects arising from telecommunications investment

4.2.1 Generally

In a development process there is an increasing interdependence between economic sectors necessitating increasing flows of information and enhancing the need for rapid communication. Telecommunications are a vital infrastructural component in such a process.

Although it has not been possible to determine the cause and effect relationship between telecommunications and economic development, evidence abounds that telecommunications are both a cause and a consequence of development. But benefits from telecommunications cannot be compared directly to the benefits from sectors providing basic needs and necessities of life such as food, shelter, health, or education. Telecommunications should be seen as a tool or means to an end and therefore should be judged on the catalystic value in the process of socio-economic development.

Furthermore, telecommunications contribute to the development of a shared communication environment facilitating political, cultural, economic and social integration.

As economic development takes place, some form of telecommunications gradually becomes the most cost-effective means of communication for increasing proportions of the population.

4.2.2 Telecommunications as a substitute for transport

Research[4-2] in developed countries has established that travel may be substituted by telecommunications. Similar research has not been done in developing countries. In most developing countries, however, where telecommunications networks are very inadequate, car-trips are currently made, which could have been avoided.

4.2.3 Telecommunications and energy requirements

In developed countries, several studies[4-3] regarding the effect of telecommunications on energy consumption have been undertaken. In the absence of detailed energy input-output analyses of transactions between telecommunications, transport firms, agencies and their suppliers, it is impossible to measure the effects in a proper manner. The studies indicate, however, that increased use of telecommunications tends to save energy. (Mainly fuel, but also other forms of energy).

4.2.4 Telecommunications and efficient use of transport facilities

Studies[4-4] from developed countries on how efficient telecommunications systems may reduce the idle time of vehicle fleets generally conclude that the time saving factor may range between 20 and 30 percent.

[4-2] Example:
M. Tyler, "Implications for Transport", Research Report 24. In R. C. Smith: Impacts of Telecommunications on Planning and Transport. London: Department of Transport and the Department of the Environment, (1978).

[4-3] Example:
M. Tyler, B. Cartwright, G. Bush, "Interaction between Telecommunications and Face-to-Face Communication, The Energy Factor", Intelligence Bullitin, vol. 3, Post Office Telecommunications, Cambridge (1974).

[4-4] Example:
Moon, "Technology assessment of Telecommunications/Transportation Interactions". Vol. 3. Stanford Research Institute, (1977).

There are several studies also in developing countries showing the importance of a good telecommunications system used in relation to transport. A study from India[4-5] showed that poor communication caused much unnecessary movements of empty vehicles. The potentials for developing countries should be rather substantial.

4.2.5 Telecommunications as a part of information and management systems

There is enough evidence that better management of information in all its forms can contribute substantially to solving major development problems facing developing countries.

Telecommunications development can enable individuals and enterprises to obtain accurate, comprehensive and timely information for personal and official use respectively.

Telecommunications enable business enterprises to obtain data and information on the economic situation and policies, business opportunities, markets and plans for competitors, suppliers and customers both within and outside the country.

A joint ITU/OECD study (1983) shows that while investments in telecommunications in developing countries lead to a yield of a high benefit/cost ratio, in individual cases up to 85, losses caused by inadequate telephone services in one of the industralized countries ran up to 2 % of Gross National Product (GNP). Another ITU study (1983), undertaken in Kenya, demonstrated an average of 115 : 1 in the benefit/cost ratio. This study identified nine mechanisms through which the efficiency of business firms would be improved by access to more extensive or reliable telecommunications services:

business expansion
sales
price effects
purchasing decisions

[4-5]S. N. Kaul, "Benefits of Rural Telecommunications in Developing Countries", Conference working paper no. 8, OECD, Paris (1978).

inventory level
vehicle use
production stoppages
distribution costs
labour time and management time.

The comparison demonstrates that extension and improvement of telephone and telex services within the business community can generate benefits greatly in excess of costs.

Telecommunications can also help farmers to arrange for timely supplies, effective collection of produce and access to agricultural information. Broadcasting services to the farming community can also greatly enhance agricultural and food development.

Telecommunications can also improve the efficiency of public administration.

To achieve the above benefits, telecommunications development requires careful planning in order to ensure right capacity, and an appropriate degree of flexibility to meet constantly changing needs of a nation. It must aim at achieving development goals at minimum costs and increase the rate at which objectives are realised.

4.2.6 Telecommunications and the quality of life of individuals

Telecommunications can improve the quality of life of individuals by enhancing interpersonal relationships and improving individual access to information, advice and essential services. Telecommunications also contribute to individual and family welfare by rapid access to services often needed to preserve life, health and property.

4.2.7 Telecommunications as an integral part of a development strategy

Telecommunications as an infrastructural component is a rather important part of a development process and a development strategy.

A development strategy entirely aiming at expanding telecommunications in response to the market forces, will cause a development, which is in favour of urban versus rural development, in fa-

vour of growing industries versus those lagging behind, in favour of rich versus poor people, and in favour of the administrative and political elite.

When telecommunications systems are developed according to the above strategy, demand is likely to be there in the sense that the capacity of the system will be fully used at all times involving subscribers who have the ability to pay for the services at tariffs profitable to the telecommunications sector.

An alternative strategy would be to put great emphasis on rural development and regional equality aiming at improving conditions of the rural population. Certainly, in principle, telecommunications development could be fostered as a part of such a strategy.

To develop a widespread rural telecommunications system is rather costly, however, and the target groups, essentially poor people, will lack the economic capacity to pay for the services.

Whereas the first mentioned strategy would probably yield a substantial surplus to the telecommunications sector, the second strategy would most likely imply that the sector as a whole had to be subsidized.

There are few, if any, developing countries applying any of these strategies in their pure form. Most countries seek to combine them with varying degree of emphasis on the two.

Some countries aim at a strategy where the telecommunications system is developed in such a way that the sector as a whole is earning enough money to be self-sustained. The surplus created in the profitable part of the telecommunications system is used to subsidize rural telecommunications development.

The telecommunications sector is usually a very profitable one in local currency terms. As expansion and operation of the sector claim substantial amounts of foreign exchange, however, the question arises which kind of telecommunications development contributes the most to the foreign exchange earning capacity.

A focus on the foreign exchange problem implies that priority is given to telecommunications expansions which are in favour of the export industries or import-substituting industries, among others, through improvements in the international networks.

The Team has found no studies demonstrating negative effects

of telecommunications projects. The "negative" arguments are of a general character, concerning "undesirable" (from the critics point of view) development processes in which telecommunications are actively used:

Development of telecommunications involves high technology projects creating dependence on developed countries, technologically, economically, and culturally.

The expansion of the telecommunications sector is a part of an urban and industrially based development strategy, which does not improve the living conditions of poor people.

Telecommunications is mainly available to, and used by, the elite.

4.3 Examples of benefits from telecommunications[4-6]

4.3.1 Market information for buying and selling

Introduction to telephone services into several rural towns and villages in Sri Lanka allowed small farmers to obtain current and direct information on wholesale and retail prices of fruits, coconuts etc. in Colombo, the capital city. Before the farmers had telephone service, they sold at prices averaging 50 to 60 percent of the Colombo price. When getting access to telephone, they regularly sold at 80 to 90 procent of capital price. To the extent this higher producer price did not generally affect the market price, but primarily lowered the profit of middlemen, introduction of telephone services contributed to a change in income distribution to the benefit of agricultural producers.

4.3.2 Transport efficiency and regional development

A ministry of agriculture official in Tanzania, who was responsible for project implementation from parastatals and ministry depart-

[4-6] If nothing else is stated, the following examples are from unpublished reports on specific projects on telecommunications.

ments, required daily information from these organizations. Inadequate telecommunications links necessitated frequent visits by car, the official averages three hours of travel each day.

This example is probably rather typical and illustrates the huge waste of manhours as well as the unnecessary use of energy compared to a situation with a better and more reliable telecommunications system.

4.3.3 Emergency security and isolation

During a hurricane in Fiji, one of the smaller islands suffered severe damage with loss of life and many injuries. The only means of communication, an old radio, was destroyed during the storm, and it took one week before assistance was sent to the island.

A technically well designed telecommunications system being able to resist the hurricane, would probably have been in function and made it possible to bring help, medicines etc. much earlier.

4.3.4 Communication and coordination among neighbouring countries

Political problems are sometimes exaggerated by poor communication among countries. Some years ago The Organization for African Unity stated:[4-7]

> *"The political backlash that plagues inter-country disputes in Africa can be attributed to the lack of adequate communication facilities between the capitals of neighbouring countries. The reliance on third parties, which are usually outside the continent and having preconceived notions of African conflicts, is detrimental to the peace and stability required for socio-economic development. These vested interests usually blow out of proportions, minor incidences which can be reason-*

[4-7] Organization for African Unity, "Social Aspects of Telecommunications", paper submitted to the Third African Telecommunications Conference, Liberia (1980).

ably solved if the means of communicating clearly defined positions is readily available and as speedily as possible in order to alleviate the fears of a neighbour in time of crises."

Because of the lack of communication facilities among neighbouring nations, many African countries had earlier to rely on information from Europe.

4.4 Main obstacles to telecommunications development

There are a number of constraints affecting telecommunications development in Third World countries. These among others include the following:

a) Lack of understanding, by policy makers and planners, the role of telecommunications in national development. This is partly due to the fact that benefits from telecommunications infrastructure cannot easily be identified with specific basic needs, and the benefits are less tangible compared to other forms of infrastructure such as, transport, health, education and housing.

Most developing countries are more concerned with programmes and projects which are directly aimed at improving the quality of life of the people such as provision of health and education services, housing, food and water, etc. These sectors receive more attention in national development plans and budgetary allocations. Hence, telecommunications investments in developing countries have lagged behind those in developed countries due to, among other factors, lack of priority status in national plans and budgets.

b) Scarcity of funds for capital investment is a major factor affecting telecommunications organizations. This problem is particularly significant because of the high capital requirements of the sector. The marginal capi-

tal-output ratio (the relation between new investment and expansion in output) is large compared to most other industries.

Although large surpluses in local currency can be generated by the telecommunications entity, these cannot be fully reinvested because of shortage of foreign exchange. In many countries the foreign exchange component range between 50 and 60 percent of total investment requirements, for some countries even higher. However, the foreign exchange requirements for the sector are usually small compared to total imports of a country, ranging from 0.5 to 3 percent.[48]

As a result of improved and expanded telecommunications, foreign exchange requirements of a country may be reduced in other sectors of the economy, through increased administrative and management efficiency and operational productivity. These benefits are very difficult to identify and measure, and thus planning ministries in developing countries have little information, if any, about foreign exchange savings on which to base decisions about allocations and policy.

Hence, many governments probably underestimate the importance of the sector, and give it lower priority than the sector deserves.

c) Many developing countries are engaged in the implementation of economic recovery programmes. The major focus is rehabilitation of existing investments in various sectors of the economy, while at the same time making attempts to open up new areas in order to diversify the economies.

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[48] C. P. Vaseduvan, "Financial Resources for Telecommunications Development", P. U. Report no. 40, World Bank (1978).

The priority sectors would normally include those which produce raw materials and goods for export in order to earn foreign exchange for external debt services and for imports. Industries producing basic needs goods are also given priority in national development plans and budgetary allocations.

d) Telecommunications development is expensive, and technological advancement is so fast making it extremely difficult for most developing countries to cope with new investment requirements. In addition, the equipment might not be suitable to the weather conditions of developing countries, thereby resulting in frequent breakdowns of machinery and high cost of replacements for spare parts.

Effective telecommunications development in developing countries can therefore only be possible with external financial and technical assistance through grants, loans or joint venture arrangements with foreign companies dealing in telecommunications development.

Cooperation among neighbouring developing countries in the development of telecommunications can also yield substantial economies of scale for mutual benefit of the countries concerned.

e) Telecommunications development is normally dealt with within the context of the organization's short term financial viability, and not with respect to the long term perspective of the national economy reflected in national development plans. This is due to weeknesses in planning, insufficient coordination and lack of administrative awareness of the requirements of good and reliable national and international networks on the overall development of the economy.

f) Many developing countries depend heavily on external assistance. A condition is often the use of equipment from the donor country. The diversity in the

sourcing of telecommunications equipment leads to problems of maintenance.

g) The telecommunications sector is highly dynamic, specialised and technically advanced, thereby requiring trained manpower and systematic approach to manpower development and utilization. Lack of highly qualified manpower to evaluate the sustainability of the equipment badly affects the operations of telecommunications projects in developing countries.

4.5 Conclusions

Telecommunications are vital for economic development and should as such be a part of a development strategy. Numerous studies show that the telecommunications sector is very profitable in local currency terms.

Some of the surplus created through economic activities in profitable areas and industries often favouring the administrative and political elite, may be used to develop rural telecommunications in order to benefit other target groups. Such a part of the telecommunications system has to be subsidized.

Telecommunications can be used as a substitute for transport, for saving fuel and other forms of energy, and for efficient use of transport facilities. Furthermore, telecommunications are a vital part of information and management systems.

Telecommunications use relatively big amounts of foreign exchange, but are also foreign exchange saving, a fact which is probably often underestimated.

* *Studies, mostly in developed countries, indicate that telecommunictions play an important role with respect to the above factors. For developing countries, the importance is likely to be even bigger.*

* *The changes in the relative costs of transport and telecommunications (to the benefit of telecommunications), the relative underdevelopment of both sec-*

tors, the inefficiencies in the transport sector resulting from information inefficiencies (unnecessary car-trips, empty return trips, badly timed trips); all these factors indicate that the potential gains from increased coordination between the two sectors may be relatively large.

5 A GENERAL REVIEW OF INTERNATIONAL DEVELOPMENT AND DEVELOPMENT POLICIES IN THE TELECOMMUNICATIONS SECTOR [5-1)]

5.1 The global telecommunications system

The global telecommunications system, of which any regional, national or local system forms a part, has been continuously developed and expanded for more than a century, and is now the largest and most advanced system ever created by man. Its primary objective is to enable any two subscribers to communicate with each other wherever in the world they are located. The most important element, the telephone network, has more than 500 million subscribers, but there are additional networks for other services such as telex and data communication.

The global network comprises a transmission system ranging from submarine cables crossing the oceans, via terrestrial cables of different types and microwave radio systems to satellites in the sky interconnecting fixed and mobile subscribers.

Connections between the individual subscribers are established by a system of switches or telephone exchanges, from local exchanges connecting individual subscribers to the public network, via trunk exchanges at different levels in the switching hierarchy, to the international switching centres interconnecting the national networks to form a global one.

More than 90% of the revenues of the operating agencies, usually National Telecommunications Administrations, or National Telecommunications Corporations, come from the telephone traffic. The telephone system is also a bearer of other services like telefax, distant copying with a speed of about 2 to 3 pages per minute, and low speed data transmission, up to typically 4800 bit/s. A synopsis of the types of service and the general structure of the telecommunications systems is given in Annex G.

For the industrialized countries development of telecommunications is considered as an infrastructure of increasing importance. It

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[5-1)] We refer to Annex G for description of technical installations and terms.

is also interesting to note that the Telecommunications Administrations are among the largest employer in most industrialized countries. I Norway the number of employees is about 20 000, corresponding to about 5000 per million inhabitants.

The number of main telephone lines installed and projected in the different parts of the world in millions of main lines is given in Table 5.1.

Region	1984 Lines installed	1984 Growth % per year	1989 Lines installed	1989 Growth % per year
North America	119	3.4	140	2.8
Europe	149	7.4	191	4.7
Asia	111	7.2	171	8.1
Latin America	20	10.0	33	9.1
Oceania	8	5.0	10	5.0
Africa	5	8.0	8	8.8
Total	412	6.3	553	5.6

Table 5.1 Projected growth of world's telephone system.
Source: Grabhorn, "How does World Telecom shape up in 1985?", Telephone Engineer and Management, 1985.

There is a clear disparity of telecommunications services worldwide. 15% of the world's population uses 85% of the world's telecommunications network.

Based on the projections of Table 5.1, Africa's share of the world's telephones will increase from 1.2% in 1984 to 1.4% in 1989.

5.2 Technological development trends

As a consequence of the technology development up to this decade, the global system had to be implemented as a conglomerate of networks for separate services, telephony, telex, data communication, distribution of radio and television programs etc.

There is now, however, a very fundamental change taking place in structure of the telecommunications systems, the change from the past time's analogue systems to the digital systems of today and the future.

The motivation for the change is cost saving. Digital systems will be more economical than the analogue ones, provide a better service quality, and also offer new services that cannot easily be implemented in the analogue systems.

The change is, however, not without problems. Maintenance and repair must be planned differently. Exchange of system components on site with subsequent repair at a central repair facility or at the factory may be a necessity for digital systems. This requires a different skill for the operational staff. It may require less skilled operators in the field, but more skilled people at the centralized repair facilities. The schooling system must also be adjusted accordingly, and new instrumentation and test equipment must be provided.

According to the theory of information,[5-2)] all types of signals can be converted to data streams of different rates depending on the type of signal. This will allow all services to be offered via one general digital network, the Integrated Services Digital Network, ISDN. This requires also a new philosophy for system planning.

The final implementation of the ISDN is even for the most industrialized countries for the late 90's, but it is quite clear that the plans for a future ISDN influences the cost and availability of equipment manufactured and offered today, as the changeover to a full digital system will have to be a evolutionary process.

5.3 The development of regional telecommunications systems

For a proper evaluation of a telecommunications system it is essential to put the system and its projects into a wider context, that of developing the entire telecommunications infrastructure of an area. Unstructured development can be waste of time and efforts.

The systematic method for developing telecommunications

[5-2)] A basic theory in natural science.

systems of new areas is *the master plan.* The main elements of a master plan gives clear indications to factors within an area that influence the functions and design of a telecommunications network. Ideally, all this information should have been available for an evaluation of such systems.

A telecommunications master plan should contain four well defined stages which should be completed in order, as each one is based on the data supplied by the previous one:

i) Recollection of initial data
ii) Preliminar technical studies
iii) Formulation of specifications
iv) Implementation and operation.

The area of development should be described in economical terms such as

- demography, net income per capita, exports and imports
- production sources and their operation centres
- industries and their operation centres
- means of transportation

These data give a basis for the forecast of traffic demand, which is important for determining location and capacity of the switching centres. These data must also be used to predict the traffic pattern of the region, the amount of local traffic, routes of heavy traffic etc. In an area with little or no existing telecommunications systems this is difficult, but the estimates must be based on foreseeable development in the business structure.

The structure of the network must also be determined on the basis of political intentions, i.e. how the international traffic development is wanted. For the SADCC region, it is a stated objective to reduce the dependency on South Africa and to strengthen the relations among the SADCC countries themselves. Another political intention would be to support the development of telecommunications i rural areas.

When the initial data are known, these must be translated into

a numbering plan, *a traffic plan*, and further into *a network "architecture"*, i.e. a system with switching centres of different level, interconnected with "arteries" with given traffic capacities. Traffic capacity is determined by the traffic data, including projections of future developments, together with figures for grade of service. Requirements for standardization require that the capacity values are rounded up to standard values. One consideration for determination of channel capacity is the requirement for transmission of television, which require capacities equivalent to 960 voice channels.

Requirements to transmission quality are also standardized by the CCITT, (see Section 5.4), and it is in general not advisable to deviate from these specifications.

There is no simple one-to-one relationship between the initial parameters and the system design. The quality of a master plan depends on the accuracy of the background data. Engineering judgement and predictions of development are important elements. The system designs must therefore be evaluated accordingly.

5.4 International organizations and the development of telecommuncations systems

For a global system comprising the national systems of every country of the world, coordination and standardization is of paramount importance to ensure smooth working. This has been successfully done under the auspices of

The International Telecommunication Union (ITU), through its two main committees

- *CCIR (Comitê Consultativ International de Radio)*
  and
- *CCITT (Comitê Consultativ de Telephone et Telegraphie)*

which issue standards for construction, operation and maintenance of all parts of the telecommunications systems. The recommendations of the CCITT and CCIR are not mandatory, but they are re-

spected by practically all administrations, and the recommendations are widely used in equipment specifications.

The ITU also offers technical assistance, harmonization, development and enhancement in the field of telecommunications throughout the world. It depends on the United Nations Development Program (UNDP) for funding of the activities related to the support for economic and social development.

Several other international organizations are involved in telecommunications system development throughout the world:

The International Bank for Reconstruction and Development (World Bank) and The International Development Agency (IDA).

These are the largest source of funds for telecommunications development, in particular in developing countries. The World Bank has recently changed its policy with regard to investments in the telecommunications sector. Up to 1986 the loans in this sector have been about 1 to 2 % of the bank's $10 Billion annual loan portfolio.

In 1987 the loans rose to about $600 million, which is an increase by a factor of about four. The Bank also encouraged borrowers to adopt long term institutional and regulatory policies for stimulating the growth of their telecommunications sector.

The United Nations Educational, Scientific and Cultural Organization (UNESCO)

is responsible for implementation of the International Programme for the Development of Telecommunications (IPDC). The programme aims at increasing cooperation and assistance in developing communication infrastructure and decrease the gap between individual countries in the field of communications. The Intergovernmental Council of the IPDC is responsible for taking decisions on a number of intergovernmental and regional communication development projects in the developing countries.

The International Telecommunications Satellite Organization (INTELSAT),

which in 1985 had 114 member countries and 165 countries, territories and dependencies using the satellites, is operating a global commercial satellite communication system. It also helps design, planning, construction and effective operation of the earth stations of its global system. INTELSAT also leases satellite capacity for domestic systems to 26 countries, of which 6 in Africa. The lease charges for the satellite must be paid in foreign currency. This is one reason why the countries need a terrestrial wideband network.

The International Maritime Satellite Organization (INMARSAT),

is a 50 country member organization which provides satellite communications to the world's shipping and offshore industries. The organization leases satellite capacity for telex, telephone and data communication to users equipped with ship earth stations. INMARSAT is now in the process of data and later voice service also to air mobile and land mobile users. The INMARSAT system is also important for the safety of life at sea. There is at present one coast earth station in Africa, in Egypt.

Pan-African Telecommunications Network (PANAFTEL)

provides interregional cooperation activities in developing telecommunications in Africa. Other collaborating regional organizations for harmonizing and improving administrative and technical services in Africa include the Pan-African Telecommunications Union (PATU), and the Southern African Telecommunications Conference (SATAC).

Southern African Transport and Communications Commission (SATCC)

coordinates regional development in the Transport and Telecommunications sector within the SADCC Region.

5.5 Technological change and economics of scale

The basic telecommunications services have changed remarkably little during the last decades, but the technology for implementing the systems which provide the services are in a dramatic transition period.

As a result the real cost of providing and maintaining telecommunications services has fallen in recent years, telecommunications is a declining cost industry. Two factors account for this: technological change and economics of scale.

It is very important for a developing country to adopt the most appropriate[5-3)] technology, resulting in the lowest cost and highest availability for given operational requirements. Adoption of the newest proven technologies is therefore important.

Technological innovation has played an important role in reducing equipment costs and increasing equipment reliability, increasing the efficiency of network utilization, lowering energy and space requirements, and improving the quality and diversity of the services.

Three interdependent factors are of importance:

1. Significant innovations in basic electronic technology (transistors, microprocessors etc.).

2. New processes in telecommunications equipment manufacturing, better suited to large scale mass production, resulting in higher reliability and lower costs.

3. Innovation in basic technology and in production processes become necessary and economically feasible with the large growth in the demand for telecommunications equipment.

As such, the effects of scale and technology are inseparable, and statistical analyses of their development can never fully disentangle them.

[5-3)] By appropriate technology is meant the most recently developed "proven" technology. However, special cases may need special solutions.

The combined effects of technology and scale on cost of providing telecommunications services can be dramatic. A significant example is the development in Taiwan during the period 1956 to 1977. The number of telephone lines in service increased from about 37,000 to 1.2 million, an annual growth rate of 19 percent. At the same time, labour productivity improved dramatically, the number of staff per 1000 lines dropped form 114 in 1965 to 15 in 1977 and to less than 8 in 1981.[5-4] The rapidly decreasing cost per line kept tariff increases below the general rate of price inflation, and the 1956 tariffs, which were already low by world standards, dropped by half in real terms by 1977. In spite of these low and falling tariffs, the rapidly growing telephone system generated internally more cash than it invested, and as a result the telecommunications sector transferred increasing proportions of revenue to government in the form of taxes.

5.6 Organizational structure, management efficiency and the question of pricing policy

Empirical studies show that there are considerable differences among countries in costs and tariffs. These differences cannot generally be attributed only to the effects of differences or changes in technology and scale. Among others, factors such as organizational structure, management efficiency, the attention given to maintenance and staff development may greatly influence costs of operation.

In developing countries, the telecommunications sector usually comprises at least

a) one operating entity, which provide monopoly public and leased telecommunications services, often organized with postal services and operating under government control

b) various networks that meet special needs

[5-4] The rapid expansion of the systems implied an increase in the number of employees, however.

In literature, it is usually claimed to be an advantage to organize telecommunications as an autonomous entity, independent from postal services and independent from government.

Telecommunications is a dynamic, capital-intensive sector whereas the postal sector is less dynamic and labour-intensive. The provision of telecommunications services requires a much higher proportion of skilled labour and professionals than does the provision of postal services.

However, several related services should be organizationally integrated adding for example telex and data services. Integration can reduce interconnection costs, equipment may easily be standardized, stocks of spareparts and the investment in training may be reduced and duplication of plants may be avoided.

Long term telecommunications plans should certainly be a part of the national plan. Independence of government means, however, that the telecommunications entity should be free from day-to-day government interference, not having to secure government approval for normal technical and expenditure decisions.

As to tariffs, the general view is that prices charged should reflect the costs of providing services. Empirical analyses show that telecommunications operating entities can easily generate sufficient resources from users of services to cover all costs.

Most developing countries have rather skewed distributions of income and exhibit large differences in regional income. Therefore, poor potential telephone users may not be able to pay telephone tariffs that cover the full costs. This is particularly true in smaller towns or more remote low-traffic areas where the cost of providing services are high.

Consequently, there may be instances in which it is desirable to charge prices below cost. A certain degree of cross-subsidies is the norm in most countries.

6 THE DEVELOPMENT OF TELECOMMUNICATIONS IN AFRICA AND IN THE SADCC REGION

6.1 The Telecommunications situation in Africa

As seen from Table 5.1 the African countries' share of the world's telephones is slightly above 1 %. The telephone density is also low. With 8 million lines for a total population of about 440 million inhabitants, the average density is about 5.5 per 100 inhabitants in 1989. The situation for the SADCC countries and for some other African countries for the years 1980 and 1986 is shown in Table 6.1.

Countries in SADCC	1980	1986
Angola	0.52	0.56
Botswana	0.76	1.00
Lesotho	0.16	0.62
Malawi	0.15	0.24
Mozambique	0.24	0.32
Swaziland	0.75	1.34
Tanzania	0.20	0.24
Zambia	0.65	0.70
Zimbabwe	-	1.26
Some other African countries		
Algeria	1.80	2.58
Egypt	0.92	1.84
Kenya	0.45	0.58
Nigeria	0.10	0.26
Sierra Leone	0.24	0.39
Uganda	0.20	0.18

Table 6.1. Direct exchange lines (DELs) per 100 inhabitants.
Source: African Telecommunications Development Conference "Telecommunications Statistics of African countries".

As the table indicates, the density is rather low in Africa and also in the SADCC countries. Most of the SADCC countries have a telephone density above the average of Africa, however.

It should in this context be noted that the telephone density for most industrialised countries in in the range 50 to 100 DELs per 100 inhabitants.

The main connections to the African continent are via submarine cable, radio relay (e.g. across the Read Sea) and various satellite links. The new earth station i Mwembeshi II in Zambia will for example provide direct links with the USA, Canada, and South America in addition to the links with the West African Countries.

6.2 The PANAFTEL network

6.2.1 Introduction

It was the urge for unified development of the African continent that developed the idea in 1962 of setting up the Pan-African Telecommunications Network (PANAFTEL) with the objective of interconnecting national networks. After the first meeting of the ITU in Dakar in 1962, where the first international plan for development of an African interstate telecommunication network was outlined, the plan was reviewed at three subsequent meetings in Rome 1963 and in January 1967, and in Mexico City December of the same year. The Organization of African Unity (OAU) was established in 1963 to promote African unity and to coordinate integrated socioeconomic development of the continent. The OAU established in 1977 the Pan-African Telecommunications Union (PATU) as a specialized agency, to be responsible for the telecommunications sector on the continental level.

As a continental organization, PATU's role is to:

* *promote the development of national telecommunications services and their extension to rural areas;*

* *encourage and coordinate the implementation of regional interconnection links and seek the diversification of transmission systems;*

* *explore ways and means of achieving efficient operation of regional networks and encourage the routing of intra-African traffic through transit centres in Africa;*

* *seek to harmonize tariffs and promote the conclusion of "Telecommunication Operating Agreements" between Member Administrations;*

* *recommend procedures and methods for efficient maintenance to be adopted by African Administration;*

* *promote the extension of telecommunication services in the rural and remote areas;*

* *seek the progressive introduction of new technologies;*

* *promote the development of human resources;*

* *promote and develop research and the local manufacture of telecommuniactions equipment;*

* *encourage the utilization of African expertise;*

* *develop inter-African cooperation.*

The objectives could be quantified in the following way, as stated by the PATU:

> *"A telephone density of 1.0 per 1000 inhabitants and one Public Call Office (PCO) per 10 000 rural population and distributed such that each inhabitant might be within five kilometres of a telephone by the year 2000."*

The feasibility studies for PANAFTEL network began in 1970, and the initial studies were completed in 1972 when involved organizations met in Addis Ababa to discuss the viability of the project and in particular the financial aspects. After the economical survey, it was necessary to conduct the technical survey, and it was determined that the telecommunications network in the Eastern and Southern Africa would link i.a. Tanzania, Zambia, Malawi and Botswana with extensions to Mozambique, Angola and Zimbabwe.

6.2.2 Technical structure

In the early 1960's the African telecommunications system consisted of relatively underdeveloped national networks which, moreover, were invariantly linked to the switching centres of the former colonial powers.

Up to these days most of the traffic between neighbouring countries Zambia and Zaire would go Lusaka - London - Brussels - Kinshasa. Circuit routing of this type is partly due to network structure and the lamentable state of the Zaire telecommunications network, and partly to tariff policy. (Calls from Zambia to Lumbumbashi in Zaire go directly via a low capacity microwave route which is mainly funded and maintained by Zambia PTC. See Annex D.4.2). It was therefore necessary to restructure the PANAFTEL network to obtain the objective of unifying the continent.

6.3 Telecommunication systems in the SADCC region

6.3.1 Introduction

The PANAFTEL network embraces the whole of the African telecommunications network from subscriber to subscriber, both for telephone and telex services.

Fig. 6.1 shows the international part relevant to the SADCC countries. It consists mainly of line-of-sight radio relay microwave systems, but there are also troposcatter radio-relay systems, submarine and land coaxial cables and satellite links.

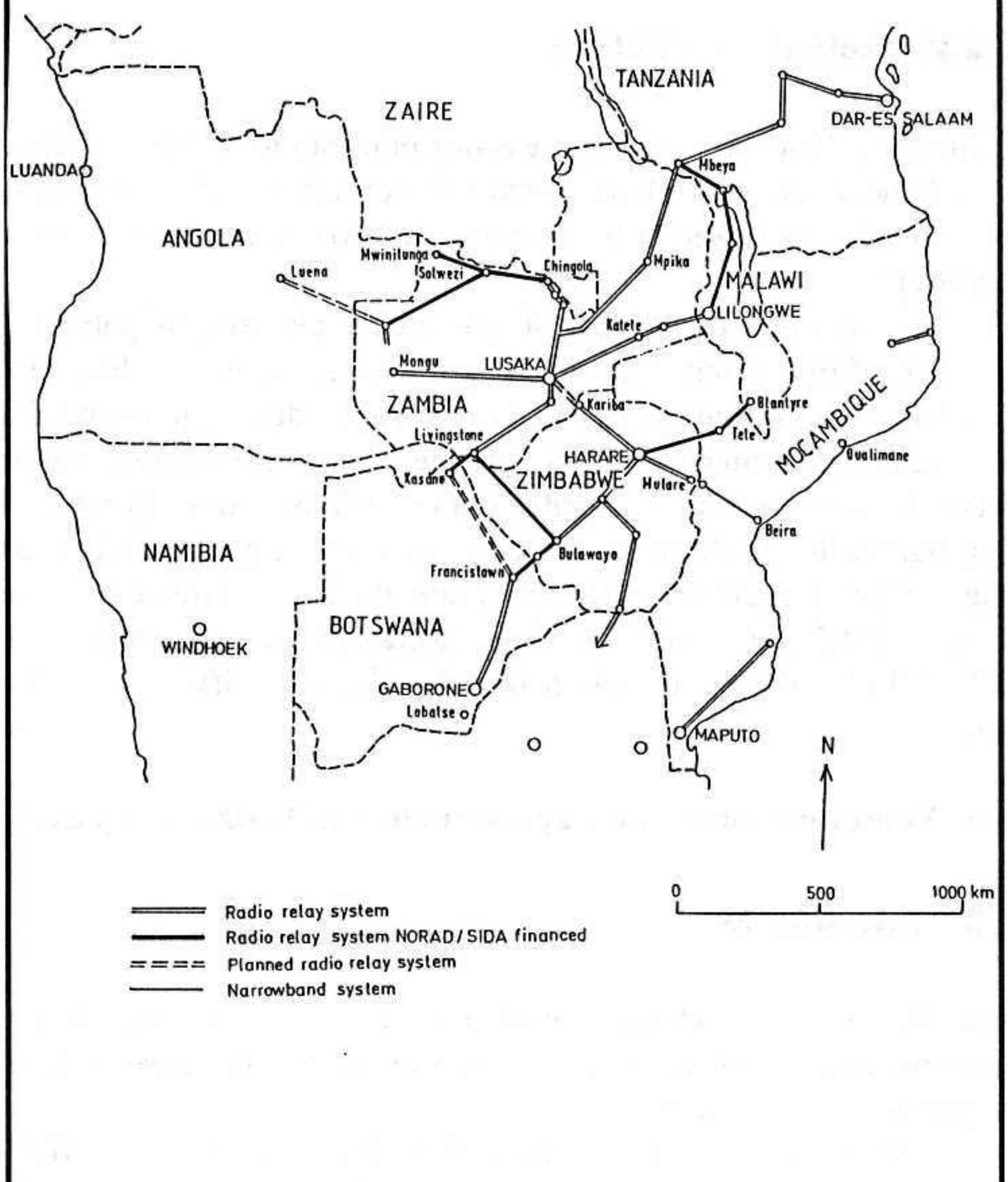

Fig. 6.1 The PANAFTEL network in the SADCC countries.
Source: PTC, Zimbabwe. 1989.

The high quality multichannel trunks which have been installed to interconnect national networks to form regional systems have in practice also helped to improve the quality of national networks.

6.3.2 International telephone switching centres

Each of SADCC countries is equipped with an International Telephone Switching Centre (ITSC). The main data for the ITSCs are given in Table 6.2. The ITSC's are located in the capitals of the countries, except for Zimbabwe, where it is located in Gweru.

6.3.3 PANAFTEL routes as per 1985

Each of the countries in the SADCC region has at least one high grade terrestrial multichannel link to one or more of their neighbouring countries with possibility of transiting to other countries. The situation concerning the international links of the SADCC region is summarized in table 6.2.

	TAN	MAL	ZIM	ZAM	MOZ	BOT
TAN	X/Bar 355/ Fujitsu 1978	Microwave digital 34 Mbit/s 1987		Microwave LOS 960 chan. 1982		
MAL	Microwave digital 34 Mbit/s 1987	SPC Analogue 256/512 NXE-20 1981	Microwave 34 Mbit/s 480 ch. 1989	Microwave LOS 960 chan. 1984	Microwave LOS 480 chan. REG 024	
ZIM		Microwave 34 Mbit/s 480 ch. 1989	Digital 3000/3000 Axe - 10 1985	Microwave LOS 960 chan. 1987/88	Microwave anal./dig/sat	Microwave LOS 960 chan. REG 004
ZAM	Microwave LOS 960 chan. 1982	Microwave LOS 960 ch. 1984	Microwave LOS 960 ch. 1987/88	X/Bar - Dig 800/1024 ARM AXE-10 1979/85		Microwave LOS 960 chan. 1986
MOZ		Microwave LOS 480 chan. REG 024	Microwave analog./dig/ sat		Digital 2000 AXE-10 1989	
BOT			Microwave LOS 960 chan. REG 004	Microwave LOS 960 chan. 1986		Digital AXE-10 1986

Table 6.2 International links and international switching centres.
Source: PTC, Zambia.

	TAN	MAL	ZIM	ZAM	MOZ	BOT
TAN		UK **d**	UK **d**	d **d**	SA **d**	UK-KENYA **TR**
MAL	UK **d**		d **d**	d **d**	d **d**	SA **d**
ZIM	UK **d**	d **d**		d **d**	SA **d**	SA **d**
ZAM	d **d**	d **d**	d **d**		SA **d**	SA **TR**
MOZ	SA **d**	d **d**	SA **d**	SA **d**		SA **SA(TR)**
BOT	UK-KENYA **TR**	SA **TR**	SA **d**	SA **TR**	SA **SA(TR)**	

d = direct circuits, TR = transit in the region, SA = transit via South Africa, ( ) = alternative routing

Routing of telephone calls: → Early eighties; → **1986/87**

Table 6.3 Routing of telephone calls, early eighties and 86/88.
Source: "SADCC Macroeconomic Survey" (1986).

It is also possible to obtain an impression of the effect of systems implemented in the early eighties to 1986/88 time frame from the effect on traffic routing. Data from "SADCC Macroeconomic Survey" (1986) is summarized in Table 6.3.

This shows that all the routings via the United Kingdom are replaced by direct links or transit in the region. Botswana - Mozambique is still indicated to have links routed via South Africa with internal routing as alternative.

From the information available there seems to be a possibility for transit via Harare when the digital microwave link via Beira is implemented, and operating agreement concluded, which should take place in 1988.

The Zambia - Botswana traffic, which in the early eighties was routed via South Africa, can now be routed via the microwave radio relay system Francistown - Bulawayo - Livingstone, which has been constructed under Project REG 004. The Francistown - Bulawayo trunk will open up for internal transit for calls from Botswana to all of the other SADCC countries. From Table 6.3 it appears that there will be both a digital (34/140 Mbit/s) and an analogue (960 channel) system.

The parts of the PANAFTEL network financed by NORAD is described in chapter 7.

7 NORWEGIAN ASSISTANCE TO THE TELECOMMUNICATIONS SECTOR IN THE SADCC REGION[7-1]

The following projects forming part of the PANAFTEL network have been financed fully or partly by the Norwegian Agency for Development (NORAD).

REG 004 Analogue Microwave radio relay system, BOTSWANA - ZIMBABWE - ZAMBIA. NORAD ca NOK 60 mill, SIDA ca SEK 45 mill.

Description of project: The purpose of the project is to improve the telecommunications services between the three countries and provide connection to the Pan African Telecommunications Network (PANAFTEL). A microwave radio relay link with a capacity of 960 telephone channels will be provided between Francistown in Botswana, Bulawayo in Zimbabwe and Livingstone in Zambia. The project includes the construction of 20 stations with buildings, towers, radio equipment and power supplies, as well as training and maintenance facilities and support. The project was put into service August 1984. An extension with a spur link to Kasane and extended capacity between Livingstone and Lusaka is implemented in 1989.

REG 009 Digital Microwave radio relay system, MALAWI-TANZANIA. NORAD ca NOK 43 mill, SIDA ca SEK 28.5 mill. Agreement 1985.

Description of project: Implementation of a connection between Malawi and Tanzania in order to improve telecommunications service between the countries and to bridge a gap in the Pan African Telecommnunications Network.

[7-1] An overview of Norwegian assistance in general to the telecommunications sector is given in Annex H.

REG 020 Analogue Microwave radio relay system NW ZAMBIA, together with technical assistance to the ZPTC. NORAD NOK (75 + 12) mill plus ZPTC ZKW 4.5 mill. Agreement 1983 and 1986 (techn. ass.). Start of service 1985.

Description of project: The purpose of the project is to develop the telecommunications services in the North-Western Province of Zambia and provide for a future connection between Zambia and Angola. A high capacity 960 channel microwave link is established between Chingola and Solwezi and 300 channels between Solwesi and Zambezi, with a 300 channel spur link to Mwinilunga. The project includes 23 stations with buildings, towers, radio equipment and power supplies, as well as training and maintenance facilities and support. The project was completed and put into traffic in October 85, as scheduled. As a further support to the telecommunications sector Norway has agreed to give technical assistance to Zambia's Post and Telecommunications Corporation with special importance attached to maintenance.

REG 024 Digital Microwave radio relay system MALAWI, MOCAMBIQUE and ZIMBABWE. NORAD NOK 50 mill, SIDA SEK 45 mill. Agreement 1987.

Description of project: Implementation of radio link communication between Blantyre in Malawi via Tete in Mocambique to Harare in Zimbabwe in order to improve services between the countries involved and connection to the Pan-African Telecommnuications Network.

In addition, NORAD has supported the following projects in the SADCC region:

Reg 008: HF radio connection MOCAMBIQUE-MALAWI-ZIMBABWE. Agreement 1983.

The project is completed and in operation. Norwegian support: NOK 5 mill (Included here though it is not a microwave project, since it was a temporary communication link awaiting a microwave link)

REG 043: Technical assistance, ZIMBABWE. Under implementation.

Norwegian support to date NOK 3 mill (total grant NOK 5 mill). Related to this, Norway has also given general support to SADCC's transport secretariat in Maputo, SATCC. SATCC is responsible for the telecommunications projects from SADCC's end, but the Norwegian support to SATCC is not for telecommunications.

The relevant projects are:

REG 003: Technical support to the establishment of the Transport Commission under SADCC (SATCC).

The Norwegian funding is channelled through SIDA.

REG 028: Consultancy fund, SATCC.

Norway has also funded studies on regional telecommuncations projects that have not (yet) been funded, including **REG 300 (Maritime telecommunications)** and **REG 041 (BLANTYRE-MZUZU, MALAWI).**

ZAM 100: Commodity assistance: delivery and installation of telephone exchanges to rural areas. Agreement 1983.

The exchanges are funded from the bilateral country programmes, as commodity assistance or bilateral project aid. The exchanges have

been supplied by STK, who has also been involved in the installation work. Last exchange installed ultimo 1988. Norwegian expenditure NOK 30 mill.

Radio link project, BOTSWANA. NOK 43 mill. Under implementation.

An evaluation of the projects REG 020, REG 004, REG 024, and ZAM 100 is presented in Chapters 9, 10, 11, and 12.

8 THE EVALUATION APPROACH

8.1 Introduction

An evaluation of a selected number of Norwegian supported telecommunications projects in the SADCC region was an important part of the sector study. In this chapter we will discuss:

* *criteria for selection of projects for the evaluation, and the project selection*

* *an approach to the evaluation of infrastructure projects, with four stages*

* *methodology, indicators and sources of information*

8.2 Selection of projects for the evaluation

8.2.1 Number of projects to be evaluated

Chapter 7 gives a summary of the Norwegian support to the telecommunications sector during the last 8 years. A description of some technical aspects of some of the projects are given in Annex H.

The projects included in the evaluation should present a representative picture of this sector assistance.

According to the Terms of Reference (Appendix A), the sector review is to be based on

> *" a comprehensive evaluation of 3-5 completed projects in the SADCC region of Africa".*

The term completed is not specified, but we take it to mean that the project has been put into operation for investment projects, and that the personnel should have been working for at least two years in the case of technical assistance projects. According to this, there are 5 projects to choose among, REG 004, 008, 009, 020, and ZAM 100. REG 024 was not completed before the field study.

There is a trade-off between a larger, more representative sample with less possibilities to study the individual projects in depth, and a smaller sample allowing more in depth analysis (an extensive versus an intensive approach). Since the evaluation aims at going beyond the technical aspects, and include an analysis of the wider impacts of the projects, the Team strongly recommended a more in depth study of not more than three projects. Since three of the projects are rather similar (international radio link projects funded over the SADCC grant, and implemented as turn-key projects by Norwegian companies), it should still be possible to secure a reasonably representative picture of the sector support by looking at these projects.

8.2.2 Criteria for selection of projects

In the selection, the Team has put emphasis on the following criteria:

* ***type of development assistance:*** *support to the telecommunications sector has been given both as commodity assistance, project assistance and commercial assistance, financed primarily from regional (SADCC) funds, but also with some bilateral funding*

* ***project components:*** *some projects focus primarily on delivery and installation of equipment, others also include institutional support to the telecommunications administrations, particularly through long term technical assistance.*

* ***type of telecommunications services:*** *telecommunications systems form a hierarchy, from the individual connections, through exchanges at different levels, to the radio links connecting several countries. The projects supported by Norway are both international radio links, national radio links and telephone exchanges to rural areas.*

* ***type of technology:*** *most of the projects are based on analogue technology, but recently digital technol-*

ogy has also been introduced. Two projects are based on digital technology, REG 009, which was taken over by the MPO and TP&TC in 1987, and REG 024, which was not yet completed. REG 009 is geographically separated from the projects REG 004, REG 020 and ZAM 100. REG 024 was under construction. It was therefore felt that it might be difficult to include any of them in the project evaluation. In a discussion of the national telecommunications plans of the individual countries, it will however be possible to include a discussion of the more general problems related to change from analogue to digital technology.

* ***geographical representativity:*** *the projects have covered different parts of the SADCC region, including projects or parts of projects in Botswana, Zimbabwe, Zambia, Mozambique, Malawi and Tanzania. The selection should include at least three of these countries, to exclude the danger of generalizing on the basis of country specific problems. The selection should preferably include countries with different macro-economic situations. At the same time it may be advantageous to have more than one project in one country, to be able to look more in depth at the telecommunications sector in one country.*

8.2.3 Proposed selection of projects

On the basis of the above considerations, the Team proposed the following three projects to be included in the evaluation:

REG 004 Radio link Botswana-Zimbabwe-Zambia

REG 020 (orig. ZAM 018) Radio link North-Western Province, Zambia

ZAM 100 Commodity assistance: delivery of telephone exchanges to rural areas

REG 004: This was the first of the three international radio link projects which together constitute the major part of the Norwegian assistance (together with REG 009 and 024). Since REG 024 has not yet been completed we found it difficult to include it in line with the other projects, though for other reasons it could have been very relevant.

A major objective with these projects has been to reduce the dependence on South Africa. Because of its location, we consider REG 004 to be better suited than REG009 for a discussion of this aspect.

REG 020: Though it is part of the PANAFTEL network, with a possible further connection to neighbouring countries, this is primarily a national project. As such it aims at linking a peripheral region to the national centre, and thereby contributes to economic and social development in the region.

Phase one of the project included delivery and installation of equipment, as a turn-key project implemented by the Norwegian firm EB Nera. In phase two it has been extended to include technical assistance to the Zambian telecommunications administration. It therefore illustrates a transition from an investment project with a comparatively short term perspective, to a broader and probably much more long term project aimed at institution building. While this is a common change in aid projects during the 80's, it raises special problems with regional projects, since it touches upon the relationship between SADCC, as the organization securing funds for the investment projects, and the national telecommunications administrations, whose responsibility they become after completion.

ZAM 100: Commodity assistance is a minor part of the assistance to telecommunications in the SADCC region. It has been used in Asian countries, and totally it is therefore a substantial part of the Norwegian sector support. This alone would justify the inclusion of ZAM 100. In addition the assistance consists of telephone exchanges to rural areas, and the justification is specifically the potential contribution of telecommunications services to the general process of rural development. For the wider discussion of the socio-economic im-

pacts of telecommunications services, and more particularly the potential role of telecommunications in a more poverty oriented strategy, this seems highly relevant.

Upon request from NORAD, it was also decided to include some aspects of REG 024 in the evaluation, particularly to illustrate differences with regard to technology choice and project planning. Since REG 024 was not completed at the time of the field work, no impact assessment could be undertaken.

In the Team's opinion, this selection should give a basis for considering the major issues of relevance to the sector evaluation, and present a reasonably representative picture of the Norwegian sector support. The selection will include three (four when REG 024 is included) countries, but with a particular focus on Zambia. This will give the Team an opportunity to look at the sector as a whole more in depth in one country, but at the same time securing the possibility of showing differences between the countries.

8.3 The project evaluation approach

8.3.1 Methodology

In chapter 3 the Team presented some methods for analyzing telecommunications as an infrastructural component in the development process. According to economic theory all projects are economically favourable as long as benefits exceed the opportunity cost of capital. A suitable method for making such assessments is the cost-benefit analysis.

Regional projects, like REG 004 and REG 024, are supposed to meet the above stated criterion without any further investigations. REG 020 is a part of an international link, in addition to being a part of the national network in Zambia, connecting the North-Western Province to the rest of the country. The political benefits arising from this project are probably so big that the project is viable, although costs may exceed revenues in the short run. ZAM 100 is also vital for political reasons: the rural exchanges are necessary ele-

ments in the telecommunications network structure down to district level.

When it comes to projects aiming at making telecommunications available beyond district level, the need for making cost-benefit analyses is more evident, particularly in vast, scarcely populated areas inhabited by poor people. Costs per subscriber tend to increase dramatically in such areas, and estimated benefits may be smaller than costs.

Since the projects involved in this evaluation are of a kind which normally would imply benefits in excess of costs in a cost-benefit analysis, the Team would not give priority to actually making such an analysis. One element in such an analysis would be to have a representative sample of actual and potential subscribers in the North-Western Province. These people would have to be interviewed in order to make estimates on the actual and potential benefits arising from the availability of telecommunications. Such a program would have been very time-consuming and costly, and regarding the security situation in the area, impossible to bring about.[8-1)]

The Team thus decided to make a rather crude economic assessment of REG 020 and ZAM 100 supplied with qualitative evaluations, based on a few interviews.

8.3.2 Stages in the evaluation

As a way of structuring the evaluation of infrastructural projects like telecommunications services, the Team has made use of an approach consisting of four stages:

*1) - **the planning and implementation process:** the way in which the projects were planned and implemented, including relationship to national plans, inte-*

8-1) To undertake a cost-benefit analysis regarding REG 020 and/or Zam 100 would probably imply that the Team, or at least some members of the Team, had to use most of the time of the study tour in the North-Western Province. For obvious reasons, apart from the security situation, this was not possible.

However, in chapter 9.4 the difference between benefit and revenue is illustrated. (Consumer surplus).

gration into national structures, up to the stage when the projects are "handed over" to the relevant authorities in the recipient country.

*2) - **the functioning** of the projects after implementation: realization of the direct objectives in terms of increased capacity and functioning links, operation and maintenance problems and preconditions for continued functioning in terms of personnel, funds (local and foreign), and generally the question of project sustainability and dependence on continued aid.*

*3) - **the use** of the projects: how are the services being used, by whom and for what purposes.*

*4) - **the impacts** of the projects: knowing how they are functioning and being used, what are the impacts of the projects, compared to the specific objectives of the projects and the more general objectives of Norwegian aid.*

8.4 Sources of information

In preparing this study, the Team has made use of the following sources of information:

Written documents:

- *feasibility studies*
- *project documents*
- *agreements/contracts*
- *Progress reports/project reviews*
- *project files in MDC/Oslo and MDC/Rep*
- *national development plans*
- *national sector plans*
- *SADCC plans*

General interviews:

In Norway:

- *MDC staff*

- *EB Nera staff*
- *STK staff*
- *consultants*
- *returned experts*

In recipient countries (Zambia, Zimbabwe, Mozambique and Botswana):

- *National planning authorities*
- *Sector ministries*
- *Telecommunications administrations*
- *MDC/NORAD representations*
- *Other donors involved in the sector*
- *Provincial and local authorities in the North-Western Province, Zambia*
- *Interviews with users (administration, companies, health institutions, schools etc.) in the North-Western Province.*
- *Project personnel, both local and expatriate.*

The Team spent 6 weeks in the SADCC region, visiting the four countries.

9 REG 020 MICROWAVE SYSTEM FOR NORTH-WESTERN PROVINCE IN ZAMBIA

9.1 Project background and initiation

9.1.1 The project in the context of PANAFTEL and the National network

The microwave system implemented under the project REG 020 serves two main functions,

-to include the last province of Zambia, the North-Western province, in the national telecommunications network, and

-to form a part of the future PANAFTEL links to Angola.

Before the construction of this system there was nothing of what we today think of as normal telecommunications systems beyond the province capital Solwezi, except for some overhead lines difficult to operate and maintain, and some High Frequency radio equipment.

The microwave system is shown on Fig. 9.1. It connects the provincial capital Solwezi of the North Western Province of Zambia and the district centres of the province to the national system via Chingola and Kitwe to Lusaka.

9.1.2 Background to the NORAD assistance

The provision of a microwave link to the North-Western province in Zambia was on international tender in 1981.

This project was part of the establishment of a national analogue microwave network covering all provinces in the country. The evaluation committee recommended the German supplier Standard Electric Lorenz (an ITT subsidiary) with EB-Nera of Norway as number 2. It was finally decided to award the contract to EB-Nera.

In this decision it was considered that ITT (North Electric Co.) has had several years delay in commissioning of the NX-1E exchanges. When this result became official, the Federal Republic of Germany who had earlier indicated that they would fund the project, withdrew its support, and Zambia approached Norway with a request for assistance. It was impossible to secure regular export credits for the Norwegian deliveries, since the necessary guarantees could not be provided. In 1982 the project was therefore approved for funding by NORAD, as a grant to the Zambian government. Originally it was considered for bilateral funding, (under the project code ZAM 018) with a special allocation added to the regular country programme, but later it was transferred to the new grant for regional SADCC projects, with the project code REG 020. The justification for the status as a regional project lies in it being part of the planned east-west PANAFTEL network linking Zambia to Angola.

The agreement between Norway and Zambia was signed in 1983, and the contract between PTC Zambia and EB NERA was signed in April 1983. In January 1984 Zambia also requested for Norwegian technical assistance to PTC, for a total of 16 positions in the fields of maintenance, network planning and training. In 1985 NORAD agreed to fund 5 expatriate positions in PTC, which were considered necessary for the operation and maintenance of the supplied equipment, and for the training of Zambian personnel.

As the technical assistance was seen to be linked to the earlier supply of equipment, it was treated as an extension to the existing project. The assistance to the national telecommunications administration thus became a regional project.

NORAD's assistance to the project thus did not originate from a careful analysis of Zambian needs and Norwegian priorities, but rather as an ad hoc solution to a problem related to Norwegian commercial interests. In a way aid followed business. This situation also created time pressure on NORAD, which in turn may have influenced the type of background information collected and analysis undertaken. No analysis of the potential socio-economic implications of the project seems to have been undertaken, and its role in a general development strategy for the province was not assessed. The expected benefits were therefore presented in a very general way.

Similarly, the technical assistance was seen as a follow up of the earlier investment support, and not based on an analysis of PTC as an organization, and its need for assistance in general.

The background of the project, and the regional status of what in practice in many ways is a bilateral project, may have contributed to its being regarded as an addition to, rather than a part of, the Norwegian assistance to Zambia.

9.1.3 Objectives of the NORAD assistance

The project had a dual direct objective:

> *- to improve the telecommunications between the North-Western province and the rest of Zambia*
>
> *- to be a step in the future east-west communication in Southern Africa with a planned future link to Angola.*

It is thus both a national project linking a peripheral province to the rest of the country, and a part of the PANAFTEL network. Since the regional implication was, and still is, uncertain, the main justification for the project in the NORAD documents was its potential role in the development of a peripheral area (at that time NORAD was also involved in other activities in the province, but these have been reduced and is in the process of being phased out). The project was seen as a part of the general development of a poor and peripheral province, with development potentials in a number of areas, but the ways in which improved telecommunications would contribute to this process was not spelled out, nor how it was linked to and dependent on developments in other areas. For a project of this nature, one misses a broader analysis of the role of telecommunications in regional development in an area like North-Western province. It is stated that the project is probably not justifiable in economic terms, but that the expected administrative and social benefits make it justifiable. These expected benefits are not specified.[9-1)]

[9-1)] However, the Team's own conclusion is that the political and administrative benefits of the link justify the project.

The priority given to the project by Zambian authorities is emphasised.

Summarizing the expected benefits:

- *improved national communications.*
- *possibly improved international communications.*
- *contribute to economic development in the province.*
- *improved administration.*
- *social benefits.*

The degree to which these benefits have been realized will be discussed by looking at telephone traffic, the general economic development in the province, the impacts of telecommunication on administrative efficiency and impacts in the fields of health and education.

Since no attempts were made to collect baseline data on these issues before the implementation of the project, and since the security situation in the province during the Team's field work limited the data collection possibilities, this assessment will have to be qualitative rather than quantitative. The objectives of the extension of REG 020 reflects a growing realization that investment projects, particularly in an advanced technology sector like telecommunications, need to be followed up by measures aimed at securing the operation and maintenance of the infrastructure.

The objectives of phase two were:

- *to secure the operation and maintenance of the equipment.*

- *to support training of Zambian personnel to enable them to take over the operation and maintenance of the supplied link.*

To meet these objectives, provision of 5 experts in the fields of training, maintenance and network planning was proposed. In actual fact these positions have not been closely linked to the NORAD supported investments, but rather to the general strengthening of these functions within PTC.

There is thus a move from a project focus towards a more general focus on institutional support to PTC, but the move seems somewhat reluctant. Again this may reflect the regional status of the project, and the seemingly low involvement in the project of the NORAD office in Zambia.

The realization of the objectives must therefore be based on a general assessment of the personnel situation, and the need for expatriate personnel within PTC, and the strength of the training and maintenance functions within PTC.

9.2 The project

9.2.1 The transmission system

The transmission system implemented by the REG 020 project consists of an analogue microwave radio relay system shown on Fig. 9.1. It connects the provincial capital and the district centres to the national system via Chingola and Kitwe to Lusaka.

The microwave system from Chingola via the branching point at Chafukuma to Solwezi operates in the 6 GHz band and has a capacity of 960 voice channels per radio channel. The configuration is (1+1) radio channels in direction to Chingola and (2+1) in the direction from Chingola. The additional radio channel is used for the national TV program which is broadcast from a TV transmitter near Solwezi. The range of this TV transmitter is about 80 km. The transit exchange of the province is located in Solwezi.

From Chafukuma there is a 300 channel 2 GHz microwave system going to Zambezi and to Mwinilunga. The branching point is at Shikundwe.

From Chafukuma the radio link operates at 900 MHz with a capacity of 300 voice channels to Solwezi, where the transit exchange of the province is located.

From Kayimbwe there is a spur link to Kasempa and from Chitoko a spur link to Chizela. The spur links are operating at 1.5 GHz, and the capacity is 120 channels.

The 5 Super Groups (60 channel groups) are used to connect district centres of the province to Solwezi. The number of channels actually implemented is 7 to Solwezi and 6 from Solwezi for each

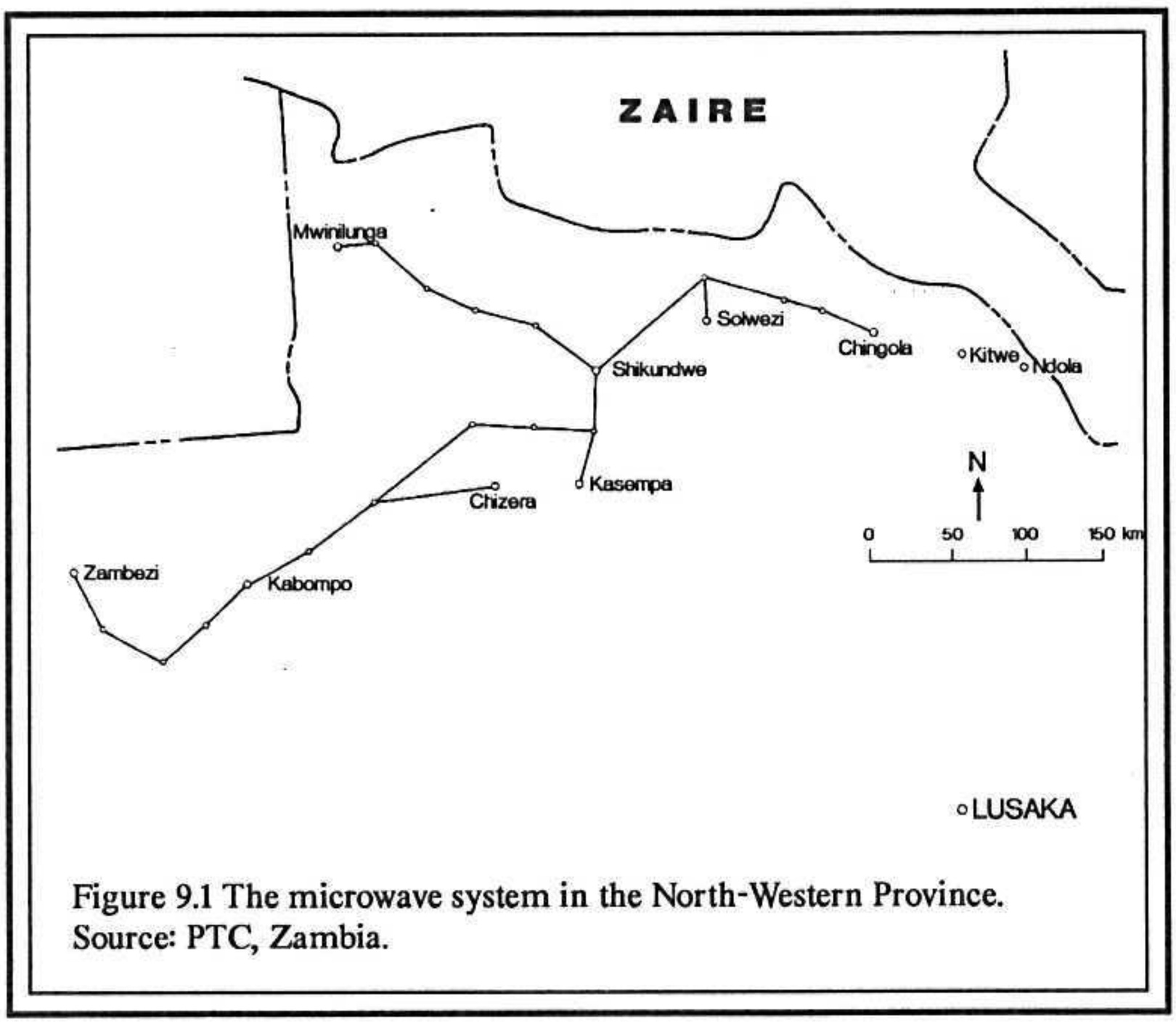

Figure 9.1 The microwave system in the North-Western Province.
Source: PTC, Zambia.

district centre except for Chizela where the numbers are 6 and 5 respectively.

One of the voice circuits between each district centre and Solwezi is allocated for telex, 24 telex circuits in each voice circuit. These are extended via the radio link from Solwezi via Chingola to the telex exchange in Kitwe. One voice channel between Solwezi and Kitwe is allocated for this purpose.

The project comprises 23 radio relay stations, complete with buildings, access roads as required, towers and power supply, together with spare parts, test equipment and training. The radio equipment was delivered by EB NERA, whereas the multiplexing equipment was delivered by Ericsson.

9.2.2 The exchanges connected to the radio system

Each of the district centres is equipped with an STK MCR (Metaconta Rural) telephone exchange, four financed by the World Bank and

one by NORAD under project ZAM 100. The capacity of the exchanges is 128 subscriber lines and 13 external lines, except for the Chizela where the exchange has a capacity of 96 subscriber lines and 12 external ones.

The current number of connected subscribers is given in Table 9.1.

It was stated by the operational staff that it was not advisable to increase the number of subscribers to an exchange above approximately 80 % of its full capacity. (Concerning connectable capacity for the MCR exchanges, see table 12.1) One reason for this could be

Location	Capacity	Number of connected subscribers
Solwezi	600	464
Chizela	96	44
Kabompo	128	82
Zambezi	128	83
Mwinilunga	128	83
Kasempa	128	74

Table 9.1 Telephone exchanges.

Source: PTC, Zambia.

technical; the subscribers were selected users, who were using the telephones almost continuously, resulting in high traffic per line. Other reasons could be a necessity for flexibility, to be able to accomodate very important new subscribers. There was also a fairly high turn-over of subscribers. This would require that a number of lines must be held in "quarantine" before they are handed over to new users.

The exchanges are not designed to operate with party lines.

There are further 8 PABX (Private Automatic Branch exchang-

es) in the province, 3 privately owned and 5 owned by the PTC. None of these are connected to the rural exchanges. The size of PABX most wanted is (4+10), 4 external lines and 10 internal ones.

The MCR exchanges at the district centres are connected to the transit exchange in Solwezi. This exchange, which is of type NX-1E, does not operate satisfactorily, and will be replaced later in 1989.

The Solwezi transit exchange is connected to the national network via the transit exchange in Kitwe and via the Lusaka transit exchange as described in Annex D.

9.2.3 Project implementation

The project was implemented by EB NERA on a turn-key basis. This meant that EB Nera was responsible for buildings, tower, power supply, access road etc as required, in addition to the electronic equipment. Also spare parts, test equipment and training was included.

The system was commissioned route by route, with the first one Chingola - Solwezi on 22 October 1984, Solwezi - Mwinilunga 26 June 1985, Solwezi - Zambezi 6 July 1985 and spur link to Chizela 26 September 1985. The complete system was commissioned 2 October, 1985.

PTC expressed general satisfaction with EB NERA.

NORAD was requested on 20 October 1988 to place an order for spare parts with EB NERA according to the manufacturer's offer R4880807, but answer was not given by the time of field work.

9.2.4 System maintenance; procedures and problems

A critical factor in obtaining the full benefit from investments in advanced telecommunications systems is the maintenance of the system. This is particularly difficult in the SADCC countries for many reasons, e.g. shortage of adequately trained staff, shortage of foreign exchange for procurement of spare parts, long distance and difficult goods handling for sending equipment to the factory for repair, a severe shortage of transportation.

This situation was taken into account when the project was initiated, by adding training and spare parts components to the contract. It was also an important part of a special evaluation initiated by NORAD to i.a.

- *assess existing maintenance routines and -organization*

and, if needed,

- *prepare alternative proposals for the maintenance organization.*

The evaluation was performed in March 1988, and the final report came up with a series of conclusions and recommendations, some of which are repeated here:

- *the shortage of transportation is serious,*

- *the maintenance routines for radio link systems in Zambia should also be applied to REG 020,*

- *the Electronic Repair Centre in Lusaka should be utilized to its maximum extent,*

- *NORAD should finance regular visits of experts to inspect the system, once or twice per year,*

- *spare parts supplied for a period of three years were already exhausted for some of the types,*

- *PTC and EB NERA should agree on a long term repair contract.*

It is significant to note that it was not recommended to renew the 2 year maintenance contract, since the transfer of know-how, the on-the-job training and the monthly reporting to the PTC had not been successfully performed.

The conclusions of the evaluation report from the technical

team were not reexamined, but the recommendation to conduct regular visits to the system is endorsed. It must be born in mind, however, that preventive maintenance in this large area, when only one vehicle is available, is not realistic.

9.3 The use of the system

9.3.1 The users of the system

According to the lists from PTC, there are altogether 830 telephone

District	Gov.dep.	Distr. counc.	UNIP	PTC	Others
Solwezi	165	17	1	19	149
Zambezi	35	13	3	4	36
Kabompo	28	16	1	3	24
Kasempa	27	11	1	3	25
Mwinilunga	26	19	4	2	31
Chizela	22	6	4	2	15

Table 9.2 The distribution of users. The North-Western Province.

Source: PTC, Zambia.

subscribers in the province, 56% of these are in in the provincial headquarters Solwezi, the remaining in the five district headquarters (Table 9.2).

According to the telephone directory, the distribution of the subscribers are as follows:

The category others typically includes parastatals, churches/ missions, donor assisted development projects, banks, private businessmen etc. The number of parastatals is particularly high in Solwezi.

The political/administrative system (government departments, district councils and UNIP) accounts for between 52% (in Solwezi)

and 65% (in Chizela) of the subscribers. They are therefore the main users of the system.

In addition to carrying telephone and telex traffic, the system is also used to bring the national television programme to Solwezi.

The users, and direct beneficiaries of the telephones (as well as the few television sets in the province) are obviously the better off parts of the population in the urban centres. In a national perspective, the "urban elite" of North-Western province is, however, rather disadvantaged because of the remoteness and underdeveloped character of the province as a whole.

The purposes for which the telephones are used, will also to a considerable extent be of a nature which can benefit larger sections of the population at least in the district centres (e.g. provision of commodities for the shops, drugs for the hospital, fertilizers for the cooperatives etc.).

9.3.2 Traffic data; what does it tell about the system?

Most of the telephones in the province are operated by subscribers in business or public services. The traffic per subscriber is therefore high. This results in high probability that the called subscriber is busy. Moreover, it appears that most of the calls at the district centres are to the province or the national capital. The probability of successful call attempt is dependent upon proper working of the transit exchanges in Solwezi, Kitwe and Lusaka.

Both the Solwezi and the Lusaka exchanges are experiencing severe congestion, and it is therefore not surprising that the subscribers complained about the grade of service.

A series of traffic measurements over 24 hours were conducted at the Solwezi exchange on 1 to 2 June 1989 in order to obtain some quantitative impressions about the volume of traffic, the grade of service and the traffic distribution among the different districts.

Fig. 9.2 shows the number of answered calls over a 24 hour period, one set of bars showing the transit plus outgoing calls, and one set of bars showing local plus incoming calls.

It is apparent that the number of successful external calls is

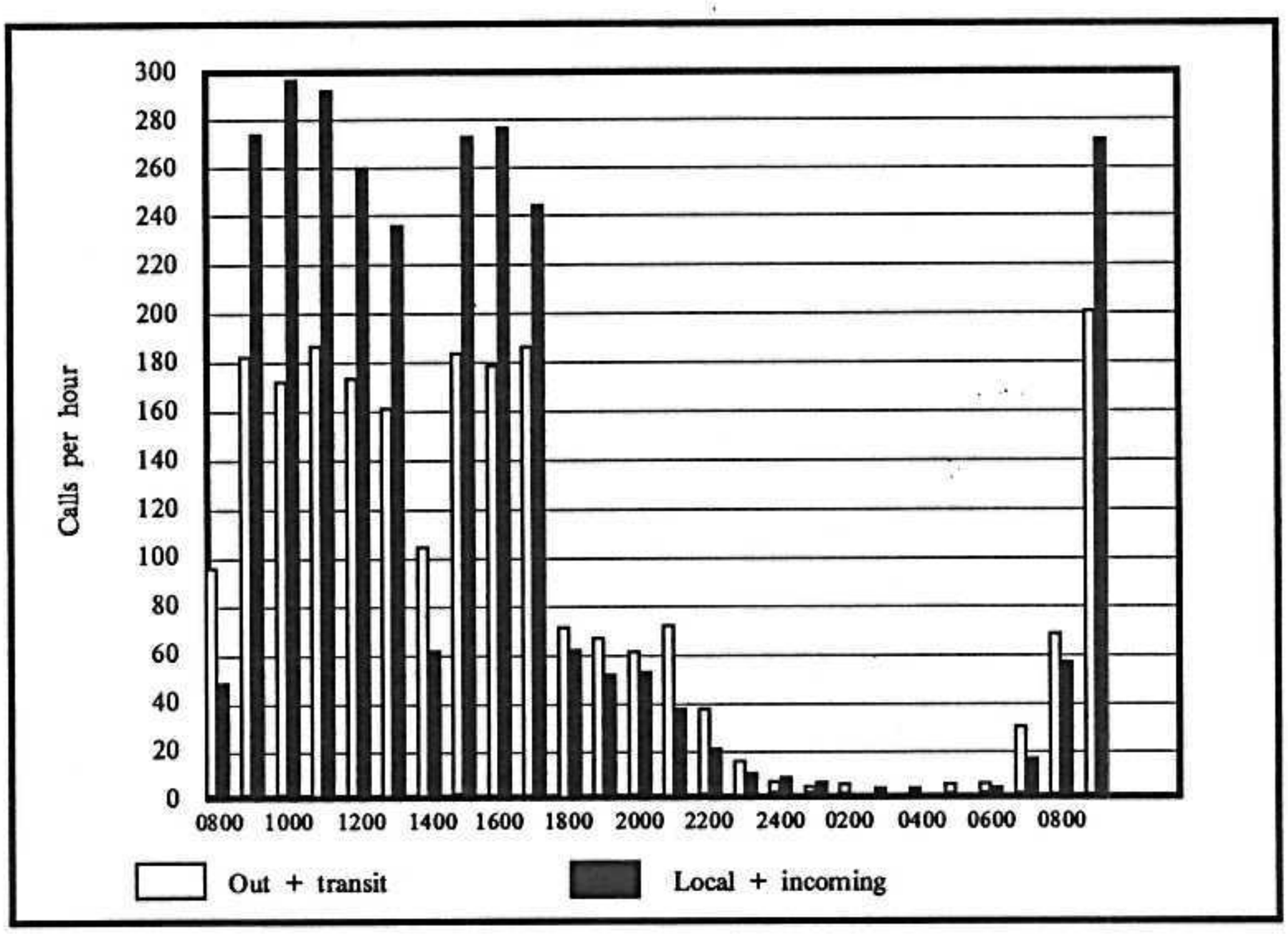

Figure 9.2 Number of answered calls.

Source: Measurement at the Solwezi exchange 1 to 2 June 89.

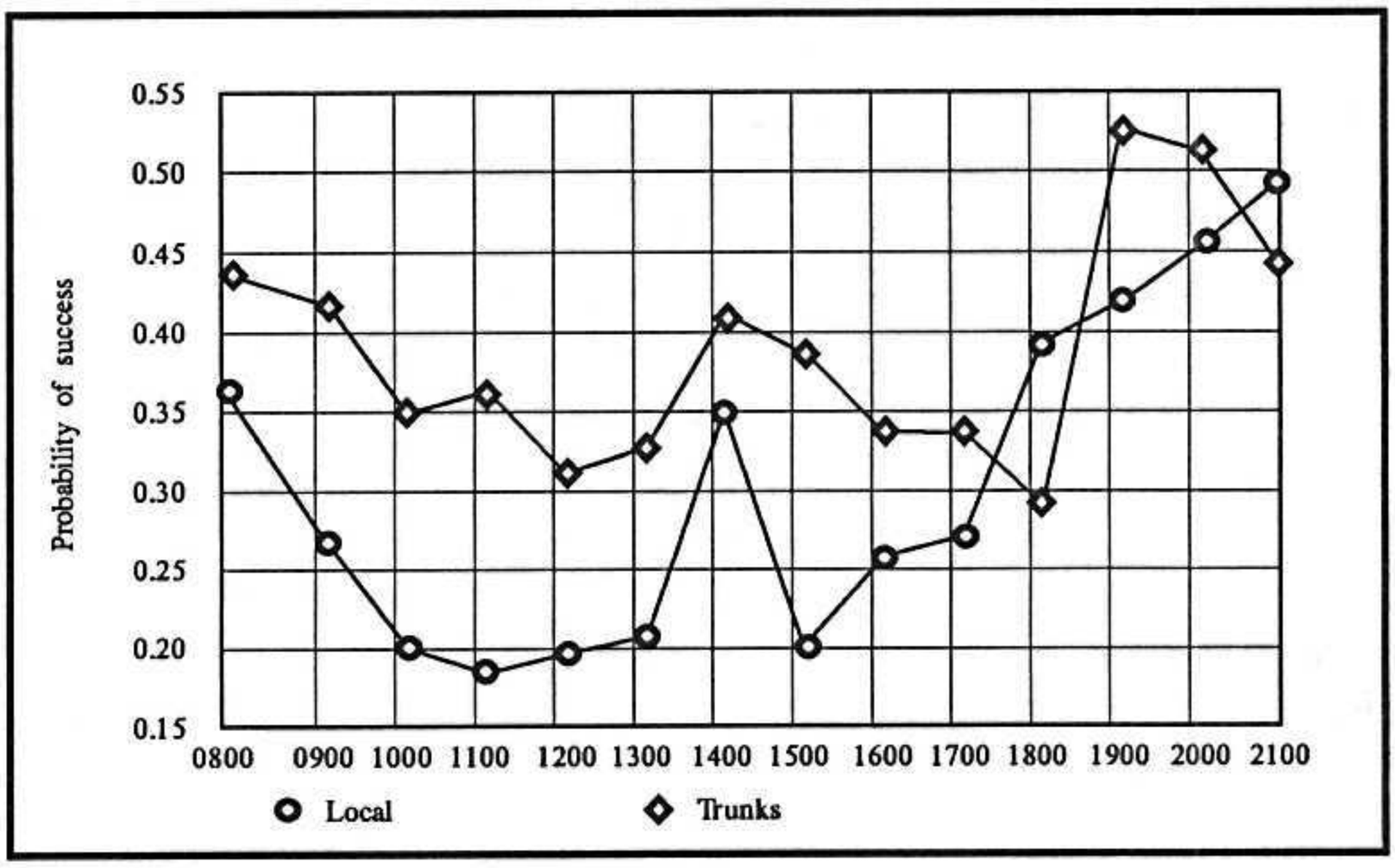

Figure 9.3 Rate of successful calls.

Source: Measurement at the Solwezi exchange 1 to 2 June 89.

very high compared to the local ones, which also explains that the exchanges had to be redimensioned to cater for more external traffic.

The congestion is illustrated by the measured rate of successful calls during the busiest period of the day, as shown on Fig. 9.2.

The distribution of calls is illustrated in Fig. 9.3, which shows the number of outgoing call attempts to the different exchanges connected to Solwezi. The average is taken over the four busiest hours.

9.4 System costs and revenue

An evaluation of costs and benefits connected with REG 020 may be done according to different assumptions.

One such assumption is that the link in question is to be a part of an international system, connecting - some time in the future - Angola and Zambia. If and when such an international system is established, the link will be used to carry more traffic than now and thus create more income. In addition to the international traffic arising from such an extension, the link into Angola will become a part of the national telecommunications system of that country and may be of some importance at provincial and district levels in Angola.

If we consider the system as a national one, however, as a part of the Zambian telecommunications system alone, it is evident that the system has to be heavily subsidized, at least for the first years. It has to be taken into account, however, that the utilization of capacity is rather low compared to the potentials of the link, a situation which is to be expected for the first years. A higher utilization of available capacity will increase income. On the other hand, extension of telecommunications services beyond the present level, implies that most of the rural exchanges have to be expanded, and connection of new subscribers tends to increase costs. It is thus of some importance to try to assess future needs for telecommunications services in the North-Western province and try to evaluate the economic effects of future demand.

Future demand for telecommunications services depends on the development potentials of the province and how these potentials are utilized. Telecommunications are in itself a factor of growth, however, and one should ideally try to evaluate how a better and fur-

ther developed telecommunications system may influence activities in other sectors. It would be wrong to evaluate only the economic viability on the basis of costs and revenue in the sector as such.

The investment costs of the link amount to about NOK 80,000,000 (1985), including a Zambian component for some civil works. This means an investment of about 119,000 NOK per subscriber. (1986/87). In PTC's calculations, the link should be depreciated over 20 years at an interest rate of 8 %. The investment costs per year associated with the link are thus approximately 8.2 mill NOK. (Calculations in fixed 1985-prices).

A depreciation period of 20 years is probably too long taking into account the fast technological development in this sector. If we reduce the period to 10 years, yearly investment costs will amount to about 11.9 mill NOK.

In connection with ZAM 100 one of the rural MCR exchanges was installed in the province, at Chizela. The investment costs for such an exchange amounted to about NOK 1,035,000 (1985). Investment per subscriber (1986/87) in that district was then about 17,200 NOK. According to PTC procedures exchanges should be depreciated over ten years at an interest rate of 8 %. The investment cost per year for the exchange in Chizela amounted thus to about 154,200 NOK. If we take it that the exchanges in Zambezi, Kabompo, Kasempa and Mwinilunga on the average cost the same, (some of them are more costly, because of higher capacity), the five districts have altogether investment costs per year as to exchanges amounting to about 771,000 NOK. In addition comes the exchange in Solwezi which is much more costly.

Yearly investment costs for the link (20 years depreciation) and the five above mentioned exchanges amount to approximately 9.0 mill NOK. Although we have not taken into account the costs of the exchange in Solwezi and the investment costs as to subscriber lines, and not at all taken into consideration any costs arising from operating, maintaining and renewing the national network system, the above amount is much more than the total billing in the whole province today. (5.3 mill ZKW in 1987/88).

The outcome of the calculations is dependent on the exchange rate used. In November 1985 the rate was 1.62 NOK for the ZKW. In

December the same year the rate was 1.30, in March 1986 1.15 and in January 1987 0.60. In 1988 the rate was around 0.80, and in 1989 0.66 falling to 0.44 in August 1989.

If we use the exchange rate at the beginning of the year 1986, yearly investment costs for the link (20 years depreciation) and the five exchanges would amount to around 7.8 mill ZKW. If we use the average exchange rate for 1987/88, which was about 0.8, the above investment costs would amount to ZKW 11.2 mill. Calculations of the investment costs is based on the costs in NOK at the end of 1985. (Table 9.3) When comparing costs and revenue, this fact should be taken into account, some inflation has taken place from the end of 1985 to 1987/88. Taking inflation into account would mean that the costs would be higher than calculated above.

Even the present exchange rate seems too high and a more reasonable rate would imply a considerable higher amount of costs in ZKW. After the devaluation in august 1989, tariffs have been increased considerably. This example illustrates how dependent the sector is on fluctuations in the exchange rate. To which extent this increase in tariffs will affect demand is difficult to assess, but it is reasonable to assume, particularly in a rather poor area, that some subscribers will be disconnected and that the general use of telephone will be somewhat reduced.

In 1987/88 total billing in Chizela was ZKW 180,979. Given the exchange rate at that time, this revenue is not enough to cover the yearly investment costs for the rural exchange only. (ZKW 192,700). Total billing in the other District centres is probably big enough to cover the investment costs of the exchanges and some of the other local area costs. (Table 9.4).

If we do not take into consideration investment costs as to the link, and compare the remaining area costs, (including costs of the exchanges), with revenues in the province, we find that the operating costs exceeds revenues in 1986/87. In 1987/88, however, there is a surplus of about 1.3 mill. ZKW. The considerable increase in income from 1986/87 to 1987/88 is partly due to an increase in the number of subscribers, but mostly due to more extensive use of telecommunications services in the Solwezi district.

In order that area revenue should cover area costs also including yearly costs of the link itself, (amounting altogether approximate-

Exchange	Telephone connections 1986/87	1987/88	Telex connections 1986/87	1987/88	Total billing 1986/87	1987/88
Chizela	60	58	-	-	150,567	180,979
Kabompo	56	63	-	-	251,395	475,108
Kasempa	65	73	-	-	135,409	348,779
Mwinilunga	79	75	-	1	197,225	311,489
Solwezi	393	408	1	5	1,502,397	3,651,548
Zambezi	79	84	-	2	210,062	368,726
Total	732	761	1	8	2,447,055	5,300,629

Calculated investment costs for the link and five of the rural exchanges (1985 prices)

20 years depreciation:	7,800,000
10 years depreciation:	11,200,000

Table 9.3 Telecommunications services in the North-Western Province. Total billing. Calculated investment costs. ZKW '000.
Source: Financial Department, PTC.

Cost category	1986/87	1987/88
Staff costs (Salaries)	671	833
Vehicle expenses	106	138
Plant equipment maintenance	139	178
Depreciation	2,013	2,418
Other expenses	324	411
Total expenditure	3,253	3,978

Table 9.4 Operating costs - North-Western Province. ZKW '000.
Source: Financial Department, PTC.

ly to 14.2 mill ZKW, based on the exchange rate in 1987/88, 20 years depreciation), revenue in the province had to be about *three times* as high as actual figures. If we base the calculations on a depreciation period of 10 years for the link, revenue in the province had to be *four times* as high as now to cover the costs. And still we have not included any costs arising from maintaining and renewing the national network system and we have not taken into account the effect of inflation.

The exchange in Solwezi and the main exchange in Lusaka are quite serious bottlenecks for traffic to and from the province. More capacity as to these exchanges - capacity will be enlarged at the end of 1989 - will certainly imply increased traffic and thus generate higher income. It may still be possible to connect a few more "profitable" subscribers, particularly in the Solwezi area. A further extension of the system to new subscribers, will imply expanding rural telecommunications, however, and in such a case additional revenue will probably be less than additional costs of expanding the system.

Although the number of subscribers may still be somewhat increased, it seems evident that the North-Western province has to be heavily subsidized in order to cover investments and other fixed costs related to the present installations. And a possible additional expansion of the telecommunications system in the province will probably increase the need for cross-subsidies.

In the final analysis one has to take into account the future use of the link including a planned expansion into Angola. For the time being it is very difficult to make good assumptions as to when and how this plan will be carried out. It is also difficult to evaluate how much traffic will be generated and the revenue arising from such traffic. As for now there is very little communication between Zambia and Angola.

If we assume that the investment costs of the link should to some extent be covered by international traffic some time in the future, the economic realities as to telecommunications in the North-Western province is not too bad. It has also to be taken into account that telecommunications is an infrastructural component contributing to production and income in other sectors. It should also be noted

that there seem to exist to some extent a substitution between telecommunications and transport in the province.

Telecommunications is a rather import-intensive sector, both regarding investments and spareparts. While it is possible to assess the needs for foreign exchange for investment and operation purposes, it is very difficult to assess the telecommunications sectors ability to earn foreign exchange, Apart from the economic impact of international calls, the sector can contribute favourably as to foreign exchange in two ways. Expanded and more efficient telecommunications may contribute to more efficient production for exports or production of import substitutes, and telecommunications may contribute to foreign exchange saving by substituting transport.

In the North-Western province very little is produced for export purposes. A certain production of import substitutes is more likely and telecommunications may play a role in such a process. The most evident way telecommunications in the North-Western province can contribute to balance of payment problems seems to be through transport substitution.

* In Chapter 8 we presented the reasons why we did not plan to undertake a cost-benefit analysis, of the kind outlined in Chapter 3. Below, we give an example of what could be meant by benefit (consumer surplus).

  In the above very crude economic analysis, we found that present revenues are not big enough to cover costs. In a cost-benefit analysis, present revenues would not be an adequate measure for benefits. This fact may be illustrated by an example from the district centre in Chizela: a ten minutes call to Lusaka costs about 50 kwacha, whereas a car-trip to Lusaka may cost 3-4000 kwacha. To the extent a telephone-call can fully substitute a face-to-face conversation, and the two mentioned ways of communication are the only alternatives, the benefit of the call is equal to the cost of the saved trip. In the above case the benefit is 60 to 80 times as high as revenue. This example may not be typical, but it should demonstrate that calculations according to a cost-benefit analysis might give very

different results compared to the simple calculations presented above.[9-2)]

9.5 Impacts

9.5.1 Economic potentials in the North-Western province and the development of telecommunications[9-3)]

The main problem of the NW-province is that the majority of its people in the rural areas is still not in a position to make a reasonable living from available resources. People are generally poor, of the poorest in the country, out-migration is taking place and the dependency on imported foodstuffs is quite high.

However, there seems to be a potential for increased self-sufficiency of the following products:

sorghum, cassava, sunflower, groundnuts, rice, limestone, cattle, vegetables, fish, game, timber, clay, and sisal.

There is also a potential for export to other provinces as to honey, beeswax, timber, pineapple, coffee, soyabeans, and rubber.

Experience from the last years shows that reliable supply of input and marketing services and properly run credit schemes is what is needed to encourage people to increase cash crop production.

The North Western Provincial Cooperative Union plays an important role for agricultural development. The most important func-

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[9-2)] The figures from Chizela were given by a district official. Whether telephone conversations "really" substitute transport to a large extent is difficult to tell, but the possibility is obvious.
An alternative to a telephone call and a car-trip to Lusaka might be mail. Prior to access to telecommunications, letters or cars were the only possible ways of communication. It was claimed, however, that it was very difficult to obtain replies from Lusaka, and if so, the replies could take half a year or more. This fact caused a lot of frustration, and the consequence was that writing letters was more or less abandoned. Instead, officials in Chezela undertook several unsuccessful car-trips to Lusaka per year. (The officials in Lusaka were usually on travel, or engaged in some urgent business).

[9-3)] A more detailed description of the North-Western Province is given in Annex F

tions of the union are to supply peasants with necessary input of seeds, fertilizer etc. and to collect produce from various depots in the districts.

The Cooperative Union is organized on four levels: National, Provincial, District, and Primary societies. There are 54 Primary societies in the North Western province. Supplies of fertilizer, seeds etc. are distributed from the Provincial level through district levels down to the Primary societies, and produce are collected and stored for further transport at these societies.

A main problem for efficient distribution of inputs and efficient collection of produce is the fact that telecommunications are not available below the district level. The Cooperative Union plans to install some sort of a radio system in order to cope with the difficult communication problems.

A further development of telecommunications in the districts could possibly contribute to increased cash crop production and to more efficient provisions of supply and collection of produce. As mentioned above, the province has several underutilized resources and some resources not utilized at all. The province has all the typical features of an underdeveloped rural area, however, including a poorly developed infrastructure.

In a future development strategy of the province, telecommunications should be treated as a part of a total plan where the sector is expanded in view of expansion plans for other sectors, in particular the transport sector. Such a process will probably take quite some time, however, particularly in view of the difficult economic situation of the country.

9.5.2 The social impact[9-3)]

Interviews at provincial and district levels indicate that the telephone

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[9-3)] By social impact is here primarily meant impact from telecommunications on health and education. In view of the situation in the Province, and the time available, the Team was unable to collect information on other social issues. (See also the case study on Chezela in Chapter 12).

People in and around the provincial capital, Solwezi, have the possibility of seeing television, for the time being this possibility is only optional, however. So few people have the purchasing power to make use of this option. Therefore, it did not make sense to investigate into possible political, social, cultural effects arising from television programs. The majority of inhabitants in the province live outside the area covered by television.

system has bettered communication in the health sector. The telephone is primarily used for communication between district hospitals and provincial medical authorities. This bettered communication implies, among others, a better utilization of very scarce vehicles and makes it more certain that car trips are more successfully completed.

Telephone was seldom used by the district hospitals, when it was necessary to send patients to the General Hospital in Solwezi. There is a very inefficient internal telephone system at the provincial hospital. This fact explains to some extent the hesitation and reluctance on the part of the district hospitals to communicate effectively with the provincial hospital.

The need for telephone communication also including health centres on district level, was strongly stressed by medical officials. People had to walk or use bicycles to bring information about health problems. It was pointed out, however, that improved telecommunications would not in itself solve the problems at hand. The capacity of the medical system was too small, particularly with respect to doctors and nurses, and there was a severe shortage of transport.[9-4)]

For the time being the shortage of transport capacity seems to be the most serious problem.

Primary schools seem to use telephone mainly for administrative purposes, and for making appointments, implying, among others, a better utilization of scarce transport means.

[9-4)] Members of the Team visited a small village about 30 kilometres outside Solwezi. The village had a tiny health station, run by a man. The station was well stocked with respect to medicines, used for curing some of the common diseases. Whenever acute health problems arose, which occured all the time, the only alternative treatment was at the General Hospital in Solwezi. There were no cars available in the village nor in the neighborhood, and the village had no telecommunications. Messages to the hospital were brought by a young boy on a bicycle, which was broken down at the time the Team visited the village. Because of scarcity of transport capacity at the Hospital, it could take several days before the ambulance came. In the meantime, many patients died.

However, the village in question was of the more fortunate ones, having at all a health station with rather ample supplies. This was not the case in most villages around. Furthermore, the visited village was situated quite close to the provincial centre, not very far away from a variety of services only available in the capital.

9.5.3 National integration, political and public administration.

Zambia has established a system of integrated political and government administrative organs from national to district levels. The political side is responsible for policy formulation, while the government side is responsible for implementing the decisions.

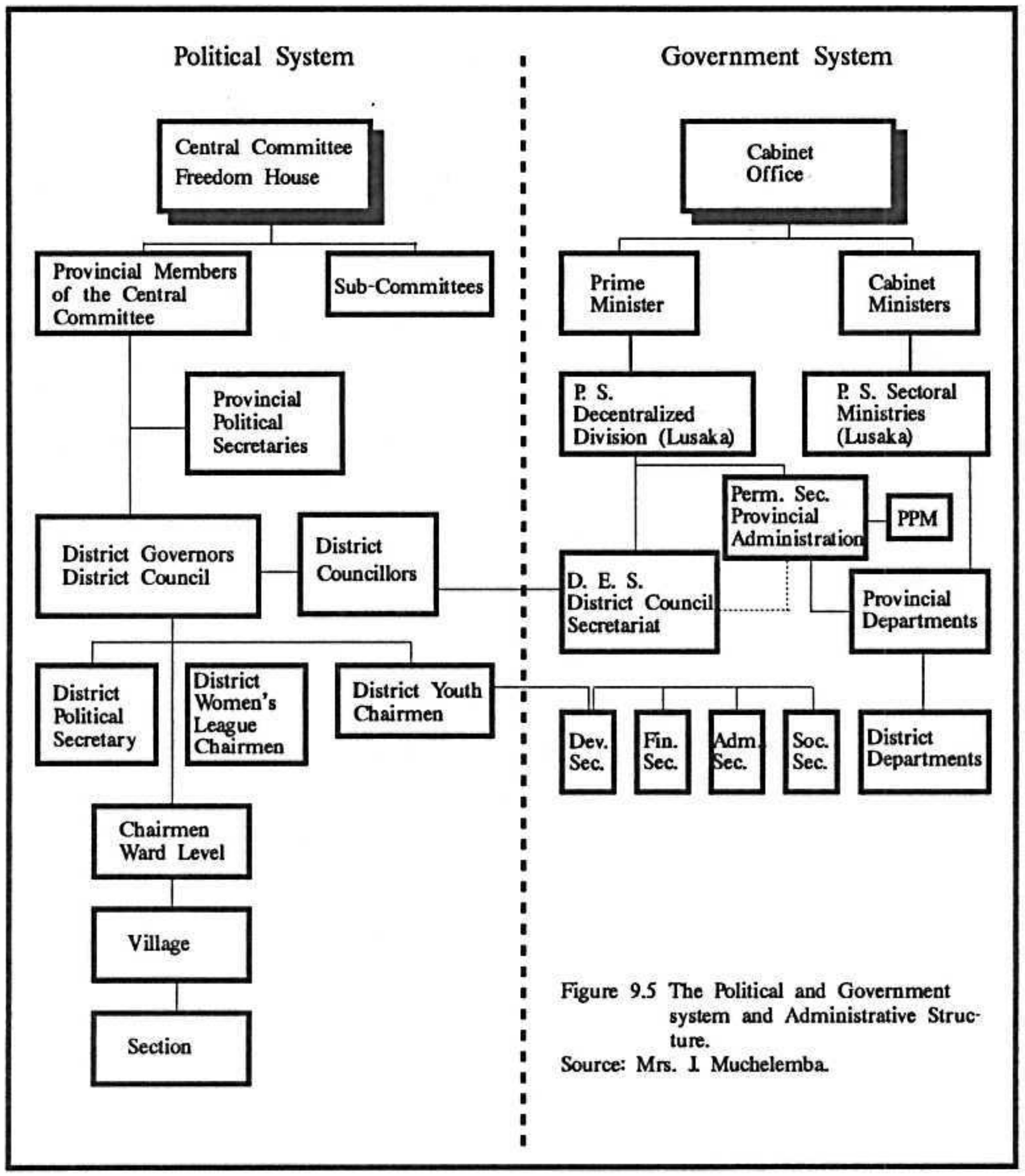

Figure 9.5 The Political and Government system and Administrative Structure.
Source: Mrs. J. Muchelemba.

The organizational structure of the administrative and political system is shown in figure 9.5.

On the basis of the administrative structure described in the above figure, the need for communication between various levels is evident. Both the provincial as well as the district Authorities have to communicate with Lusaka and vice versa on a more or less daily basis. It should also be noted that the channels of communication and delegation of authority is separate between politicians and government officials at all levels, i.e, national, provincial and district levels ultimately report to the Freedom House in Lusaka while Civil Servants report to the Cabinet Office or their respective Ministry headquarters in Lusaka.

The completion of REG 020 implies that the district headquarters in the North-Western province has become part of the National telecommunications system to the effect that the local bureaucracies are able to communicate more efficiently throughout the political and administrative hierarchy. It is likely that this improved communication contributes to political stability. Before the telephone system was established, there existed a lot of frustration in the districts because of the slow and unreliable process of communication.

Interviews with different people in the political and administrative system revealed that the improved telecommunications had made it possible to obtain information more rapidly, information vital for making decisions on political and administrative matters.

It was claimed that the improved access to telecommunications implied that telephone calls to some extent were used as a substitute for transport. The more extensive use of telecommunications also implied a more efficient way of utilizing the very scarce transport means. The importance of this was particularly stressed at district level.[9-5]

Traffic data for the North-Western province indicates that most calls are directed vertically in the political and administrative hierarchy and most calls come from the periphery directed towards the centres, in particular towards Lusaka. This fact is as expected, given the Zambian political and administrative structure. There

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[9-5] In Chapter 9.4 an example demonstrates political and economic benefits from telecommunications.

seem to be very few calls directed horizontally, i. e. across district borders.

9.5.4 Poverty orientation

At present, telecommunications does not play any important role for the poorer segments of the population. So far this kind of service is available only for public and professional use and for some few rich individuals, particularly in the Solwezi district.

REG 020 together with the rural exchange (ZAM 100) delivered to the area imply, however, that there is established in the province a workable telecommunications system down to the district headquarters.

This infrastructure is a necessary precondition for establishing a rural telecommunications system which, to a higher degree, could affect also the poorer segments of the population. A further development of telecommunications in the districts could be a means to bring about better health and educational services as well as services of various necessities down to the village level.

It is important to stress that telecommunications systems can only be built out to serve the poor and weak segments of the population after having established a national network down to the district level. Only then is it possible to expand into the rural areas at not too high costs. And if the strategy is that the telecommunications sector as such should be profitable (in local currency terms), rural telecommunications, which in most cases has to be subsidized, can only be built out if urban telecommunications can be run at a profit.

The question is thus to expand simultaneously both urban and rural telecommunications in order to create a profitable system in total.

9.5.5 The Refugee and Security Problem

The North-Western province has very long borders with Zaire and Angola. Along these borders there is a rather severe security problem. A substantial amount of refugees crosses the border from Angola. The same tribes live on both sides of the border, and it is difficult

to know who are refugees and who are not. In order to cope with these problems a workable telecommunications system is of great importance.

9.6 Conclusions

9.6.1 Lessons from project planning and implementation

In the planning of the project, more attention could have been paid to two broader issues:

- The need to look at improved telecommunications as part of a wider package of inputs in different sectors, if the expected wider impacts on economy and society are to be secured[9-6]

- The need for a critical assessment of PTC's capacity to operate and maintain the new system, a more institutionally oriented approach.

The latter issue has been adressed later through the addition of the technical assistance component. However, it is the Team's impression that there seems to be a lack of keen interest in and follow up of this part of the project from NORAD's side. Though the present technical assistance is useful to PTC, it is not part of a well developed strategy for strengthening the organization. As an example, although there is a NORAD expert at the PTC training college, NORAD does not seem to have been active in supporting the staff development of the college.

The implementation of the radio link project was successful. The "turn-key" model used secured an efficient and timely implementation. For a more general discussion of advantages and disadvantages of this model, reference is made to Chapter 13.

[9-6] In Chapter 13, the Team concludes that a main link like REG 020, which, in addition, in the future will be a part of an international link, is politically so important that thorough analyses are not needed. However, if NORAD on a later stage should consider supporting rural telecommunications in the area based on the link, there is a strong need for an integrated development approach. (See Chapter 13).

9.6.2 Lessons from operation and maintenance

Support to maintenance in the original project consisted of supply of spares, and the provision of a maintenance engineer to PTC in Solwezi for the initial period after commissioning of the link.

The focus seems to have been on the short term objective of making the system operating, rather than the long term objective of making PTC capable of operating the system. The supply of the maintenance engineer was not part of a strategy for strengthening PTC's organization in the province or the maintenance function within PTC more generally, and the expatriate was too weakly integrated into PTC's organization to have a more lasting effect. He was therefore later replaced by a NORAD expert within PTC.

The maintenance problems experienced, and documented in the 1988 technical evaluation, are partly a reflection of the general maintenance problems in the country, partly of the vastness and remoteness of the province, which aggrevates the general problems of manpower and transport.

9.6.3 Present and potential impacts from telecommunications projects

For the time being the impact of REG 020 is only in Zambia and in the North-Western province. The link implies that the Province now has telecommunications services down to the district level. There is no doubt that this is a vital improvement in the Province, better communication with the urban centres and throughout the political hierarchy is favourable as to political stability and it has easened the process of public administration.

As to social impacts bettered telecommunications services have to some extent increased the efficiency in the health sector, particularly through securing more reliable supplies of medicines and other medical necessities.

The impacts on economic activities in other sectors are more difficult to assess. The province is as a whole a backward area, both as to industries, trade and services, and infrastructure. Such areas are often in some sort of a vicious circle, tending to lag more and more behind the growth areas. Telecommunications alone can of course

not bring about a growth process. It is a vital infrastructural component, however, which could contribute to growth as a part of a comprehensive development plan.

Given the present economic problems in Zambia, it is not likely that huge investment will be undertaken i the NW-Province for the first years to come.

If we consider REG 020 in a national context, revenues from telecommunications services do not cover the full costs of the system. In view of the economic prospects of the country and the Province in particular, cross-subsidies seem to be necessary also in the future.

If and when the link becomes a part of an international telecommunications system, however, the question of profitability may change.

9.6.4 Project sustainability and need for future assistance

The telecommunications sector as such is not a foreign exchange earner except concerning international calls. And as to such external services the PTC in Zambia is running at a small deficit.

The sector is in great need of foreign exchange both for investment purposes and for running the daily operations. PTC does run on a profit in local currency terms, nevertheless the organization has to compete with other sectors for the use of foreign currency. Since it is difficult to assess how telecommunications contribute to foreign exchange earnings in other sectors, and possibly - by substitution - to foreign exchange reductions, partly by contributing to production of import substitutes, and partly by substituting transport, the telecommunications sector is dependent on the political will to give priority to the sector.

In view of Zambia's severe economic situation and the balance of payment problems, the telecommunications sector and the projects in question are not sustainable without lasting support from outside, procuring for spareparts, tools etc. The problem is not PTC's earning capacity, but the overall economic situation in Zambia.

PTC in Zambia is lacking qualified manpower for planning, operations and maintenance.

Thus there is a need for support regarding manpower development, both through fellowship and by strengthening the training college.

In the meantime, PTC will also need additional technical assistance.

10 REG 004 RADIO LINK FRANCISTOWN-BULAWAYO-LIVINGSTONE

10.1 Program initiation

10.1.1 The PANAFTEL Context

At the time the project was proposed the telecommunications system in the area, both for national and for international use, was in a poor state. The transmission system was mainly of the overhead open-wire type, of inadequate capacity, partly damaged by hostilities and large animals, and very difficult to maintain.

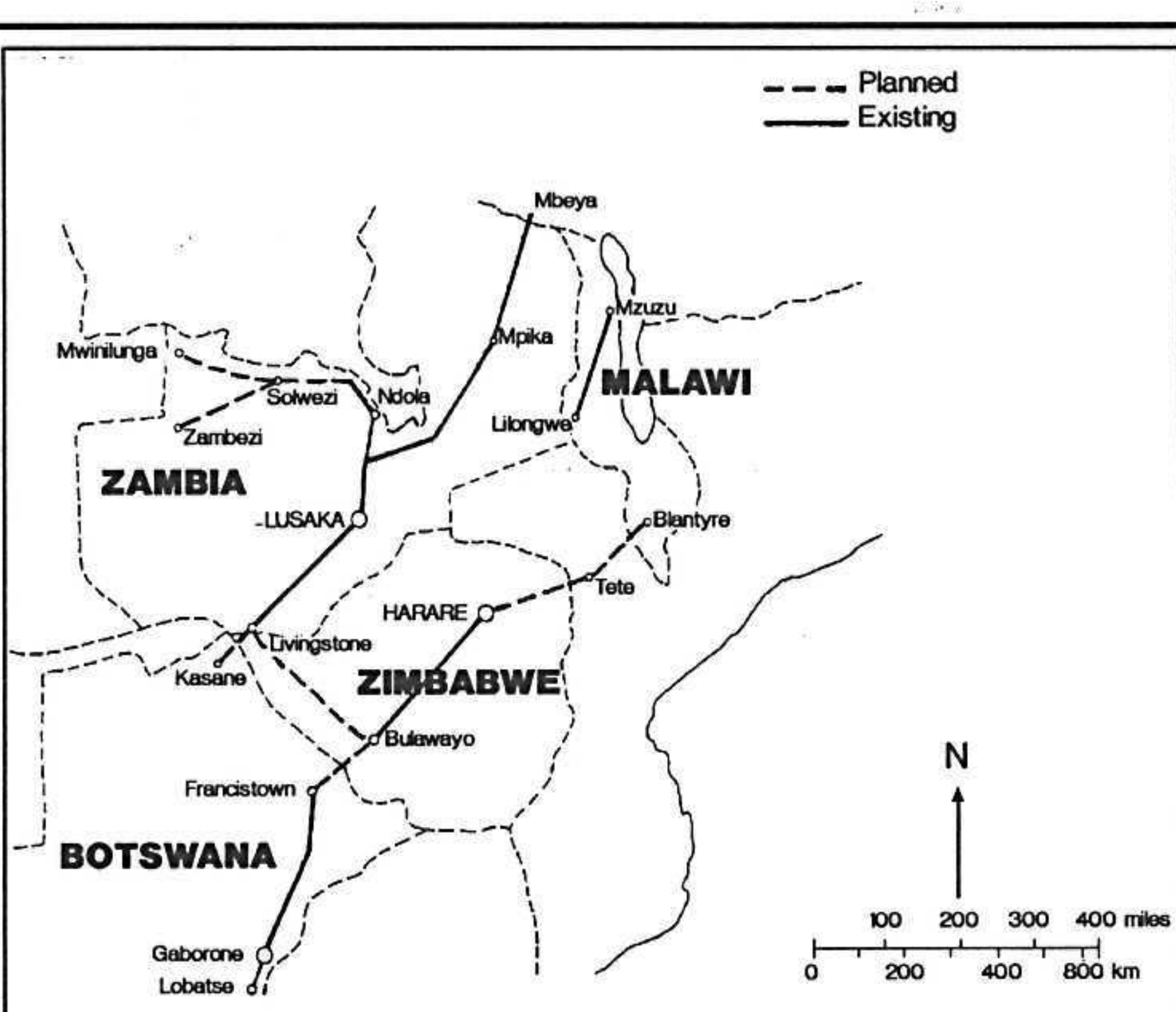

Figure 10.1 The PANAFTEL system.
Source: PTC, Zambia

In 1979 Rhodesia was not included in the PANAFTEL network. In 1981, however, the PANAFTEL system was as shown in Fig. 10.1, and it is apparent that the radio link Francistown - Bulawayo - Livingstone represented " a missing link" in the wideband system. (The link from Lusaka to Harare (then Salisbury) was of the open-wire type.)

10.1.2 Background to the NORAD assistance

During the second SADCC conference in Maputo in 1980, Norway pledged financial support to the implementation of regional development projects identified by SADCC.

One of the priority areas identified by SADCC was international telecommunications, and Norway and Sweden was requested to support improvement in the telecommunications between Zambia, Zimbabwe and Botswana (originally approved by SADCC as two projects, 5.2.1 (Botswana - Zimbabwe) and 5.9.3 (Zimbabwe - Zambia)).

On the basis of the priority given both to the sector in general, and the specific project, by SADCC and the three countries involved, and the possibilities for using a combination of Norwegian and Swedish equipment, NORAD granted NOK 58 millions to the project in 1981, from the newly established grant to regional SADCC projects. Simultaneously, SIDA granted NOK 38 millions.

In 1985, after considerable discussions, NORAD granted an additional 9 millions to the construction of a spur link to the town Kasane in northern Botswana, to connect this town to the rest of Botswana via Zimbabwe. Simultaneously SIDA granted an additional NOK 5 millions to expand the capacity of the Lusaka - Livingstone connection.

10.1.3 Objectives of the NORAD assistance

The original project document does not contain very clearly and explicitly formulated objectives of the NORAD assistance.

Generally, the project is seen as part of the process of regional integration, and reduction of the countries' dependence on RSA (The Republic of South Africa). It is mentioned that the project will make it possible to improve the communication to northern Zimbabwe, but there is no discussion of possible impacts of the project internally in e.g. Zimbabwe, neither is there any assessment of the financial viability of the project. It is assumed in the project document, that the national telecommunications administrations will, with the training component included in the project, be able to take over the responsibility for operating and maintaining the project.

In the project document for the additional components, the improvement of the telecommunications to Kasane is, together with other types of infrastructure, seen as an important element in the development of the Kasane area.

To secure the investments made, and to train local personnel, further technical assistance to Zimbabwe PTC is also considered to be necessary. There is no assessment of the financial viability of the Kasane link. The success of the project must therefore be judged against

- the actual use of the project for international and national traffic

- the changes in the pattern of international traffic towards less dependence on RSA

- possible implications of improved telecommunications in terms of reduction in the overall dependence on RSA (expressed through e.g. trade pattern)

- possible implications of the national parts of the project for local development in the affected areas.

- the viability of the project in technical, financial and manpower terms.

10.2 System implementation

10.2.1 Project definition

The project was included on a list of project that was presented at a donor conference in Maputo. The combination of a microwave system with multiplexing equipment was found suitable for a joint Swedish/Norwegian project, using equipment manufactured in these two countries and financed by SIDA and NORAD.

The project was not subject to international tendering. Offers made jointly by EB NERA and Ericsson were evaluated by independent consultants with regard to international price level and to production cost versus price.

The cost estimate for the project, based on offers from the manufacturers and estimates of local cost made by the ZPTC, was NOK 110 mill, of which 58 % was the Norwegian part and the remaining 42 % the Swedish one. This distribution reflects the relationship between the deliveries for the two companies involved.

The project was later extended to include a spur link from Livingstone in Zambia to Kasane in northern Botswana. This would give Kasane a better connection to the national network, and would also give better connections between this part of Botswana and Zambia.

The technology used is analogue. At the time the decision was made, this was a reasonable choice.

A weakness in project design is that it has limited drop-off facilities. This reduces the links value for internal communication, particularly in Zimbabwe.

10.2.2 The construction phase

The parties involved in the project implementation were:

- *EB NERA as supplier of the equipment and responsible for the installation of the equipment*

- PTC Zimbabwe and PTC Zambia and BTC (Botswana) as clients, with PTC Zimbabwe as coordinator.

In Zambia and Botswana, EB NERA was responsible for all components of the project, including civil works. In Zimbabwe, where most of the construction work took place, PTC was responsible for the civil works, while EB NERA was responsible for the other components.

This division of responsibilities caused no major problems during implementation. PTC Zimbabwe originally also wanted to do the installation of the radio equipment, but NORAD was opposed to this, fearing that it would lead to unclear responsibilities.

The construction of the system was completed according to schedule. Route I (Bulawayo - Livingstone) was handed over in February 1984, and Route II (Francistown - Bulawayo) was handed over in July 1984.

The timely implementation of a fairly complex project like this, involving work in three countries and in inaccessible parts of the countries, with long lines of supplies, is an impressive achievement in project management, for which both the company and the PTC's deserve honour.

The Kasane link was completed in 1989.

All the three telecommunication authorities expressed general satisfaction with the performance of the Norwegian company, an impression also verified by the fact that EB NERA has later become involved in other projects in both Zimbabwe and Botswana.

10.2.3 The training programme

Two types of training were included in the project:

- on-the-job training to PTC staff during project implementation

- special training cources in Sweden and Norway organized by the equipment suppliers for staff from the three countries.

In addition, samples of the radio equipment were supplied to the

PTC training college in Harare, and one teacher from the college was included in the training in Europe. It was, however, declined to give similar equipment samples to the BTC college in Gaborone.

Problems associated with the training were:

- Selection of personnel for training: Since training abroad is also considered as an incentive, it was claimed that the selection of trainees were not exclusively on the basis of their future involvement with the equipment.

- Turnover of personnel: This is an endemic problem with project related training in a situation of general scarcity of trained personnel. Due to a number of factors, there is a tendency that the trained staff disappear from the project after a while, through promotion, transfer, their leaving PTC altogether etc.

- Location of the training: It was felt by some that having the training in Europe reduced the number of people that could be offered training, both because of the costs involved, and because it was difficult for the organizations to release a large number for a long stay overseas. As mentioned above, it may also influence the selection of trainees.

- The content of the training: Not all parts of the training was considered equally relevant, and the language problem reduced the value of some of the stay with the equipment manufacturers.

The project, together with REG 024 (Chapter 11), is also the background for NORAD's subsequent support to the PTC staff training college through technical assistance (REG 043).

This highlights the need to look more closely at the relationship between project related training and general support to the national, and possibly regional, training institutions, and thus the general difficulties in a strictly project-based approach to development within a sector like telecommunications.

10.2.4 The maintenance contract

As part of the project, a maintenance engineer from EB NERA was stationed with PTC in Bulawayo after the completion of the link, originally for one year, but extended for another year.

After this, the arrangement was terminated, and partly replaced by technical assistance to the maintenance section at PTC headquarters in Harare (under REG 043). The cost of the maintenance engineer was of concern to PTC, and it was also a feeling that technical assistance in this field could be more efficient if the expatriate was better integrated into the PTC organization. This again signals the change from a project approach to a broader approach towards strengthening PTC as an organization.

10.3 Configuration and functioning

10.3.1 The transmission system

The microwave system has a capacity of 960 telephone circuits plus 1 TV channel, and a schematic diagram of the system is given in Fig. 10.2. The choice of analogue technology was a reasonable one at the time of planning of the system.

The utilization of the link can be illustrated by Table 10.1 showing the allocation of Supergroups.

On the Bulawayo - Francistown link Super group 1 and 2 are used for national links Plumtree - Bulawayo in Zimbabwe, whereas Super groups 6 to 16 are used for the international link to Botswana.

The microwave system is equipped for 24 channels Kasane - Livingstone - Bulawayo - Francistown. At present all the traffic Kasane - Zimbabwe goes via the international exchange in Francistown, since the Kasane exchange is not equipped for international switching.

10.3.2 Associated switching system

Between Francistown in Botswana and Bulawayo in Zimbabwe there

Supergroup no:	Used for:
1	Victoria Falls - Hwange Jotsholo - Bulawayo
2	Victoria Falls - Hwange Hwange - Bulawayo Hwange/Bulawayo - Kamativi to Binga
3	Hwange - Bulawayo
4	Hwange - Bulawayo
5/6	Hwange - Bulawayo
9	Francistown - Kasane
12	Francistown - Lusaka
13	Harare - Bulawayo - Blantyre
14	Harare - Bulawayo - Lusaka
15	Gweru - Lusaka
16	Gweru - Lusaka

Table 10.1 Allocation of Supergroups.
Source: PTC, Zambia.

are two drops at Tsheshebe and Ramokgwebena on the Botswanian side, with up to 60 circuits available. There are about only 5 to 10 subscribers at each location and it is a general policy not to install exchanges in small villages with payphones and 5 to 10 subscribers. A multi-access radio system will be installed in the area, and this will be directly connected to the Francistown exchange.

In Zimbabwe there is a drop at Plumtree, and an exchange of the Strowger type with a capacity of 400 lines was installed at the same time as the installation of the radio system, in 1984. In July 1985 this exchange had 174 Direct Exchange Lines and 13 party lines. At the same time there were 51 on the waiting list.

On the Bulawayo - Vic Falls part the link has played an important role in the national communications system of Zimbabwe.

Fig. 10.2 shows the exchanges connected to the REG 004 system in Matabeleland, and Table 10.2 shows the main data for these exchanges.

Vic Falls is a centre of touristic activities and economically important. Hwange is the commercial and administrative centre of the

Name	Type	Year of service	Capa-city	Working DELs	Party	Waiting list	Remark
Vic Falls	STR	1971	600	281	50	54	800 R86/87
Hwange	STR	1974	1100	711	73	22	800 E86/87
Kamatiwi	Manual						
Binga	???						
Jorsholo	Planned						
Nyamandlovu	STR	1974	45	25	116	24	200 R86/87

Table 10.2 Exchanges connected to the REG 004 system.
Source: PTC, Zambia.

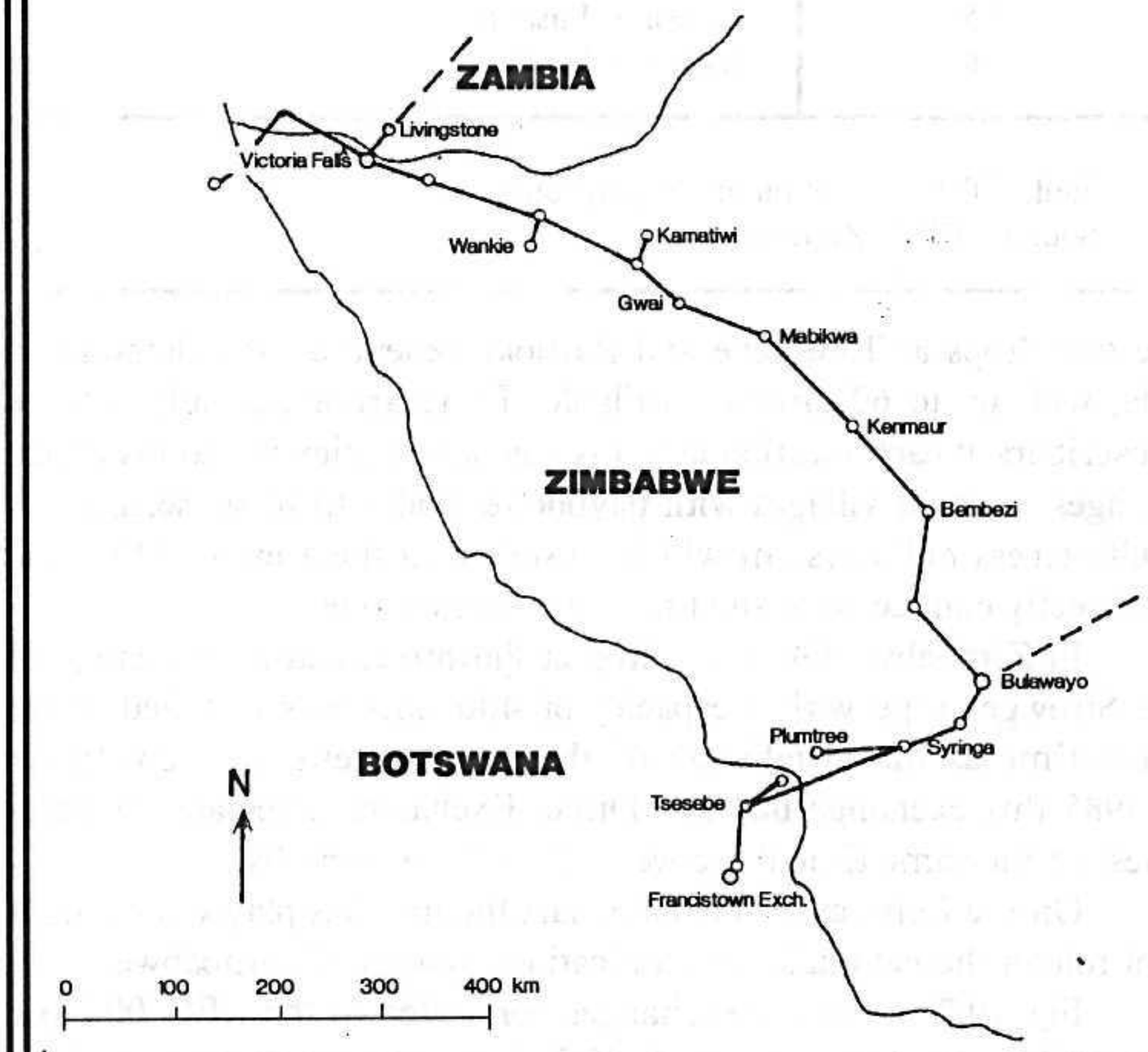

Figure 10.2 The REG 004 transmission system.
Source: PTC, Zimbabwe.

Hwange coal fields. The existing 600 lines will be increased by another 700 lines. Dett, working to Hwange, is equipped with 200 lines of which 78 are installed.

Binga is a growth centre with safari camps and crocodile farming. It is connected to Kamativi via a radio link working at 400 Hz with a capacity of 24 channels. The capacity will be expanded to 60 lines over a period of two years. Kamativi is connected to the main link at Crossroad via a spur link operating 200 MHz and with a capacity of 36 channels of which 24 are equipped.

An exchange is planned at Jorsholo.

10.3.3 Operational experience/Technical problems

A number of problem areas and shortcomings were identified. Of particular importance for the operational use is inadequate spectrum for drop and insert at repeater stations. Only 120 channels are available for drop off. This limited the possibility for utilizing the system for local traffic.

The only MUX available is the 12 - 108 kHz insert originally designed for use as express order wire.

There have been few technical problems with the equipment. It was experienced in Zambia that the multiplexing equipment was prone to damaging by lightening strokes, and that the feed windows of the antennas were damaged by birds.

There have been fading problems between Mabikwa and Gwaai. This occurs under special

SUMMARY OF FAULTS Jan 85 to June 89.	
Transmitter group:	
2 GHz amplifier	32
IF Amp/lim	16
Multiplexers	2
Oscillator	8
Mixer	2
Receive group:	
Oscillator	2
IF amp.	1
Multiplexers	1
Equalizer	3
Modulator group	1
Plug-in units:	
Demod.	6
Switches	4
P. S. U.	4
Demod. group	1
Logic switching	1
Antenna and Waveguide	2
Cable and wiring	5
Misc.	11
TOTAL	102

Table 10.3 Summary of defaults. Source: I. A. Kelly, Section Manager, switching.

conditions when the temperature is below 7 deg. C. All the bearers become affected in both directions, the total fade time is up to 30 seconds, and the period of fading lasts up to 2 hours. This problem was not foreseen during the survey, but the introduction of diversity should be considered.

Zambia reported also a design fault at the 2 GHz power amplifier, but this was rectified at the factory.

The Zimbabwe PTC had made a complete inventory of all the faults reported on the Zimbabwian part of the link from January 1985 to June 1989. The list is shown in Table 10.3, and it shows that the equipment has been very reliable. 32 of the 102 faults were on the 2 GHz amplifier, and this was rectified at the factory as mentioned above.

There were very good working relations with EB NERA. They were always willing to rectify things if problems should occur.

10.4 The use of the system

The project serves three main functions in the telecommunication system of the region:

> *An international link between the three countries, and to a lesser extent for transit traffic to other SADCC countries. The link carries the international traffic between the three countries, and has here partly served to increase the capacity of existing direct links, but also to replace earlier transit traffic via RSA.*
>
> *A new link Zambia - Zimbabwe is under establishment, and the Livingstone - Bulawayo link will then become only the secondary connection between the two countries. Similarly, when Kasane is linked to the main Botswana network, the primary link Botswana - Zambia will be via Kasane. The countries' dependence on this link alone will therefore be reduced in the near future. Botswana has a policy of not operating through more than one transit country on international traffic. The traffic from Botswana to e.g. Tanzania and Malawi*

is therefore not routed via REG 004, as was originally envisaged, but by satellite via London.

A national link for a large part of Matabeleland. PTC Matabeleland estimated that 2/3 of the traffic on the Zimbabwean part of the link was national. The connecting of the important tourist centre Victoria Falls, and the coal mining and termal power producing centre of Hwange, to the rest of the country is no less important than the international traffic.

Traffic from Kasane to Francistown (the Kasane spur link): This function of the system is temporary, since the expansion of the Botswana national network is expected to reach Kasane. It is surprising that although Botswana's plans for a future direct connection to Kasane must have been known at the time of decision-making, this is not mentioned in the NORAD project document. However, since Botswana also plans to make use of the Kasane - Livingstone link as an international connection to Zambia, the usefulness of the link will not disappear the moment Kasane is connected to the Botswana national system.

The development in the international traffic between the three countries is shown in table 10.4 below.

The international traffic, which is of particular importance given the origin of the project, shows a consistent pattern:

1) A rapid increase in the total international traffic in all the countries.

2) A reduction in the relative importance of the traffic to RSA.

3) A reduction in the use of RSA as a transit point for traffic to other SADCC countries.

4) An increase in the relative importance of the traffic between the SADCC countries.

	1980/81	1982/83	1984/85	1986/87	Annual growth
Traffic from Botswana:					
To Zambia	26071	48647	72940	118576	28,7
To Zimbabwe	284328	432067	723629	832362	19,6
Total SADCC region	355472	543516	874954	1048933	19,8
To RSA	2811768	3759344	4140845	4889700	9,7
% of total to					
SADCC	10,6	11,7	15,8	15,5	
RSA	83,7	81,1	74,6	72,5	
% of SADCC traffic transit via RSA	17,5	11,7	6,6	6,5	
Traffic from Zambia:					
To Botswana	38000	72000	88000	129170	22,6
To Zimbabwe	315000	470000	560000	1018740	21,6
Total SADCC region	525850	753960	1004620	1621840	20,6
To RSA	507700	704600	820000	760000	7,0
% of total traffic to					
SADCC	19,8	17,7	18,9	26,4	
RSA		19,2	16,5	15,4	12,4
% of SADCC traffic transit via RSA	11,7	14,4	13,4	4,2	
Traffic from Zimbabwe:					
To Botswana	180445	272794	328346	502693	18,6
To Zambia	160491	244891	311434	856118	32,2
Total SADCC region	554856	801871	1060895	2116684	25,0
To RSA	11081911	12684677	8765175	10043541	-1,6
% of total traffic to					
SADCC	4,4	5,4	9,1	11,5	
RSA	88,1	85,7	75,1	54,8	
% of regional traffic transit via RSA	5,1	5,7	4,3	1,9	

Table 10.4 International traffic from Botswana, Zambia and Zimbabwe. (Outgoing traffic in minutes).
Source: PTC, Zimbabwe.

Several factors have contributed to these developments, but the development of the PANAFTEL network, of which this link is a crucial part, has been an important factor behind this development.

No similar traffic measurements are available to show the development of the national traffic along the link, but the general development of the traffic in the Matabeleland region shows a similar

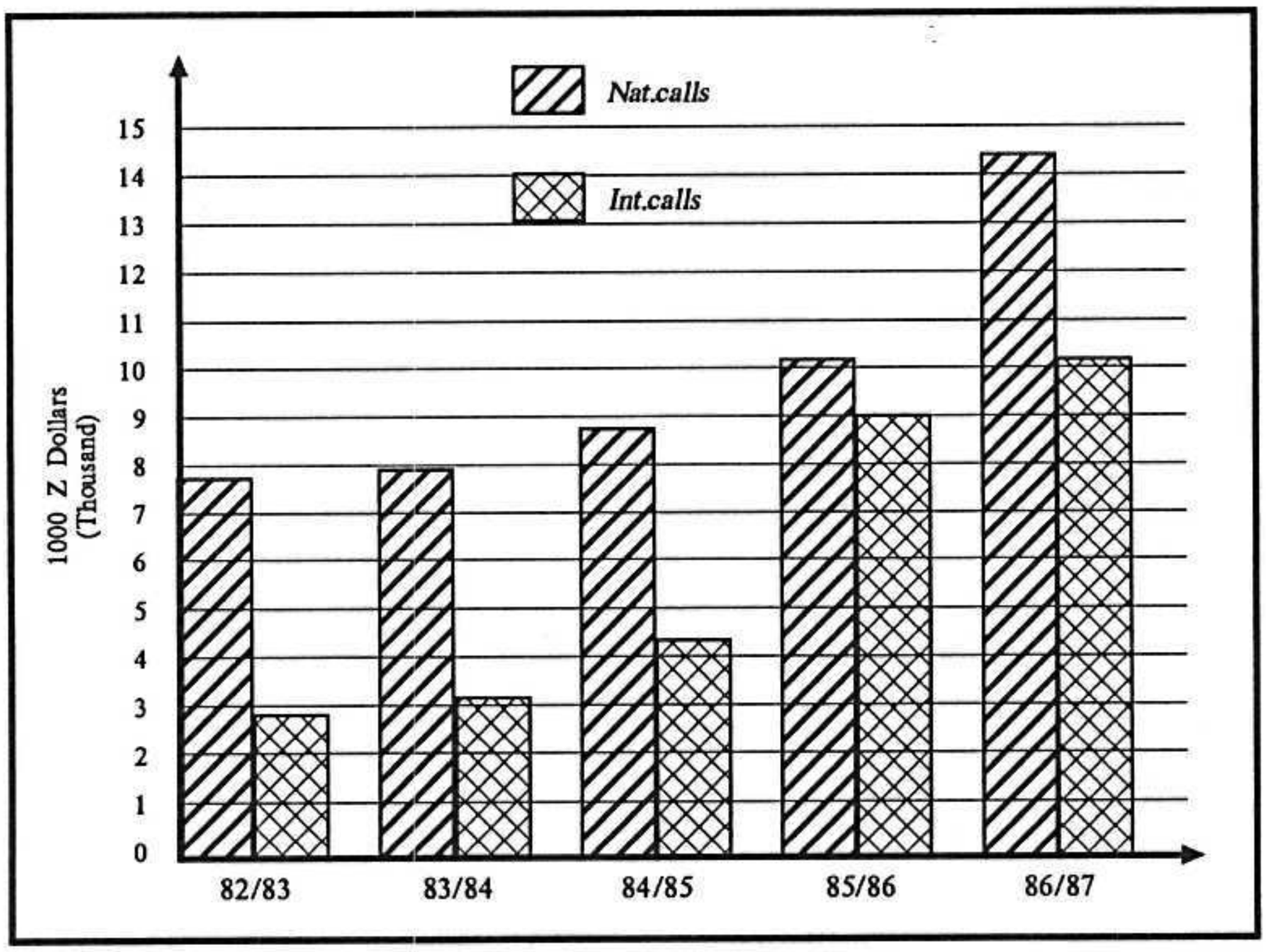

Figure 10.3 Revenue from Matabeleland.
Source: PTC in Zimbabwe.

pattern of rapid growth. Figure 10.3 below shows the development of revenue in Matabeleland, as an indicator of traffic changes.

No traffic measurement is available for Kasane. At present there are about 100 subscribers in Kasane, plus another 30 on the waiting list. Of the 96 listed in the telephone directory 42 were government departments, and 54 commercial/private subscribers, including tourist lodges and other activities related to the tourist industry.

10.5 System costs and revenue

The cost of project REG 004 amounts to 67 mill. NOK. If the link is

From - To	Paid minutes	USD/min	USD
Bot.-Zimb.	832,362	0.84	699,184
Zim.-Bot.	502,693	1.00	502,693
Zam.-Bot.	129,170	1.80	232,506
Bot.-Zam.	118,362	1.14	134,933
Zam.-Zim.	1,018,740	1.00	1,018,740
Zim.-Zam.	856,118	1.00	856,118
Mal.-Zim.	507,695	1.50	761,543
Zim.-Mal.	467,510	1.00	467,510
Total			4,673,227

Table 10.5 International traffic. Paid minutes and income. 1986/87.
Source: PTC, Zimbabwe.

to be fully depreciated over 10 years at an interest rate of 8 %, yearly investment costs amount to approximately 10 mill NOK.

The link is a part of an international system for the four countries Zimbabwe, Zambia, Botswana and Malawi. Furthermore, the link is used for internal traffic in some of these countries, particularly in Zimbabwe.

We are not in a position to fully evaluate costs and benefits associated with the link. What we know is the cost of the link, the investment costs, and revenue from international traffic, generated from use of the link. Paid minutes in 1986/87, and income in USD is shown in table 10.5.

In NOK the income is about 35 mill, almost four times the yearly investment costs of the link. In addition, some income is generated from internal traffic, particularly in Matabeleland in Zimbabwe.

We have no information about operating costs associated with the above international and national traffic. We are not in a position to assess other cost elements. It seems fair to assume, however, given the above revenue compared to the investment costs of the link, that the project is economically favourable.

10.6 Project impact

10.6.1 Impacts on telecommunications

The project has improved telecommunications both between the countries, and internally, particularly in Zimbabwe. As shown in Chapter 10.4, this has contributed to a process of rapidly increasing telephone traffic between the SADCC countries, and a reduction of their dependence on RSA for regional telephone traffic.

Within the field of telecommunications, the project must therefore be said to have fulfilled its main objective.

For Zambia, this has led to a situation where inter-SADCC traffic is now greater than traffic to RSA, while for Zimbabwe and Botswana, traffic to RSA is still 4-5 times the traffic to all other SADCC countries combined. Even with the changes experienced, RSA, as the dominating economic power in the region, also continues to dominate the pattern of telephone traffic.

Similarly, the project has served to improve telephone services in Matabeleland. For a tourist centre like Victoria Falls, such services are an absolute necessity.

The main link has had no effects on internal telecommunications in Botswana so far, because the number of subscribers in the area where the link passes through is too small to justify the setting up of exchanges.

The Kasane extension has dramatically increased the capacity and quality of telephone services to the Chobe district in Northern Botswana, also an important tourist destination. Here improved telephone services have been coordinated with an improved road, and supply of electricity. The telephone connection is, however, too recent (established this year) to expect any wider impacts so far.

10.6.2 Telecommunications and dependence on The Republic of South Africa

A more difficult question is how these changes in telecommunications effects the general dependence on RSA. Telecommunications seem to have no direct, short term effect in these terms.

Looking at other crucial indicators of dependence on RSA, like transport, it seems clear (though the data base for drawing these conclusions are not very solid), that the trend during the 1980's has been in the opposite direction, towards increased dependence. In 1981, it has been estimated that about 1/4 of the regions overseas trade passed through RSA, while the figure in 1987 had increased to more than 1/2 (SADCC Regional Economic Survey 1988 and SADCC Macro Economic Survey 1986). The deteriorating security situation in Angola and Mozambique, the main alternative routes, has contributed heavily to this tendency. Telecommunications as such cannot change these facts.

10.6.3 Telecommunications and regional integration

Increased communications between the SADCC countries is both an indicator of, and a contributor to increased regional cooperation.

Politically, telecommunications projects like REG 004 have been important in two ways:

> *The joint effort in defining, securing funding to and implementing the project has acted as a proof that regional cooperation is feasible, and can bring results.*
>
> *The possibilities for increased communication by itself will also facilitate increased political contacts.*

Economically, the short term impacts are less obvious. Looking at the development of inter-regional trade during the 1980's, the SADCC Regional Economic Survey (1988) concludes that "it seems clear that there has been both an absolute and a relative decline in regional trade flows".

It would be unrealistic to expect immediate changes in trade patterns as a result of improved telecommunications. The forging of increased economic links is a long term process which SADCC is now giving more attention to in its recent production oriented strategy.

10.7 Conclusions

10.7.1 Lessons from project planning and implementation

Generally, the implementation of the project must be seen as a success. The division of responsibilities was adopted to the relative strength of the organizations involved.

The strong role played by the company has advantages as well as disadvantages. The major advantages are clear lines of responsibilities, and that it is easier to secure progress in implementation and thereby timely implementation, in short efficient project management. The possible disadvantages are less involvement of the national organizations, and the possibility of overestimating their capacity to take over responsibility for the project after its completion.

There is a general satisfaction with the performance of the company in all the three countries, which is also reflected in their interest in its continued involvement in new projects.

A major weakness in project design was that it did not to a sufficient degree take into account the dual role of the link, as an international link and as a vital part of Zimbabwe's national network. The facilities for connecting subscribers to the link were too limited.

As in the case of REG 020, we see a pattern of an investment project being later followed up by a technical assistance project to the national telecommunication administration. This may be seen as a result of lack of realism in the original assumptions made about the strength of the national administrations. In the specific case of Zimbabwe, this also resulted from the rapid loss of highly qualified manpower through outmigration, at least partly after the project had been approved.

On the positive side it should be noted that NORAD showed willingness to assist in solving the problems as they became apparent, even if this involved stretching the concept of "regional" assistance to also include what is in practise a bilateral technical assistance project. This illustrates a general problem related to the SADCC assistance to investment projects.

In afterthought, it may be said that the project was too easily considered as a purely technical investment project, and the institu-

tions involved not assessed. The planning had a too narrow perspective. This may partly be a result of the use of the regional grant, which, at least at that time meant less involvement of the NORAD offices in the respective countries, and that the project was not based on a long process of interaction between the donor and the national sector authorities.

From an evaluation point of view, it is also a problem that the objectives of the project, apart from constructing the link, was not clearly spelled out.

10.7.2 System operation and maintenance

The system has had some minor specific operational problems, but generally the problems in this field are of a general nature, general to the sector and to the countries, i.e. problems of transport, scarcity of foreign exchange for spares and lack of qualified manpower, low status of maintenance work in the organizations as compared to planning and implementation of new projects, and problems of making preventive maintenance a routine.

In all the countries, the manpower problem is critical, and future assistance to manpower development is needed.

The establishment of the Electronic Repair Workshops in both Harare and Lusaka has been a major step forward in terms of capacity for local repairs. The rapid expansion of the telecommunications networks, both through this and similar projects, has not yet been followed by a parallel strengthening of the PTC's to enable them to maintain the networks. This is a fundamental problem in all the countries involved.

As stressed in Section 10.2, when moving from construction to maintenance, it becomes increasingly difficult to retain the original project approach, and the capacity of PTC as a whole becomes the issue.

10.7.3 Present and potential impacts

Two issues are relevant here:

- *Further traffic increases*

- *Wider impacts of increased telecommunication traffic.*

While there has been an increase in the telephone traffic, this is less than the capacity of the radio link. This illustrates two points, firstly that a radio link is only one component in the expansion of the network, and that traffic increases depend on a parallel expansion in the switching system and not least in the subscriber network, and secondly that if the possibilities for interaction has been very limited in the past, it takes time to develop the contacts that will lead to traffic.

The potential for wider impacts of increased communications obviously depends on a number of other factors. Trade demands both complementarity in production, ability to compete with alternative sources of supply in terms of prices, quality etc. and transport possibilities.... Possibilities for telecommunication is a precondition for increased contact in other fields, but cannot by itself garantee such contacts. In the case of the SADCC region, the development of increased economic links will take much longer time to materialize.

In the political and social field, the impacts of improved telecommunications are more immediate, as they have happened in a situation of increased political cooperation between the countries within the framework of SADCC.

10.7.4 Project sustainability

With the type of project we are discussing, it becomes very difficult to consider the sustainability of the project as such, since it it is an integrated part of a network.

Financially, it can be estimated whether the traffic that the link generates is sufficient to make it economically viable.

However, the general policy of all the countries in question is that of demanding financial viability for the telecommunication systems as a whole, while accepting that individual links are unprofitable.

The tentative results for the original link, as far as present data

allows an assessment are that the international traffic give a total income sufficient to cover the costs of the link (Chapter 10.5). The link therefore seems to be commercially viable even with the present traffic, which only utilizes a minor part of the links capacity (31% of the capacity used north of Bulawayo, only 16% south of Bulawayo). With the likely future increases in traffic the link should become even more profitable to the PTC. The spur link to Kasane is, with the present traffic pattern, clearly unprofitable.

Both in Zimbabwe and in Zambia, the PTCs have difficulties securing the allocations of foreign exchange that is needed for the operation of the systems. It may therefore be appropriate to consider the use of commodity assistance to assist the corporations in securing the necessary spareparts for the equipment supplied through Norwegian assistance.

All countries experience a critical shortage of qualified and experienced manpower. Again this is not a problem that can be solved at a project level. Only increased capacity for training, both nationally and regionally can provide a long term solution. Still, the sector will for a number of years depend on a continuation of the technical assistance.

11 REG 024 RADIO LINK HARARE - TETE - BLANTYRE

11.1 Program initiation

11.1.1 The PANAFTEL Context

The aim of the PANAFTEL system is to implement a harmonized system of wideband transmission links between the countries in the region. That requires both the replacement of existing, inadequate connections, ovehead lines etc. by microwave links, and implementation of new links.

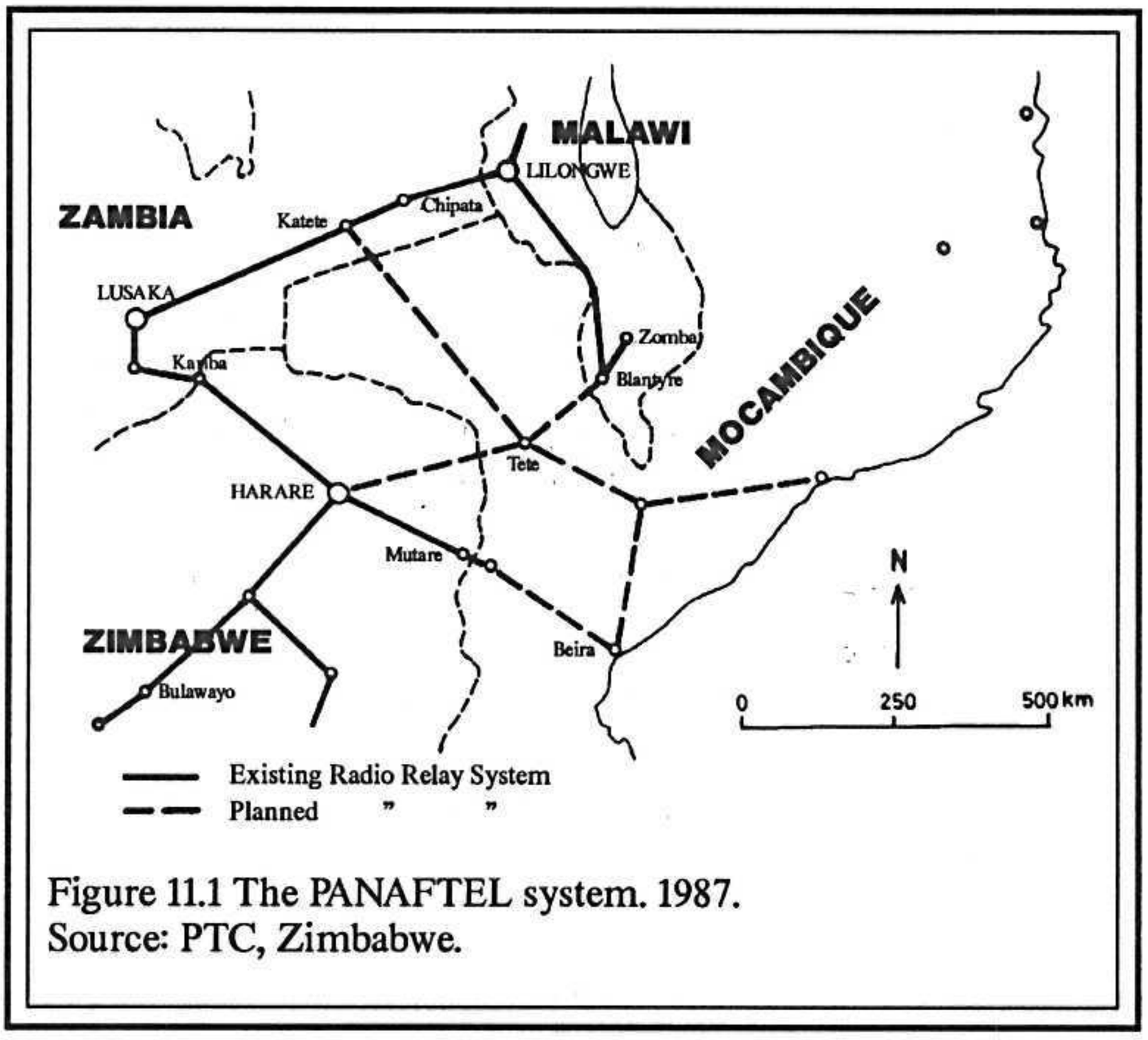

Figure 11.1 The PANAFTEL system. 1987.
Source: PTC, Zimbabwe.

Fig.11.1 shows the relevant part of the PANAFTEL system as per January 1987, prior to the REG 024 project.

Terrestrial links from Zimbabwe to Blantyre must go via Bulawayo, through Zambia and via Lilongwe.

Communications to the Tete region in Mozambique via terrestrial means is difficult due to the status of the national system in this country. That precludes cable and overhead systems.

REG 024 will therefore be the first possibility of a broadband link between these Zimbabwe and the Tete region.

In addition to its PANAFTEL role the REG 024 will be used for communications to a part of Zimbabwe, Mashonaland from Idara to Bereru, which at the moment is without satisfactory communications infrastructure. The local requirements were taken into account when the location of the stations were determined. This enhanced the value of the project.

Mozambique wants a spur link to Songo/Cabora Bassa for national communications, but that will require an extra repeater.

11.2. System implementation

11.2.1 Project definition

A preinvestment survey of the link Blantyre - Tete was performed in 1979. In 1984 Teleplan performed a desk study for the whole Harare - Blantyre link.

A field survey was performed in November 1985, and this formed the basis for the final selection of sites for the stations and towers.

A 34 Mbit/s digital radio link system in a (1+1) configuration operating in the 2 MHz range was proposed. This would provide 480 telephone channels. Later, the data rate on the Harare - Bereru link was increased to 740 Mbit/s, or 1920 telephone channels.

The total project cost was estimated to be NOK 95 mill, of which about 40 mill would be covered by contributions from Sweden.

Zimbabwe was appointed by Malawi and Mozambique to act as a coordinator for the project.

The contract for the project was signed in Gaborone on 6 February 1987.

11.2.2 The construction phase

The system was installed by EB NERA, and the installation of the electronic equipment took place in 1988. The antennas arrived in April, and the other electronic equipment in May. The heavy equipment came via South Africa, and the light equipment by air. The equipment has been operating since September 1988.

The civil works were at some of the stations quite large and costly, including difficult road constructions to the special rocky hills, "kopjes" typically of the area inspected during the evaluation process.

Also, earthing was a problem due to the combination of the soil conditions and the high intensity of lightening strokes. The civil works were carried out without any special problems by local contractors, although the economy in Zimbabwe is heated, but the finalization of the civil works went slowly.

Customs clearance could be lengthy in Zimbabwe, partly due to earlier attempts by other companies to smuggle goods together with telecommunications equipment. There were no problems in Mozambique and Malawi.

The TDM expressed great satisfaction with EB NERA as a contractor. The project was completed on schedule, which was a unique experience in Mozambique. There were no disputes. The work was well done, and there was a good attitude to the work. There was no claim from the contractor due to customs and transport problems.

The project implementation was monitored by a Steering Committee with representatives from NORAD, EB NERA, Intech, the telecommunications consulant and the Telecommunications Administrations involved, and the experience from this was good. This made it possible to identify problems at an early stage and timely take corrective measures.

11.2.3 Training program

A training program was conducted in Bergen for the radio part and in Stockholm for the multiplex equipment, totalling 11 weeks. There were two to three students from each country.

The courses were completed before shipment of the equipment in order that the students could participate in the installation phase on site.

One experience of EB NERA was that it would be better to deliver equipment to the courses and arrange the courses in the home country of the students. This corresponds to the experiences of the PTCs from the training component in the earlier projects (ref. Para 10.2.3).

A successful course on System Planning was held in Harare in 1988.

11.2.4 Maintenance contract

The project included a training period of two to three months, and there was in addition a one year maintenance contract covering all three countries.

11.3 Configuration and functioning

11.3.1 The transmission system

Fig. 11.2 shows the schematic of the REG 024 system. It is important to note that the repeater stations are located with a view to use them in the national communications system. Those intended for rural communications are therefore equipped with multiplexers.

From the Idara Hill station there is an 8Mbit/s spur link to Ruwa, which is equipped with a Strowger exchange with a capacity of 100 lines. The exchange is installed in 1989, and there are plans for an expansion to 768 lines in 1993 - 95.

Arcturus is connected to Idara Hill via James Farm with a capacity of 8 Mbit/s. The exchange in Arcturus, of type Strowger, with a capacity of 200 lines, was installed in 1986. There are plans for expansion in 1990 to a capacity of 768 lines.

The town Murewa is connected via a 34 Mbit/s link to the Sayanyama repeater station. At Murewa a digital exchange type BTI/UXD-5B will be in operation by the end of 1989.

Mutoko is also equipped with a Strowger exchange with a ca-

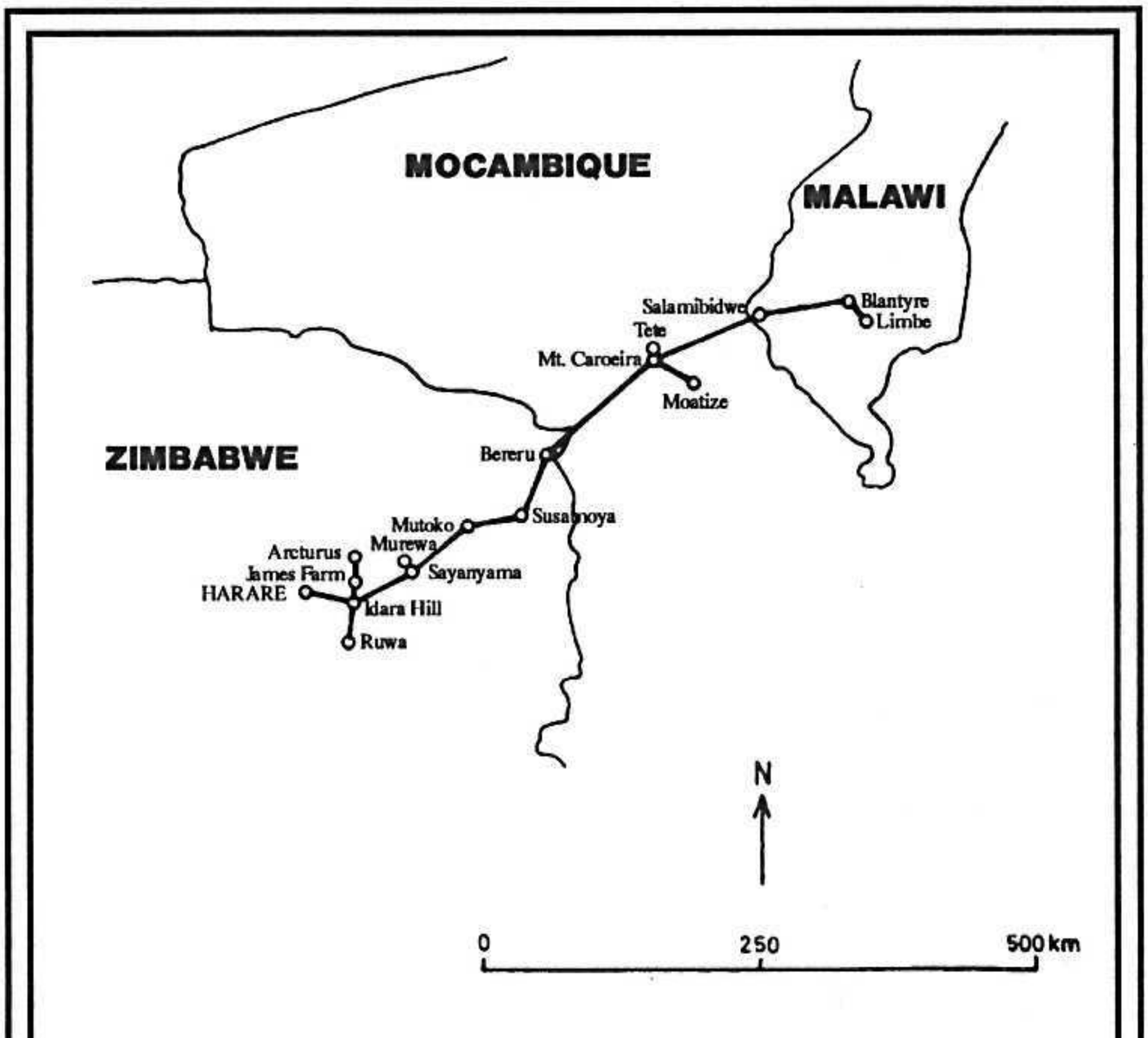

Figure 11.2 Reg 024 schematic.
Source: EB NERA. 1986.

pacity of 200 lines, installed in 1987. There is a planned extension to 512 lines in 1990.

The important growth centre Kotwa is connected to Susamoya via a rural radio.

Between Bereru in Zimbabwe and Mt. Caroeira in Mozambique there are two 34 Mbit/s radio channels, one to be terminated in Mozambique and one for transit to Malawi.

From Mt. Caroeira there is one 34 Mbit/s link to Tete provided under the REG 024 project. Tete is equipped with a digital exchange, type AXE, with a capacity of 2700 lines commissioned in 1989. From Tete there is a 8 Mbit/s link to the important coal mining town Moatize. This link was also provided under the REG 024 project.

There is naturally no traffic data available for the system.

11.4 System operation

Formal hand-over of the system to the National Telecommunications Administrations is planned to take place i September 1989, and no operational experience is therefore available.

The equipment has, however, been operating since September 1988 without any particular problems.

11.5 Economic viability of the system

For the time being there are no data available showing the economic viability of the link, and therefore we do not try to make any economic assessment. (We refer to the feasibility study made by Teleplan in July 1984).

11.6 Conclusions

The conclusions have to be limited to the experiences from the planning and implementation of the project.

The main differences compared to REG 004, the other international radio link project included in the evaluation are the change from analogue to digital technology, in line with the general tendency in new projects in all the countries, and the more conscious inclusion in project planning of the national communications needs along the link.

The main points are:

This is a digital system, which is the right choice, also in developing countries, and also in a country like Zimbabwe, which has a relatively well trained staff in conventional technology. The representatives of the PTC did not see any problem in operating the basically analogue exchanges together with the digital transmission system.

The system is well planned to allow maximum possi-

ble use of the transmission facilities for communications in an area which up to now had no or very little telecommunications infrastructure. This represent an improvement compared to earlier international projects like REG 004.

The PTC was satisfied with the supplier and with the equipment which up to now had been running for about one year.

There was also a strong interest in the system in Mozambique, where it would enhance the communications in Beira, and the TDM expressed strong satisfaction with the supplier.

12 ZAM 100 TELEPHONE EXCHANGES TO RURAL AREAS IN ZAMBIA

12.1 Project background and initiation

As part of its strategy of orienting the telecommunication development more towards rural areas, PTC Zambia started a programme of installing automatic exchanges to rural centres in the late seventies.

In 1977, 26 automatic exchanges of the type Metaconta Rural Exchanges, were procured under a World Bank loan. The exchanges were supplied by the Norwegian company STK (then a subsidiary of ITT).

To standardize the exchanges in rural areas, PTC wanted to install another 29 MCRs in the early eighties, and NORAD was requested for financial assistance in October 1982. In 1983 NORAD agreed to fund 16 exchanges under the commodity assistance programme to Zambia, with a possibility of funding another 13 at a later stage.

As in the case of REG 020, the Norwegian assistance to the project originated from an earlier involvement of a Norwegian company, and the proven competitiveness of Norwegian equipment.

In justifying the use of bilateral aid for the telecommunications sector, it was stressed that the supply of telecommunications to rural areas was closely linked to NORAD's general strategy of assistance to the rural areas in Zambia. The potential role of the project in promoting rural development was therefore even more central to ZAM 100 than to REG 020.

12.2 Project planning and implementation

12.2.1 Project planning

Two issues were of particular importance:

- The choice of exchanges: PTC had good experience with the MCRs they already had in operation. The request for additional MCRs was therefore justified from a desire to standardize the equipment. However, PTC also had (and still has) a number of Ericsson exchanges (ARK and ARF). Some of these are in the ar-

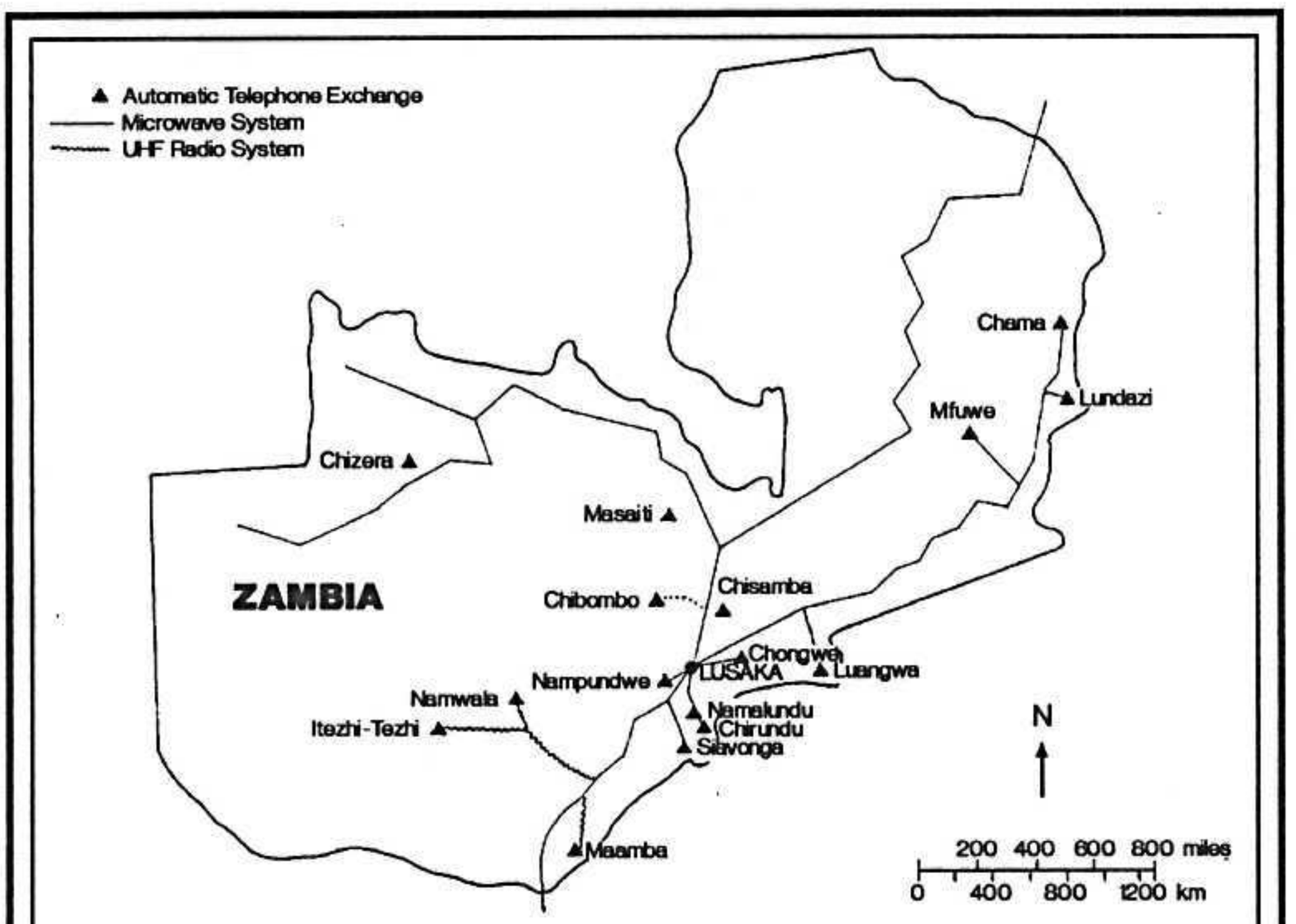

Figure 12.1 The MCR exchanges funded by NORAD.
Source: PTC, Zambia.

eas where installation of MCR exchanges was planned. There does not seem, from PTC, to have been any attempts to standardize the type of exchanges within e.g. a province, which would have had advantages for training and supply of spares.

PTC's additional arguments for choosing the MCRs were that they could be controlled from the nearest major exchange, and therefore would require less travelling, and that they had some additional functions compared to the alternative.

- The location of the exchanges: In principle, PTC has an elaborate procedure for assessing telephone demand in an area, on the basis of population, economic activities etc. It is uncertain to what extent this procedure has been used in planning the location of all the exchanges. A review of the project proposal carried out by Teleplan in 1983 questioned the priority of some of the areas selected, but without proposing to interfere with PTC's priorities. The location of the exchanges include minor district centres, a mining community, an airport (in the vicinity of a national park), a border post etc.

The location of the exchanges is shown on Fig. 12.1.

The exchanges are widely scattered over most of Zambia. This meant that the logistics of project implementation would be demanding.

12.2.2 Project implementation

The exchanges were to be supplied as commodity assistance. PTC was responsible for buildings for the exchanges, coordination with the establishment of transmission facilities as well as external lines, while STK was to provide and install the exchanges.

In 1983 a Plan of Action for the delivery was signed by NORAD and Zambia, and a contract was also signed between NORAD and STK.

It soon became appearant that it was not possible to adhere to the original time schedule. There were serious delays, caused i.a. by

- delays in the completion of the buildings for the exchanges
- delays in customs clearance of equipment in Zambia
- delays in power supplies
- delays in connecting the exchanges to the transmission system.

According to the original plans, the 16 exchanges should have been

installed by the end of 1985, and the (optional) additional 13 during 1986-87. By March 1985 a project completion before August 1986 was considered optimistic, and by the end on 1987 three of the exchanges were not yet installed.

The planning of the project seems, both from PTC's and NORAD's side, to have paid too little attention to the problems of coordinating a number of different activities in 16 widely scattered locations, some of them quite inaccessible. Not unexpectedly, it turned out to be difficult for PTC to manage these activities according to the time schedule. In the Team's opinion, commodity assistance is not a suitable form of assistance to a fairly complex project like this.

12.3 Operation and maintenance of the exchanges

An evaluation, focusing on the maintenance of the exchanges, was carried out by Intech in 1988. The evaluation revealed important weaknesses in the maintenance of the exchanges.

> *"The observed maintenance situation of the exchanges, rectifiers and batteries appeared to be variable and very occasional, e.g. battery maintenance was only acceptable on half of the inspected sites. General/preventive maintenance routines for the MCRs were not observed. repair and maintenance was carried out based on fault reports..... Too often alarms were observed, both urgent and non-urgent." (Intech 1988, p 23-24)*

Six of the exchanges delivered under ZAM 100 were inspected. Of these three were functioning reasonably well. One of the exchanges was not in operation at all, while two others had no functioning transmission system, and therefore could only connect local calls.

The PTC Electronic Repair Centre in Lusaka is capable of repairing all the PCBs for the exchanges. It does, however, lack foreign exchange to import components needed for the repair.

12.4 The use of the exchanges

The capacity of the 16 exchanges, and the subscribers connected to the exchanges are shown in Table 12.1.

For the 13 exchanges commissioned at the time of the statistics, 40,7% of the connectable capacity was actually in use. Another 21,9% was reported to be on the waiting list. In one case where we were able to control these figures locally (Chizera), the reported waiting list appeared to be non-existing, and the number of subscribers had actually declined. This case may not be typical (e.g. in Siavongo the number of subscribers has increased substantially).

The exchanges are designed for 50% local and 50% external traffic. This has proved to be a mistake. Since these exchanges are located in small towns, with relatively few subscribers, the use of telephones are primarily for communication out of the town, to provincial and national centres. PTC today estimates that the actual traffic is around 25% local and 75% external. The actual traffic pat-

Exchange	Exch. cap.	Con. cap.	Wgk. 1987	Waiters	Curr. Dem.	For.cast 1996
Chama	128	96	31	29	60	190
Chibombo	128	96	46	15	61	100
Chirundi	96	72	41	6	47	80
Chisamba	256	192	33	70	103	200
Chizera	96	72	69	19	89	140
Itezhi-Tezhi	96	72	69	19	89	140
Luangwa	96	72	29	39	68	90
Lundazi	384	288	71	19	90	300
Maamba	128	96	36	6	42	100
Mfuwe Airport	96	72	31	-	31	80
Namalunda Gorge	96	72	73	4	77	140
Namwala	128	96	99	48	147	245
Siavonga	512	384	68	75	143	412
Nampundwe Mines	96	72	-	60	60	90
Chongwe	96	72	-	100	100	300
Masaiti Boma	96	72	-	40	40	80

Table 12.1 The MCR exchanges under Zam 100.

Source: PTC project for extension of METACONTA rural exchanges under Norwegian Aid.

tern for 3 of the exchanges, counted during one hour, is shown in Table 12.2.

The percentage of local traffic varies between 7 and 30, highest for Siavonga, which is the largest of the centres. Another very interesting feature is the dominance of outgoing calls. The periphery has a greater need for communicating with the centre than the other way around.

Looking at the type of subscribers, between 20 and 68% are government departments, another 10% public institutions like PTC itself and ZESCO, and the remaining other institutions and individuals.

The distribution of subscribers in four centres are shown in Table 12.3.

District	Local calls	Outgoing calls	Incoming calls
Chibombo	15	191	8
Chisamba	16	105	12
Siavonga	39	623	28

Table 12.2 Traffic pattern for three ZAM 100 exchanges. No. of completed calls during one hour.

Source: PTC, Zambia.

The category *others* typically includes:

churches/missions, externally financed development projects, local businessmen, banks, hotels.

The general pattern seems to be that in the smaller centres, the government departments are the dominating users of the exchanges, but as the centres increase in size, and thereby also have more developed economies, other types of subscribers becomes more important.

This underlines the point that the potential impacts depend very much on the characteristics of the centres.

District	Chizera	Luangwa	Siavonga	Itezhi-Tezhi
Government departments	22	11	26	19
District authorities	6	10	3	3
UNIP	4			
PTC	2	1	4	5
Zesco	-	1	28	3
Others	17	9	82	38

Table 12.3 Types of subscribers.
Source: PTC, Zambia.

12.5 Impacts of the exchanges

The available information only allows assessment of the impacts of the exchanges at a very general level. We also interviewed different categories of users in one of the centres, (Chizera). The results from these interviews have already been presented in Chapter 9, and will only be briefly repeated here.

The exchanges are located in places which represent the lowest level in the centre hierarchy in Zambia, typically smaller district headquarters. They are not rural in the strong meaning of directly supplying people in rural areas with telephones. These centres, however, are important as to the satisfaction of the needs of the rural population, and have to play a crucial role in further economic development in the rural areas. An important way of promoting rural development is therefore to strengthen these centres.

The centres supplied under the current programme varies in size, economic characteristics, location. Some are specialized centres established for mining or power supply, others are small district centres, only a few have a varied economic base. Nampundwe is a small mining community, Chirundu is a border post, Siavonga is a larger centre on Lake Kariba, with a considerable potential both within fisheries and tourism, Namalundu Gorge is a settlement connected to a power project, with little activities apart from this, while others are more typical small district towns (Chizera, Chama, Chibombo).

Improved telecommunications would therefore play very different roles in the centres, depending on its characteristics.

Generally, the greatest short term impacts are political and administrative. Linking peripheral centres (and some of these centres are really peripheral) to the national network is part of a process of national integration, and may serve to reduce tension.

In an administrative hierarchy, the district administrations have frequent needs for contacts with provincial and national authorities. A major use of the telephones are therefore for administrative purposes. As already stated, the administration also dominates as users in the smaller centres. Such improved communications may both speed up decision making and reduce wastage of time and money on frequent travels to the provincial and national centres.

The economic impacts will vary depending on the types of economic activities in the centre and the surrounding area. The types of economic activities which at present make direct use of telephones in the centres served by ZAM 100, are tourist oriented activities (in Siavonga, Mfuwe and Itezhi-Tezhi), which for obvious reasons are totally dependent on telecommunications, trade, petrol stations and banks (only in a few larger centres), mills and other small scale industries.

The direct beneficiaries of the telephones (those having direct access to telephones) will normally be the local elite. The poor cannot afford to have a telephone, and their use of it would be too irregular to justify the investment. They may, however, have access to telephones through relatives, neighbours or public institutions. Payphones are under introduction in Zambia, but so far has not reached these centres.

The poor may of course benefit indirectly from improved functioning of public services.

The primary school system makes limited use of the telephones, and primarily for administrative purposes.

Similarly, in the health sector, the telephones are primarily used for administration and procurement, less e.g. for referring patients.

CASE STUDY: Chizera (Mfungwe) district, North-Western Province.

Chizera is the smallest district in the province, with approximately 15 000 inhabitants, and a scattered population.

The economy of the district is dominated by peasant farming, there are no commercial farms.

The town does not have electricity. It is connected to the provincial headquarters by a good quality gravel road.

The town is primarily an administrative centre.

The town is connected to the NORAD funded microwave link, and equipped with a MCR with a capacity of 96 lines. The town has about 50 subscribers, all within a radius of 4 km from the district headquarters.

Most of the telephone traffic is to Solwezi, the Copperbelt and Lusaka.

From the point of view of the users, a main problem with the present situation was the difficulties in getting through to Solwezi, primarily caused by the congestion of the old Solwezi exchange.

Temporary breakdowns of the system had been experienced, but not frequently.

There were also complaints about the quality of the connections, particularly noise on the line.

The main user of the exchange is the district administration. The administration claimed that the telephone had to a considerable degree replaced travelling, both to Solwezi and Lusaka. As a remote district, it is very dependent on contacts with the provincial and national centres. A 10 minutes call to Lusaka costs about 50 kwacha, a trip to Lusaka easily comes to 3-4 000 kwacha.

The importance of improved communication is partly political, a peripheral district becoming a more integrated part of the national system, and partly administrative, making the administration more efficient.

The largest economic activity in Chizera is the IRDP, which is focusing on small scale industries, in particular carpentry. It has a workshop, and have contracts with pitsawers and carpenters for the delivery of products.

The project is part of a provincial programme with German assistance, and operates as a commercial enterprise.

The communication needs are partly internal to other parts of the programme, partly to the contracted groups and partly to Solwezi and national centres for supplies etc.

Only for the latter purpose is the telephone used at present. The programme has its own radio communication system, because the telephone has not been reliable enough. Contacts with the groups have to be by visits.

Other economic activities include a shopkeeper who also operates a mill. The main uses of the telephone here are for ordering of commodities and spares for vehicles and machinery, and contacts with banks. The mill has had technical problems, and in ordering of spares, the telephone has been of great use. The most important benefit from the telephone is transport saving and saving of time. It enables him to make advance orders, and thereby secure that when he arrives to Solwezi, Kitwe, Ndola or Lusaka, the things he needs are there.

The health centre in Chizera makes use of the telephone, for administrative purposes, and in ordering of medicines. The telephone is however not used for referral of patients to the provincial hospital in Solwezi.

The primary school similarly primarily uses the telephone for administrative purposes, primarily to save time for travelling to the district educational office in Chizera. The telephone at school is also occasionally lent to parents.

In a town like Chizera, the major benefits from improved telecommunications in the short run are political and administrative, with smaller benefits for some economic activities and service institutions.

12.6 Conclusions

12.6.1 Planning and implementation

Contrary to the other projects in the sample, ZAM 100 has been a "problem project" in terms of implementation. This is a result of a combination of several factors; the type of assistance, the implementation model, and unrealistic planning.

On the basis of the experience from ZAM 100, it should be questioned if commodity assistance is an appropriate way of assisting development of telecommunications to rural areas. This is not to question the possible role of commodity assistance to the sector more generally, e.g. for the supply of spares it may indeed play an important role.

ZAM 100 was not implemented as a turn-key project. Given the nature of the project, with a number of widely scattered project locations, implementation on a turn-key basis, by a Norwegian company, probably would have meant considerably higher costs.

The planning was based on too little information about traffic pattern, and the design of the exchanges is therefore not adopted to the actual traffic (too low capacity for external calls).

If support to rural exchanges were to have been an integrated part of an overall assistance to rural development in Zambia, there would have been a need to look more closely at the individual locations, their development potentials, other development activities in the locations and possible needs for supplementary assistance to secure the expected benefits.

12.6.2 Operation and maintenance

The maintenance of the exchanges, as well as part of the associated transmission system is not satisfactory. Routines for maintenance exists, but are not followed.

The operation and maintenance experience from ZAM 100 highlights some of the important general problems in this area, accentuated by the peripheral location of some of the exchanges, and the associated transport problems.

The successful establishment of the electronic repair centre in Lusaka has, however, dramatically improved the national repair capacity.

12.6.3 Project sustainability

Most of the exchanges supported under ZAM 100 will not in the near future generate sufficient traffic to be commercially viable. This confirms a general pattern, that expansion of rural telecommunications have to rely on subsidies from the more profitable parts of the networks.

Financially, the sustainability of this part of the telephone network therefore depends on the ability of the remaining part of the network to generate sufficient surplus. In this sense, support to e.g. expansion of the subscriber network in Lusaka may be an a necessary precondition for PTC to be able to expand rural telecommunications.

Since many of the exchanges are located in peripheral areas, they are likely to be more severely affected by the general maintenance problems than more centrally located installations.

PTC will probably also in the future require import support to supply the necessary spares for the exchanges.

12.6.4 The request for additional assistance

PTC has requested NORAD for additional assistance to rural exchanges. The request concerns:

- *6 new exchanges to areas not yet supplied*
- *Increased capacity for 23 existing exchanges*
- *Modification of 26 exchanges to increase capacity for external calls.*

On the basis of the experiences from ZAM 100, NORAD has expressed scepticism towards the request.

The situation presents a dilemma. The experience from ZAM 100, as described in this chapter, is not totally positive. On the other

hand, Zambia has invested in Norwegian equipment, which needs modification and capacity expansion, and is hardly likely to get support from other donors.

The rural exchanges constitute the network level, from which rural telecommunucations can be developed. In cases where these exchanges are located in district centres, they are a means for serving vital political and administrative purposes, binding the political and administrative hierarchy together. In cases where the echanges are to be located elsewhere, the main purpose of the exchange should be to be a vital element in a development plan, located in a "growth pole" or an area suitable for expanding rural telecommunications. In the latter cases, a thorough evaluation of costs and benefits should be carried out. (See Chapter 3 and 13).

A selective support to rural telecommunications networks should be given serious consideration. The fact that there were some problems concerning the implementation of ZAM 100, should be a learning experience, and should not imply that projects of this kind will not be supported in future. On the contrary, support to rural exchanges ought to be a priority field, provided that the issue is treated as a part of an integrated development approach. It is therefore astonishing that NORAD seems to be reluctant to give further aid with respect to such exchanges. If NORAD should be willing to reconsider the issue, a stronger involvement in analyses about short term and long term effects is neccessary.

13 TELECOMMUNICATIONS SECTOR POLICY IN GENERAL: CONCLUSIONS AND RECOMMENDATIONS

Our analyses, conclusions and recommendations are based on the basic assumption that the developing countries' long run objective is to develop into societies with a variety of industries being able to compete on the international market. We thus take it to be a basic precondition that the developing countries wish to, or have to, adopt to the prevailing trends of international economic development.

Furthermore, our conclusions and recommendations shall take into account the general objectives of Norwegian development assistance.

According to the above conditions, the Team finds it reasonable to state:

* *Interregional telecommunications projects (international projects) are clearly profitable and vital for international trade, regional cooperation and international contacts in general, and the Team concludes that such projects should to be supported by NORAD. It is a fact that Norwegian companies have the technology and competence to assist in such projects.*

* *On the national level, Norway should be prepared to support "missing main links" in the national networks. Such projects are favourable economically, socially and, not the least, politically, and constitute a precondition for rural telecommunications development at a later stage. As in the case of interregional projects, Norwegian companies can contribute.*

The question of Norwegian support to telecommunications becomes more complicated when considering further expansion of the national networks. One has to evaluate the question of urban versus rural networks, of regions (areas) experiencing growth versus backwards

regions, the question of supporting "growth poles" versus balanced growth in all regions and balanced growth in all parts of regions, and the question of which groups of people should benefit most.

The above mentioned issues are not purely economical, they are also basically political, and concern social and cultural development.

In this context, telecommunications have to be evaluated related to more general philosophies of development.

We shall discuss the matter in view of two basically different strategies of development:

> ***Strategy 1:*** *A strategy primarily aiming at equality with respect to development among regions (provinces, districts), among industries, and among social groups of the population*
>
> ***Strategy 2:*** *A strategy aiming at a fast economic development in regions (areas) with the best growth potential.*

The principle of equality in strategy 1 is advantageous in order to avoid social disparity and political instability. However, resources are used in a very "scattered" way, which may hamper economic growth. A balanced growth strategy[13-1)] may develop a rather large unproductive public bureaucracy, busy in planning and administering projects never implemented or implemented at a very slow pace. There are few incitaments for entrepreneurship and for mobilization of private resources, production, distribution and transport may not be cost-effective, and the working moral may be low.

The main advantage of strategy 2 is the focus on releasing productive resources, private capital, know-how and entrepreneurial skills. The largest disadvantage is a tendency to create and possibly enlarge inequalities among regions, industries and groups of people.

[13-1)] Theories of balanced and unbalanced economic growth have been very much discussed in relation to development strategies. See for example: Albert Hirschman, "The Strategy of Economic Development", New Haven (1958), Hans Singer, "The Theory of Balanced Growth and Economic Development. Theory and Facts. (1958), and Ragnar Nurske, "Problem of Capital Formation in Underdeveloped Countries", Oxford (1953).

High migration may also be a problem, creating slums and increased number of criminals in the bigger cities.

Experience from developing countries over the last decades shows that countries, which have mainly followed strategy 2, have had the highest economic growth. The economic benefits have been very unevenly distributed, however, both among regions (areas) and among groups of people.

In practice, most developing countries support a development process combining the two strategies, depending on political, social, cultural and institutional conditions in the individual country.

Economic growth is a major objective of Norwegian development assistance. However, another important objective is to support projects improving conditions of the poorest and least resourceful groups. While the first objective is supported by strategy 2, the second objective seems to be better met by strategy 1.

> * *In a long run perspective the strategies may be combined. Hence both the above mentioned objectives may be accounted for. By focusing on development of productive forces, particularly in areas with good growth potentials at the early stages of development, the economy may come faster to a "take-off"*[13-2]. *In a later stage, more attention could be paid to equity problems.*

For political/social/cultural reasons, however, all regions (provinces) should be involved in the growth process in some defined priority areas.

Expansion of telecommunications should thus be an integral part of the development strategy of a country. Let us discuss this problem using Zambia as an example.

According to a combined development strategy it seems reasonable and evident that all regions should be connected to the na-

[13-2] It is outside the scope of this study to give an insight into different development theories and a thorough analysis of development experience in different countries. Nevertheless, the Team is supposed to draw conclusions and give recommendations as to strategies and priorities for the telecommunications sector. Such conclusions can only be drawn on the basis of views on economic development and development in general. The above conclusions are based on the Team's evaluation of theory and practice.

tional network. The link to the North-Western Province completes the main network in Zambia. Although revenues from the link do not for the time being cover operating costs in the area, the project is favourable because of its social and political benefits. The link is also a basis for rural telecommunications development at a later stage.

When it comes to further expansion of the telecommunications networks, the problem of choice must be more carefully considered. Support to rural telecommunications in remote areas in the North-Western Province would clearly be in line with NORAD's objective of supporting the poorest. Such an expansion would be very costly, however, and the effects on economic growth would be rather uncertain.

On the other extreme, NORAD could choose to support urban telecommunications in and around the largest cities, such an expansion would be profitable and most likely affect economic growth in a positive way. However, the greatest benefits would be to the richer groups.

Most developing countries have to give priority to a rather limited number of development projects. This is also true regarding infrastructure projects in general and telecommunications projects in particular. Therefore, it is vital to have an integrated development plan giving clear priorities to projects, areas and target groups.

A vital element in such a plan is to define a number of growth areas and growth poles, possibly at least one in each province.[13-3)] The growth poles should be selected on the basis of the growth potentials of the areas, and infrastructure investment should be coordinated, given the overall growth priorities.

From the point of view of the national telecommunications organization, PTC in the case of Zambia, urban telecommunications would be very favourable and create a substantial economic surplus. On the other hand, expanding rural telecommunications to very remote areas would imply a substantial loss, which had to be paid for from the profitable parts of the network system. Supplying telecommunications to some selected rural growth areas, would be in a middle position, some creating a surplus and some a loss.

13-3) Zimbabwe has defined a number or rural growth poles to which rural telecommunications will be expanded.

Traditionally, the estimated internal rate of return on investment is used as an economic criterion. The incremental revenues generated by a new project are estimated (as a proxy for benefits) and are compared with the investment, operating and maintenance costs over a certain time span. From the point of view of a telecommunications organization, this is a relevant evaluation method.

Since the effects of telecommunications projects have a much broader perspective, however, the following conclusion is valid:

* *Although a network expansion in a given area may be implemented and operated at a loss for the telecommunications organization (PTC), the expansion may be favourable from a national economic point of view. In order to evaluate expansion projects in a broader context, cost/benefit analyses should be used. Expansion projects may be evaluated and chosen among, according to the ratio of benefits to costs.*

In a cost/benefit analysis several adjustments are made compared to the traditional analysis. First, the prices used for the inputs in the projects should be reconsidered to compensate for any distortions in the price system. (The use of shadow prices).

Secondly, benefits will usually be higher than revenues, because of at least three reasons:

1. Subscribers and users of public call telephones may value the service far more than they are required to pay for it. (Consumer surplus).

2. New telephone subscribers not only incur benefits for themselves. They increase the benefits of being connected to the system for those who are already connected. (Subscriber related externalities).

3. The willingness to pay a given price to make a telephone call reflects only a minimum estimate of the benefits incurred by the caller and does not reflect the benefits of the calee. (Call-related externalities).

The cost-benefit analysis thus reflects the economic potentials of an area and is as such a useful tool for giving priority to specific projects and to the development of growth poles.

As could be expected, cost/benefit-analyses undertaken in several developing countries indicate that the ratio benefit to costs is higher the more urbanized the area, and highest for the higher income groups. However, the ratio is positive also in many rural areas, indicating, among others, the existence of a huge unsatisfied demand, and the high costs of alternative forms of communication.

In a dynamic context, PTC as an operating entity could totally run at a profit by combining economically (from the sector point of view) favourable projects in urban areas with subsidized projects in rural areas. This mix of projects should be selected on the basis of a cost/benefit analysis, given the prevailing development strategies, and the prevailing political and social constraints.

* *As a conclusion, we will state that in a long run perspective, NORAD should focus more on strategy 2 than strategy 1 in the first stages of development, primarily supporting the objective of economic growth. The main point is that such a policy will bring the country in question faster to a development stage, where it is economically feasible to start developing backward areas. When this stage has been reached, NORAD should support projects in such areas.*

* *NORAD should thus be willing to support telecommunications projects in urban areas, as well as in selected rural areas. When concentrating on rural areas, support should be given on the basis of a cost/benefit analysis, and as a part of an integrated rural development plan.*

* *Whether or not Norwegian firms should contribute in rural telecommunications projects is an open question. So far, Norwegian firms have little experience in this field.*

The above conclusions and recommendations are based on a long term perspective. In a more short term perspective and according to a policy giving more weight to other objectives than economic growth, the conclusions may be others.

A fast expansion of the telecommunications networks tends to create "bottlenecks" in the system, which may severely reduce operating capacities. An example is the main exchange in Lusaka. This exchange is vital for communication throughout the country and congestion problems affect all provinces and districts. Another example is the exchange in Solwezi, the capital of the North-Western Province.

Inadequate capacities result in huge numbers of unsuccessful calls, reducing the efficiency of private and public enterprises and organizations. Thus:

* *NORAD should be prepared to support projects eliminating such bottlenecks. The benefit/cost ratio is likely to be very high for such projects, and the gain is distributed to all areas and groups of people connected to the system.*

As stated above, rural telecommunications projects should be an integral part of a rural development plan. For such projects NORAD should apply "an integrated development approach". More generally, the question of "a sector approach" compared to "an integrated development approach" depends on the type of project considered. The Team draws the following conclusion:

* *All projects concerning rural telecommunications should be evaluated in a context of integrated development plans, and the more so in poor and remote districts. Main national links, and particularly international links, which are economically profitable and vital for developing the countries' economic potentials, do not need the same broad scope of evaluation.*

The choice of appropriate technology is important for all development projects, and in particular for telecommunications projects

where the technology content is so high, and where the choice will have strong impact on performance, costs and ease of operation.

It is not possible to define generally what appropriate technology is. However, as a general rule the latest technology should be applied, because of:

- improved performance
- wider choice of equipment and stronger competition on the world market with a corresponding reduced cost
- easier operation and maintenance

There might be exceptions, where local circumstances lead to special solutions, applying technologies that are not of the latest development.[13-4)]

One particular question concerns digital versus analogue systems. The digital systems are basically more complex, but once they are properly developed, mass produced and with adequate operational experience, they are usually superior in performance, lower in cost and easier to operate and maintain.

The Team thus concludes:

** As a general rule, digital technology should be preferred for future projects supported be NORAD.*

A critical element in rural systems is the supply of power. This is particularly important for equipment in chains, like microwave links, where proper functioning of the whole system relies on proper operation of each part of the chain.

Public power is the obvious choice, when available, supplemented with back-ups in the form of Diesel-generators with batteries for no break operation.

[13-4)] An example of adequate use of "old" technology is the commissioning of the exchanges of the Strowger-type in Zimbabwe. The approach was astonishing at first sight, but it became clear that the matter had been thoroughly considered, taking into account equipment costs, the availability of mapower with adequate qualifications, and in view of the future conversion of the national telecommunications network into a fully digital one.

Since modern electronics can be constructed with a decreasing requirement of power, the renewable power sources become more attractive. Solar power generators are one of the possibilities. It must be emphasized, however, that the conditions must be suitable with regard to sunshine statistics. It may also be neccessary to use supplementary power sources, like wind generators.

* *Because of the cost-decreasing elements, solar power will be more attractive in the future in places with favourable sunshine statistics.*

An important objective of Norwegian development aid is to secure a sustainable development, and to avoid creating dependence on continued aid. Telecommunications development has the following characteristics:

* *Since telecommunications are a highly developed, technologically advanced industry, with relatively few, quite large firms competing on the world market, most developing countries have to import a major part of investment facilities and spare parts. In such a respect, the developing countries will be dependent on developed countries in a long run perspective.*

  Furthermore, the telecommunications sector needs well educated and highly trained manpower, particularly in engineering, a fact which may create dependence on outside help for many years to come. The questions of training and of strengthening the capacities of the national telecommunications administrations, are therefore of vital importance.[13-5)]

* *The marginal capital-output ratio in the telecommunications sector (the relation between new investment and expansion in output) is large compared to most other industries.*

13-5) Regarding the SADCC countries, the Team has put major emphasis on the question of training and "institution building". (See Chapter 14).

In many countries the foreign exchange component range between 50 and 60 percent of total investment requirements in the sector, for some countries even higher. As such, the telecommunications sector is rather foreign-exchange-intensive, and thus very much dependent on the balance of payment situation. However, as a result of improved and expanded telecommunications, foreign exchange requirements of a country may be reduced in other sectors of the economy.

So far, there is no research indicating the net effects on the balance of payment.

Another aid objective is to contribute to lasting improvement in the economic, social and political conditions of the population in the respective developing country. Generally, the Team concludes:

* *Like other infrastructure investments telecommunications are important for the above objective.*

  Since telecommunications are a cost-declining industry, tending to become cheaper relative to other means of communication, the relative importance of the sector is increasing with respect to economic, social and political integration.

An objective of Norwegian aid concerns environmental issues. The main conclusion is:

* *To establish and operate telecommunications systems create few environmental problems.*

  To the extent telecommunications can substitute transport, or be a means for making better utilization of transport fleets, the sector contributes to reduced energy consumption. Misuse of cars is a widespread problem in many developing countries, very much caused by false or inaccurate informa-

tion. The potential for saving transport seems to be rather big.

Research both in developed and developing countries support this conclusion.

According to the Norwegian aid objectives, particular emphasis is placed on improving the situation for women. Some years ago, when the exchanges were manually served, women were usually employed as operators. This fact had some importance in rural areas in Norway and in most developed countries. With automatic exchanges, which is the most realistic alternative for developing countries, (see the discussion above), the need for operators is no longer there.

In developing countries, the development of rural telecommunications is important for health and different aspects of family welfare. Traditionally, women have taken responsibility for these matters. Therefore, a strong focus on women's situation and welfare, would imply giving some priority to development of rural telecommunications.[13-6)]

With respect to telecommunications development, the Team will conclude the following:

* *Like in many other technologically oriented sectors, few women are employed in telecommunications. Planning authorities in ministries and in the telecommunications organizations have not put particular emphasis on this question. The question is one of attitudes, both on the part of men and women. NORAD could contribute by emphasizing the matter more strongly.*

A fast development of rural telecommunications could contribute to improving conditions for women.

The stated Norwegian objectives also put emphasis on national plans and priorities. The following conclusions seem reasonable:

13-6) Village oriented aid-projects, particularly supporting production activities, run and managed by women, will certainly benefit from access to telecommunications.

* *Telecommunications are not given the priority the sector deserves in national development plans and recurrent budgets.*

Although having problems with qualified manpower, the telecommunications organizations are rather professional entities, whereas planning ministries often lack the competence needed to fully integrate the sector in the development plans.

At provincial level, the Team experienced that there were no cooperation between the telecommunications sector and the Regional Planning Authorities with respect to planning. PTC did its own collection of essential statistics in the North-Western Province, information which was available in the Regional Planning Office. Hence, telecommunications were not well integrated in the Provincial Development Plans.

Another key issue is the question of turn key projects compared to projects involving to a higher degree the Local Administration in the planning and implementation process.

Turn key projects are usually most effective for system implementation with given performance and within a specified time. This is mainly because the responsibility is uniquely defined. The responsible contractor can direct its efforts to the "critical path" of the project, whether this is transportation, civil works or equipment installation.

The turn-key approach is not so easy to combine with strong involvement from the receiving side. Difficulties can therefore arise when the receiving organization shall take over the responsibility for operation and maintenance of the system.

It is also a disadvantage of turn-key projects that the learning element for system implementation is missing.

A general rule for the choice of project cannot be given, but turn-key projects are most attractive to solve unique problems for

which a timely completion is important, such as removal of bottlenecks in the telecommunications system.

A stronger participation by the Administration is important for projects initiating activities for which the Administration will bear the long time responsibility, and where building up own competence is essential. It must, however, be emphasized that the Administration must have the necessary resources to accomplish their part, in terms of manpower and financial resources. This was a problem for the ZAM 100 project.

Norwegian companies have been strongly involved in the projects evaluated by the Team. According to Norwegian development policies, Norwegian firms may be involved in the aid projects if they are competetive in the world market. In general, the Team concludes:

> *It is very difficult to establish a competitive price level for delivery of telecommunications equipment, and particularly for equipment delivered and installed in developing countries.*
>
> *This is due to the fact that the telecommunications industry is considered as strategic in the wide sense in most industrialized countries, and therefore supported in different ways, through development contracts and protective procurement systems.*
>
> *Regarding deliveries to developing countries, there could be additional elements of support that distort the competitive situation.*

Prior to the implementation of the REG 004 project, the combination EB NERA and Ericsson had been evaluated by SWEDTEL, the consultancy company of the Swedish Telecommunications Administration, as competitive on international level.

Also the offer from EB NERA / Ericsson for this project was examined by the Contract Revision Office of the Norwegian Defence Supply Command, and by independant telecommunications consultants.

The REG 020 project was initiated by an international invita-

tion to tender by the PTC of Zambia. Companies from the United Kingdom, Japan and Germany in addition to EB NERA submitted their bids, and EB NERA was selected after a thorough evaluation of price, delivery time etc.

The REG 024 project was awarded EB NERA on the basis of direct negotiation. This approach was chosen based on previous experience with the company, both with respect to cost and with respect to the cooperative relations with the telecommunications administrations concerned. In addition, the project would be closely monitored, economically and technically, by the telecommunications consultant of NORAD.

The ZAM 100 project, telephone exchanges to rural areas in Zambia, was an extension of an earlier delivery of 26 automatic exchanges by the Norwegian company STK, then a subsidiary of ITT, now STK Alcatel, financed by a World Bank loan. This should demonstrate the competitiveness of this supplier.

The conclusion to be drawn from this is that the suppliers used for these projects are competitive in price and equipment performance, and contact with the administrations involved indicate clearly that the companies are appreciated for their cooperative attitude.

14 TELECOMMUNICATIONS POLICY IN THE SADCC REGION: CONCLUSIONS AND RECOMMENDATIONS

14.1 Regional Cooperation

Telecommunications development is one of the priority areas within the SADCC regional cooperation, and considered to be one of the basic requirements for economic development in the region and for effective cooperation among the member states. The main aim of regional telecommunication development is to reduce the dependence on the Republic of South Africa as a transit point for intra-regional traffic and promote increased communication between the member states. The Southern African Transport and Communications Commission (SATCC) is therefore responsible for promoting projects with a regional impact such as the PANAFTEL microwave network, satelitte earth stations, international switching centres etc.

The telecommunications development within the SADCC region is based on the SATCC Ten-year Development Plan of January, 1987 which primarily consists of project listing country by country. The Plan is due for revision in 1991 and the new plan will be based on strategic planning, and each SADCC country is supposed to have a telecommunications master plan. SATCC's priority areas will include the completion of the "missing links" in the PANAFTEL network, to Namibia through Nghazi in Botwana and to Angola through the North-Western Province of Zambia.

As a matter of policy, SATCC's involvement in telecommunications development ends at the investment stage. The administration and management of the telecommunications projects fall under the responsibility of the national telecommunication authorities. With regard to manpower development in the telecommunication sector, basic training (i.e. at technician level) is a national responsibility, while the medium to high level training, technical training and management training, is proposed to be conducted on a regional basis.

14.2 National Policies

At the national level, each SADCC country aims at providing

telecommunications services to both urban and rural areas. Telecommunications development is included in the national development plans, as a subsector together with transport in most countries. There is generally a lack of integration between telecommunications and other sectors both in the national plans, and more particularly so for planning at sub-national level. In several countries development of the local telecommunications network is linked to different types of growth centre strategies for regional/rural development.

Only **Zimbabwe** has a fully developed telecommunications master plan.

Most countries seem to have followed a strategy for telecommunications development with three stages

1. establishment of a national network covering the main centres of population and economic activities,

2. coverage of the whole country down to the level of provincial or district headquarters, and

3. emerging approaches to rural telecommunications.

The basic policy of the **Zambian** Government is to provide telecommunications services to support the productive sectors of the economy such as mining, manufacturing, agriculture, tourism, etc. Thus the existing telephone network covers all provincial capitals and almost all district centres throughout the country. Within rural telecommunications priority is given to commercial farming and other productive activities.

In **Botswana**, the Government policy is to provide telecommunication services to all urban areas and a telephone service facility to all rural communities or villages with at least 500 inhabitants using pay phones (public telephones). A strategy for rural telecommunications is under development.

In **Mozambique**, the sector strategy aims at interconnecting all provincial capitals to the national digital system while improving rural telecommunications simultaneously. Because of the security situation, Mozambique has great difficulties in establishing a reliable, terrestrial network.

The financial policy with regard to telecommunication development in all SADCC member states is based on the profitability of the entire telecommunications network which means complete coverage of the cost (i.e. investment and operational costs). This policy allows for possible cross-subsidization between profitable (urban) and non-profitable (rural) areas, but without subsidies to the sector as a whole.

Because of its heavy reliance on imports, telecommunications has benefitted from the "over-evaluation" of local currencies in several countries and will be heavily affected by substantial increases in the costs of foreign exchange.

The 1980's has been a period of heavy investments in expansion and modernization of the telecommunications network in the region. As a result of this expansion, in combination with severe manpower and in some countries foreign exchange constraints, the capacity to operate and maintain the networks is now a major concern in several countries.

14.3 Some general issues from the project evaluations

14.3.1 Technology and equipment

Four general issues related to technology choice and equipment have been touched upon:

* *system structure and traffic*
* *digitalization*
* *power supply*
* *equipment diversity.*

(a) System structure: The possibility of utilizing the links for national purposes in addition to the international traffic are important. The PANAFTEL system was primarily designed for international traffic, to connect the African countries closer together, whereas utilization for national purposes was of secondary importance.

This is apparent from REG 004, which was not specified to allow for the full utilization for local traffic. REG 024, however, was clearly defined to allow for national traffic. All the repeater stations were designed for inserting traffic, and the sites for the stations were carefully selected to serve growth centres.

The utilization for national traffic is very important. When a system is constructed, there are technical and operational reasons for designing the system for a high capacity, e.g. standardization, low incremental costs, and the possibility for transmission of TV.

The traffic, however, is low relative to the capacity, and for a long period there will be ample capacity for the international traffic. During this development period, while the revenue is low, the system is better utilized when designed for both national and international traffic.

(b) Digitalization: There is a general tendency that all telecommunication systems are becoming digital. There are several reasons for this, cost and operational flexibility are particularly important. The developing countries must follow this trend in order to get standard products at the lowest possible cost.

Integration of digital equipment into analogue systems will create some problems at the interfaces, but this is a process that most industrialized countries have been through, and there are well proven technical solutions. None of the telecommunications administrations interviewed expressed any worries concerning this process.

Operations and maintenance of digital equipment are in most cases different from that of analogue equipment. There is to a larger extent a question of having special instrumentation and replacing modules. When the required test instrumentation and properly trained staff is available, digital equipment may be easier to deal with than analogue.

(c) Solar power generators: Supply of electrical power to repeater stations is usually a problem of cost and reliability, since they are frequently located in isolated places. Diesel generators are sometimes used for the primary power supply for remote stations. This requires regular inspection and supply of fuel, which is difficult when trans-

portation and foreign exchange is scarce. The use of solar power generators is therefore an attractive solution, provided that the power consumption of the station is sufficiently low. The main obstacle for use of solar power generators is the cost of the equipment, solar panels and batteries. Such equipment is being improved, and solar power generation becomes more and more attractive.

(d) Variety of equipment, the maintenance problems: Most of the SADCC countries rely to a large extent on foreign aid for the development of their telecommunications networks. Since most donors primarily fund projects using equipment from their own countries, and since a number of donors are involved in the sector, the countries will easily end up with too many types of equipment. This may create interface problems, it may require additional training, and there must be separate stores of spare parts for each type of equipment.

It therefore becomes particularly important to support efforts aimed at standardization of equipment.

14.3.2 Models of project implementation [14.1]

Two related issues have come up

* *the question of turn-key project versus implementation through the national telecommunications administrations*

* *the project approach versus a more sector/institution oriented approach.*

Both REG 020, REG 004 and REG 024 have basically been turn-key projects, with the Norwegian company responsible for project implementation, though there have also been some differences in the division of responsibilities between the company and the telecommunications administrations in the three cases. ZAM 100 on the other hand was based on a different model, with PTC in charge of

[14.1] Se also the discussion in Chapter 13.

buildings etc., and STK responsible for delivery and installation of the equipment.

As shown in chapters 9-12, the first model have been considerably more successful in terms of timely implementation.

Theoretically, the advantages of project implementation by giving wide responsibilities to the companies are

* *clear definition of responsibilities, particularly if something goes wrong: this is particularly the case if there are guarantees.*

* *secure a more efficient project implementation, and thereby reduce time and costs*

* *easier to handle for the donor, does not have to get too much involved with the day-to-day problems of implementation*

* *easier to handle for the telecommunication administration: does not have to use scarce organizational resources on the project.*

All these factors are accentuated in a situation where one deals with several national administrations.

The disadvantages are

* *may not secure sufficient involvement of the organization that is finally going to be responsible for the operation of the project*

* *reduce the learning effect for the national administrations may lead to unrealistic assumptions about the organizations, and overestimation of their capacity to operate and maintain the systems.*

The choice of model must depend both on the type of project and on an assessment of the actors in each case, and not least on the objectives that one seeks to realize.

Development assistance has moved from a project focus, with fairly narrowly defined objectives, towards a tendency to focus more on institution building, realizing that unless the institutions to take over projects are strengthened, they may not be able to maintain the projects. The objectives thus become broadened to include organizational development. NORAD started its assistance to the sector with an explicit project focus, but has later, both in Zambia and in Zimbabwe gradually come to give more general assistance to the PTCs.

14.3.3 System expansion and organizational development

This also relates to another important issue. As mentioned in Section 14.1, a rapid expansion of the national and international telecommunications network in the SADCC region has taken place in the 80's. During the same period there have been rapid changes in the technology used. This has dramatically improved the communications system in the region. Much of this expansion has been funded by donors, and implemented by foreign companies, as has been the case with the NORAD/SIDA funded projects.

The operation and maintenance of this expanded network is now a major challenge to the telecommunications authorities in the countries, but should also be of concern to the donors who have been involved in the expansion of the systems. This requires a strengthening of these telecommunications administrations, and more particularly their operations and maintenance functions, the latter both in terms of manpower and status within the institutions. Manpower and organizational development will therefore in the future be equally important issues in the development of the sector.

Both in Zimbabwe and Zambia, the PTCs have experienced a loss of qualified and experienced manpower during the 1980's, which in some respects have actually reduced their capacities.

The NORAD assistance has already to some extent moved in this direction, through the second phase of REG 020 in Zambia, and REG 043 in Zimbabwe.

An analysis of the manpower situation in the sector, and the preparation of both a regional strategy and national strategies for manpower development is one of the most urgent tasks, including

the development and coordination of training facilities within the region.

14.3.4 The regional dimension

A major part of the Norwegian assistance to telecommunications in the SADCC region has been to international radio links forwarded for funding through SADCC, and funded from MDC's special grant for regional projects.

The radio links are, together with other types of international transport and communications, the most easily identifiable projects with a regional impact. This to a large extent explains the prevalence of such projects in the early years of the SADCC cooperation. So far it is perhaps also the area in which the SADCC cooperation has accomplished the best results. Without the SADCC cooperation, and the backing to this cooperation by donors like NORAD, some of the links would have taken much longer time to be realized.

As discussed in Chapters 9 and 10, there has been a tendency to move from an initial investment project orientation, gradually towards more concern for operation, maintenance and institutional support to the national telecommunications administrations. This touches a wider issue of the relationship between SADCC and the member countries, and, from the donor's perspective, the relationship between regional and bilateral assistance.

For SADCC, there is a need to focus more on clearifying the regional dimension in systems operation, e.g. the role of regional repair facilities and regional training facilities, and also define more clearly the criteria for "regionality" for a project/activity.

Today, Norway supports the Zambian and Zimbabwean PTCs with personnel, with funds allocated from the regional SADCC grant. This way of using the regional funds may have been a practical way for MDC and the recipient countries to find money for necessary follow-up of regional investment projects, for which it may not have been possible to find bilateral funding. However, the projects are for all purposes bilateral. The personnel is not working particularly with the maintenance of the international links or training with a regional orientation. MDC should therefore consider if it is

natural to continue funding them from the regional grant. This is probably an issue which is of relevance not only for telecommunications projects, but also in other sectors.

14.3.5 Telecommunications, growth and poverty

In the short run, the type of telecommunications development that we are considering, in the countries in question, have fairly limited direct impacts for the poorer sections of society. The major exception to this general picture, is the possible impacts in terms of improved efficiency in the provision of basic social services like health.

As long as telecommunications ends at the district headquarters level, the major part of the poor rural population will not be much directly affected by the services, and the type of economic activities that the poorer sections of the urban population are engaged in, will also not be much directly affected by improved telecommunications.

Telecommunications have the potential of contributing to the general process of development through:

* *enhancing the process of national integration*
* *contributing to more efficient public administration in districts and provinces*
* *constituting an element in developing a stronger and more diversified local economy*

thereby linking the periphery stronger to the centre.

Experience from the sector also illustrates the complexity of the the issue of poverty orientation. In all countries, the government demands that the telecommunications sector shall be self-financing. Development of rural telecommunications, which will make telecommunications more available for the rural population, is also an important objective in most countries. Rural telecommunications will usually not be profitable, and it is therefore necessary, to be able

to expand the network into rural areas, to have a well developed system in the profitable areas, i.e. the largest urban centres.

At the same time, the establishment of a national backbone network, which is what all the countries has done so far, is also necessary before it is possible to develop telecommunications in rural areas.

Women is a special target group for Norwegian development assistance. In the projects that have been evaluated, no attempt have been made to give special preferences to women in terms of employment, training etc. In a telecommunications project in Bangladesh, such attempt have been made, apparently with success. Unless such attempts are made, most of the beneficiaries of training will automatically be men.

14.3.6 The political dimension

The SADCC countries are all comparatively new nations, still in the process of creating national identity and unity. Several of the countries have experienced strong centrifugal forces, and most countries have border areas which have strong links to neighbouring countries, sometimes stronger than to the central parts of their respective countries.

A communication network covering the entire country, and thereby linking the peripheral areas closer to the national centres, may perhaps in the short run be the most essential role telecommunications has to play. This aspect of telecommunications development was strongly emphasised in the countries, and are particularly relevant for projects like REG 020, linking a border province to the rest of the country.

Improved communications is a necessary part of national integration. This may go a long way towards explaining the priority given to the telecommunications sector in all the countries, as well as in the SADCC cooperation.

14.4 Options for further Norwegian assistance

On the basis of both the experiences from the evaluated projects, and a general assessment of the sector in the SADCC countries visited,

the Team would outline five main options for further Norwegian assistance to telecommunications in the SADCC region. The options represent broad directions of future assistance rather than specific interventions.

The options are:

1) Support to new microwave links, to complete the terrestrial PANAFTEL network.

The major part of past assistance has been to such links, and the experience with the Norwegian equipment and the Norwegian company has in general been to the satisfaction of the recipient countries.

There are still "missing links" in the PANAFTEL network, and some of these links are a natural continuation of past Norwegian assistance. This applies in particular to the link Zambia-Angola, which is a continuation of REG 020, and the link Botswana-Namibia, once Namibia becomes independent, which is a continuation of the present commercial assistance to Botswana. Particularly the connection of an independent Namibia to the SADCC region, without transit through RSA, would seem to be a natural continuation of the past Norwegian support to both telecommunications and Namibia's struggle for independence.

Experience from Zambia and Zimbabwe indicates that support to investment projects of this type, easily leads to a broader involvement with the national telecommunications administrations, and a need to continue with other types of assistance. As part of the assessment of possible future investment projects, there is also a need for a realistic assessment of the capacities of these administrations, and the likely future needs for assistance to secure the operation and maintenance of the links.

2) Support to regional training and repair facilities.

The individual SADCC countries have too limited requirements for specialized manpower, both technical and managerial, to justify the establishment of advanced national training institutions. As a whole, the training needs in the SADCC region may be sufficient for the establishment of regional training facilities, rather than relying on overseas training. The same argument applies for repair facilities, since the market in the individual countries may be too limited.

The establishment of regional institutions, both for training and repairs, requires careful planning to identify the needs and in order to agree on how and where the needs should be met. It also requires clearification of responsibilities with respect to the operation of such regional institutions, and a strong commitment from the individual countries (where the facility is not located) to make use of the facilities. For training, the language problem may be a problem when including Mozambique and Angola in such arrangements.

From NORAD's perspective, this would have the advantage of continuing the regional perspective of the telecommunications assistance, while at the same time orienting it more towards operation and maintenance.

3) Support to the national telecommunications administrations to strengthen their capacity to operate and maintain the existing networks.

The SADCC countries have implemented ambitious investment programmes, leading to rapid expansion of their telecommunications networks during the 1980's. Generally, the development of the organizations and their capacities to operate and maintain the expanded networks, have not kept pace with the system expansion. This applies particularly in the field of manpower development, but also development of maintenance

routines, and strengthening of the organizations in the field of maintenance. The economic situation in some of the countries, with an acute scarcity of foreign exchange for necessary imports, also makes the import of spares, vehicles for maintaining the vast networks etc. a major constraint.

Depending on the specific situation in the country, there is a need for import support to spares, for support to training and manpower development, for technical assistance and management support particularly in the field of maintenance.

Such assistance should be based on a broad assessment of the organizations in question, based on a perspective of institution building and should be integrated parts of plans for organizational development supported by the organizations themselves. This requires a much closer dialogue with both the telecommunications administrations and their parent ministries than has so far been the case, and a more active, and thus demanding, role for NORAD, both during planning and follow-up of the assistance. It also implies a continuation of the process of "bilateralization" of the telecommunications support, and may raise the question of use of bilateral rather than regional funds.

4) Support to the development of rural telecommunications.

The countries, with the exception of Mozambique, have or will shortly have a telecommunications network covering most of the countries down to the level of district headquarters. This is a necessary precondition for a future development of a rural telecommunication system. Development of rural communications is a priority area, and some countries are preparing more elaborate strategies for this development, including technological options and strategies for funding. This strategy implies a further expansion of the telecommunications networks, into more remote areas, and thus a

further addition to the already existing maintenance problems. Since rural telecommunications normally need to be subsidised, it will also influence the financial position of the sector as a whole.

Development of rural telecommunications can be primarily oriented towards high potential areas for commercial production (commercial farmers and other producers), able to pay quite high costs for installation and operation of a network. This seems to be the strategy in Zambia. It can also be more oriented towards rural service institutions like health centres, payphones in rural areas etc., which would mean users less able to pay the costs of the system, and thus more need for subsidies.

An advantage for NORAD with this option is that it makes it easier to orient the support towards poorer sections of the societies. Such an orientation would, however, need subsidies.

This option also implies a more bilateral orientation of the support, and it would be difficult to maintain the present pattern of funding from the SADCC grant. It would therefore require that NORAD and the recipient countries agree on including the telecommunications sector under the bilateral country programmes.

Assistance to rural telecommunications requires a careful analysis of the relationship between telecommunications and other sectors in the area in question. To realize the potential benefits from telecommunications, there will often be a need for supplementary assistance to other sectors. This option can therefore best be considered in areas where NORAD is involved in other sectors, e.g. through integrated rural development programmes, or in cooperation with other donors involved in rural development in the area.

Because of the need for a more multisectorial ap-

proach, the option should, if considered relevant, preferably be implemented on a pilot basis As for option 3) it will require a stronger involvement from NORAD in project planning and implementation, more so since there are no experienced Norwegian companies, with an experience similar to EB NERA's for microwave links, to rely upon. It is also uncertain if the pattern of using Norwegian equipment will be possible with this option.

5) Support to capacity adjustment in the existing national networks.

Unbalance in capacity in the networks may represent serious bottlenecks, implying very bad utilization of the systems. Selective investments with respect to capacity adjustment are likely to have huge immediate effects on overall system performance.

Capacity adjustments may be needed with respect to links and exchanges, both main and local exchanges.

14.5 Recommended strategy for assistance in the future

Having outlined the options, there is a need also to develop criteria for prioritizing between the options. The priorities will have to depend upon the policy guidelines outlined in Chapter 14.3, and take into account the differences between the countries.

On the basis of the analysis of the situation in the SADCC countries presented in the present evaluation, the Team would generally recommend that **priority is given to option 2 and 3**, i.e. assistance aimed at strengthening the national telecommunications administrations' capacity to operate and maintain the existing network.

Two main factors support this conclusion:

* *the rapid system expansion during the last decade, and the absence of a parallel development of the institutional capacities*

* *the critical economic situation in several SADCC countries, and the general policy in these countries of giving priority to rehabilitation and maintenance of existing infrastructure as part of the economic recovery programmes.*

Thus both the situation within the sector, and the general situation in the countries support the conclusion.

Regional and bilateral assistance could be used in a complementary manner in a strategy for creating a more sustainable telecommunication network. Such a strategy would, however, require a stronger involvement from NORAD, and in particular the NORAD representations in the respective countries, both in the sector in general and in the individual projects.

The above conclusions and recommendations seem to be the most relevant ones in a short term context. To increase the countries capacity to plan and run their telecommunications systems projects is vital ***before***, or at least ***along with*** further expansion of the networks. In a long term perspective, however, options 1, 4 and 5 should also be considered.

The strategy should also take into account the contributions from other donor countries in order that different projects supplement each other.

TERMS OF REFERENCE FOR EVALUATION

REG 403 – TELECOMMUNICATIONS INFRASTRUCTURE

OCTOBER 4TH, 1988

1.00 BACKGROUND

The telecommunications infrastructure is a relatively new sector it the MDC's development assistance programmes, but in financial terms it has had a rapid growth over the last 7 - 8 years with a total investment of NOK 700 million. Whilst some 30 % of these funds have been channelled through the Department of Industrial and Commercial Cooperation, the remaining 470 million have been given as grants to projects for which NORAD's Project Department also has been responsible for planning and implementation in cooperation with both Norwegian and Swedish telecommunications companies. Such companies have over the years gained considerable experience in developing countries, and completed projects are generally considered successful.

It is, however, also recognized that the introduction of high-technology infrastructure in developing countries require careful planning and coordination, and MDC will now carry out an independent evaluation of achievements and impacts of the Norwegian development assistance to this field.

2.00 OBJECTIVES

The objectives of the evaluation are:

- to undertake a general policy study of aid-financed projects/programmes in the telecommunications sector;

- to evaluate a number of selected Norwegian supported telecommunications projects/programmes in Africa; all to be used by the MDC in planning of programmes and support within this sector in the future.

3.00 SCOPE OF WORK

The evaluation shall cover the following two main sections:

a) A general sector policy analysis, and

b) a review of the MDC's sector support.

The review shall be based on a comprehensive evaluation on 3 - 5 completed projects in the SADCC region of Africa.

Note: The MDC reserves the right to review and modify the specifications of service given below. Such modifications shall, however, only take place in between the two phases of the programme (see 4.20).

3.10 Sector Policy Analysis (Phase I)

The section shall include, but not necessarily be limited to, the following sub-themes:

i) A general review of international development policies in the telecommunications sector. (Ref ITU/OECD studies)

ii) An analysis of the role of telecommunications in the overall socio-economic and socio-cultural development in the developing world.

iii) An assessment of the compatibility between the sector policies and the principle objectives of the Norwegian development assistance.

iv) A general overview of the sector investment and other assistance inputs provided by the MDC over the past 8 years.

3.20 Sector Support Evaluation (Phase II)

3.21 Preparations:

The preparations for sector for sector support evaluation will be carried out in close cooperation with NORAD's project personnel. The work will include, but not necessarily be limited to:

i) Selection of projects;

ii) compilation of projects documents;

iii) desk studies of project documents (for definition of planning models, targets, target indicators, special problem areas etc.);

iv) review of TOR for phase II as seen in the light of the project information;

v) planning of the field studies.

3.22 Implementation:

The implementation team will evaluate the projects' activities and achievements in relation to goals, production targets and inputs, as these are stated in project plans and other documents.

The evaluation will address the following aspects:

i) The impact of projects on socio-economic, regional, and local/rural levels. Possible implications of such development to gender related conditions (distribution of labour etc.), as well as the environmental impact of the projects will also be discussed.

ii) Conformity of the projects to existing telecommunications services within the sector, and coordination with the recipient governments' own development activities.

iii) Adequacy of internal organization and management of telecommunications, institutional and administrative procedures, communications between local authorities and project personnel, training of local staff, and progress towards full responsibility by local institutions and personnel for continued operation and maintenance of the projects.

iv) Constraints and problems having affected and/or presently affecting the development of telecommunications in the region in question, e.g. financial situation (local funds, foreign exchange etc.), choice of technology (analogue, digital, satellite, fiberoptics), technology transfer (training, technical assistance etc,).

v) Any other matter relevant to the framing of conclusions and recommendations for future assistance.

3.30 Recommendations

On the basis of the Sector Policy Analysis and the Sector Support Evaluation, the Consultants shall discuss options for future Norwegian development assistance in the telecommunications sector, and analyse pros and contras to alternative forms of assistance, such as project support, management, training, institution building and technical assistance.

4.00 WORK PLAN

4.10 Premises

The implementation of the evaluation will include comprehensive desk studies as well as field studies. The desk studies will be based on available information, such as project documents (feasibility reports, appraisals etc.), research reports by international organizations (e.g. ITU, OECD), and interviews with MDC/NORAD staff and other resource persons.

The field studies include visits to the recipient countries and discussions with local authorities at central and district level, beneficiaries and users, local staff and trainees, project staff etc.

4.20 Work Programme

Phase I will be based on desk studies only and conclude in an Inception Report containing the following documentation:

i) Sector Policy Analysis (3.10) - draft.

ii) List of selected projects with brief descriptions of project components and identification of aspects of special relevance to the evaluation objectives.

iii) Review the TOR for Phase II.

iv) Detailed plan for the field studies.

v) Outline the format of the final report.

Phase II shall not commence until the MDC/Norad's comments on the Inception Report are available and the proposed work programme, budget, etc. are approved. (time required for the MDC's administration of the inter-section activities is estimated to 6 weeks.)

4.30 Time frames

The resource requirements and timing for presentation of reports etc. will be stipulated in the Consultancy Agreement.

4.40 Implementation Team

The evaluation project, depending on an acceptable proposal and agreement, will be commissioned to the Centre for Studies of Development and Technology Tranfer (CDT). The Team shall comprise 3-5 resource persons, together covering the following disciplines:

a) Telecommunications engineering, economy and social science; and special experience.

b) Relevant working experience from Africa, knowledge of development assistance cooperation, and project management experience.

The MDC's policies regarding women's participation in work teams, committees etc. shall be observed.

CDT shall coordinate the activities and the recruitment of staff with the other evaluation studies REG 404 and LES 401. The total number of staff shall be limited to the extent possible.

4.50 Language

All reports and documentation shall be presented in English.

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