BERDNET -- Business, Education, Research & Development Network

(Act Locally, Network Globally)

Draft proposal of the

Sustainable Dev. Network, Pakistan.

ABSTRACT

The implementation process of Agenda 21 and the National Conservation Strategy will require quick access to national sources of information as well as international access to data and expert knowledge. The Sustainable Development Network (SDN) proposes to form a Consortium, called BERDNET, of Business Organizations, Education & Research Establishments and Developmental Organizations to run an electronic data network, allowing access to all kinds of traffic and encouraging access to users, such as NGOs and others, who would otherwise not be able to afford the resources available through computer networks. A phased technical programme and an organizational framework is suggested.

PLAN:

1. INTRODUCTION

The United Nations Conference on Environment and Development (UNCED), also known as the Earth Summit, held in Rio de Janeiro in June 1992, resulted in a global plan of action -- Agenda 21 - - endorsed by over 120 countries. The plan emphasizes the importance of environmentally sound technology, education, public awareness and training, and cooperation for capacity building. Agenda 21 repeatedly notes the need to deal with fundamental problems caused by inadequate availability, analysis, and use of information in the field of development and its relation to the environment. It has noted the lack of effective mechanisms for exchanging information between the South and the North, the lack of human resources and institutional capacity in developing countries to make use of available information, and the lack of information infrastructure to support research and development effort.

The United Nations Development Programme (UNDP) had been given the lead responsibility at the Earth Summit for capacity building, through its Capacity 21 programme, to help developing countries formulate economic, social and environmental goals, plans, programmes and policies that lead to sustainable development. As part of this effort, the Sustainable Development Network (SDN) was started by UNDP as a global programme. SDN is regarded as crucial for the success of Capacity 21, helping to provide quick access to data, its speedy analysis and the timely dissemination of information.

UNDP and its partner in Pakistan, IUCN, are keen to develop a national Agenda 21, specific to the needs of this country. IUCN has been active player in the development of the National Conservation Strategy (NCS), and continues to strongly support its implementation. As part of this effort, it has been in constant touch with the various sectors instrumental in making the Strategy successful, including the government and the business and corporate sectors -- two of the important groups of immediate interest to the SDN effort.

There are plans to set up national SDNs in different countries all over the globe. The initial plans for SDNs in different countries require them to combine electronic communication, face-to-face meetings, and other means of communications to link sources and users of information on sustainable development in government, research organizations, non-governmental organizations (NGOs), grassroots and entrepreneurial organizations on a global scale. SDNs should foster informed dialogue and communications to empower stakeholders -- those who stand to be directly affected by the development process. Round table processes as well as public or community participation in decision making are examples of the type of consultation that an SDN encourages and becomes involved with.

In the process of helping to build capacity for sustainable development by improving decision making, SDNs aim to facilitate access to the global communications network and knowledge base. This includes e-mail and electronic conferencing systems as well as computerized resources such as commercially available databases and information services and the largest international network, the Internet (with its 12 million users and growing at a phenomenal rate).

Only those who are totally averse to electronic networking would deny the fine objectives and the exciting potential of the electronic networking thrust of the SDNs. The agenda of the SDN is grand in its scope but sufficiently flexible to allow for adjustment based on the conditions prevailing in individual countries. Each SDN has been allowed time to chart out its course, and to assess how it can meet some, or all, of these objectives through a phased programme.

In Pakistan, the pilot phase of the SDN project started in December with the appointment of a Coordinator and a team of researchers. SDN is housed within the IUCN Islamabad office in the pilot phase. One of the reasons for being there is because of the major support IUCN provided to the Govt. of Pakistan in the development of the NCS. The NCS puts great emphasis on information dissemination issues in Pakistan, and SDN would be an obvious choice in acting as a link to sustainable development agendas in Pakistan and worldwide. The pilot phase of the project will be over by the end of June 1993. During this period the tasks performed by the SDN team have been according to the Terms of Reference stipulated by UNDP and directed by a Steering Committee representing a wide range of interests and concerns. The Committee is headed by the UNDP's Resident Representative, and comprises of representatives from

IUCN, Ministry of Environment and Urban Affairs, Ministry of Planning and Development, the Prime Minister's Committee for Research and Analysis, National Centre for Technology Transfer, the Sustainable Development Policy Institute, the Trust for Voluntary Organizations, IBM, the Netherlands Library Development Project and the Canadian High Commission. The composition of the Steering Committee is a reflection of the strong links that SDN has with the Government, UNDP, IUCN, NGO's, Technical Information Institutes, Libraries, the Business Sector and Donors. During the pilot phase, UNDP, IUCN and the Representatives of the Government, in particular, have been especially helpful in the work of the SDN.

In addition to compiling a "Directory of Directories" and surveying the electronic networks in Pakistan (see Appendix 1) the pilot phase of the SDN has been involved in a fairly extensive survey of potential users of SDN's services. This survey has been conducted primarily by members of the SDN team visiting 5 major cities around the country. Over 100 detailed questionnaires have been completed and in addition there have been a large number of informal meetings with potential users -- the contacts established through these meetings have been a big bonus to the formal survey. The results of the survey are being processed. As part of publicity and information dissemination, about 700 SDN

brochures have been mailed to NGOs, government departments, industry and business, research organizations, consultants, donor agencies and organizations overseas. There have been advertisements in three national newspapers describing the purpose of SDN and through them requesting interested persons and organizations who wish to become its users/partners to contact us. Finally several articles and letters to the editors of various national dailies, written by members of the SDN team, have appeared on topics such as e-mail, bio-diversity databases, UN databases, electronic networks etc. The response to this outreach effort has been generally very encouraging.

In our discussions and interviews with a wide range of organizations, and through the preliminary results of our survey, it has become evident that access to information in written and electronic form is extremely difficult and, where possible, quite expensive. National consultants are particularly concerned about this and are very enthusiastic about having e-mail and electronic information services in Pakistan. There is also a great desire, in the business sector to access better communications facilities, and with time to consider information provision and exchange as a business opportunity. This sector not only has the need but is also willing to become an active player in the communications scene. Businesses want electronic links with their partners, sales outlets and suppliers nationally and internationally. This is the largest, most enthusiastic group demanding better telecommunications and networking facilities. There is, however, a general lack of in-depth knowledge of electronic communications in this sector.

Access to trade data and technology information is important to the business and industrial sector. They would also like to access relevant government data through the network. The provision of information on environmentally friendly technologies through the networks is only one of the many areas in which SDN could also have an important impact on this sector. SDN in its operational phase should, by providing demonstrations of information technology tools, encourage this sector to become an active partner of SDN.

The business sector in Pakistan is a small user of local area networks (LANs) and the limited services of wide-area networks (WANs). Recent meetings with the Chamber of Commerce and Industries, individual businesses and multi-nationals have brought out their dissatisfaction with the quality and economics of currently available services. Some companies owning private networks are willing to open these to other users for a charge, but are forbidden by their contract with the Pakistan Telecommunication Corp. (PTC) to allow third-party usage. Such regulatory restrictions are the norm in most LDCs, but with the move towards privatization, there has been some loosening of regulations globally. The Gov. of Pakistan has moved grudgingly towards deregulation, but a lot more needs to be done to open up the avenues for data communication. See Appendix 2 for a discussion of the strong correlation between the spread of telecommunications facilities and the development in a country. The studies mentioned in the Appendix relate to voice communications, but the implication for development are even stronger for digital data communications. As for the government, despite its major need for information acquisition and sharing, a lack of knowledge and appreciation of the power of these new technologies, coupled with inertia, has led

to virtually no development beyond the use of computers for routine word processing, and some work in spreadsheets and database generation. A major effort is required to convince the government to move forward. The first step should be to use live demonstrations, for the decision makers, of the tools and services provided by these networks, showing clearly how these can improve the quality and quantity of work output. Once these officials are convinced, a serious training programme, geared to the specialized needs of each department, would be necessary. Particularly important from a sustainable development perspective is the ability and the desire to use cross-sectoral information in planning, implementation and monitoring. Appendix 4 reviews the status of networks in Pakistan, and illustrates the state neglect in this area. On the other hand, India, our neighbour, with a lower per capita income than ours, has made very significant progress in this area, as described in Appendix 5.

The route to becoming a proficient user of networks is reasonably easy. Basic computer literacy is essential. Beyond that, a desire to explore the facilities offered by networking can lead the users in a totally new dimensions of knowledge and communication. While in Pakistan, there is an interest in the education and research community to become part of the electronic networks, lack of financial resources and the high tariff rates has hindered progress. When deregulation of the telecommunications sector occurs, the ensuing competition will automatically lead to reasonable tariffs; it is then that the academics and researchers in this country will become active users of the networks. In fact the desire for information acquisition and communication is generally high -- all sectors covered by our survey want to benefit from the fruits of the information revolution.

2. BERDNET

Through this proposal, the SDN wishes to float the idea for the formation of a Consortium of users from Business, Education, Research and Development fields who would financially support the formation of BERDNET. An enlarged SDN could then implement and manage this network. Present government regulations do not allow for the formation of such private telecommunication services, and it is crucial that UNDP and others within this consortium get a waiver to bypass or modify these regulations. If this is not done most organizations, as well as the government departments, will continue to suffer the unsatisfactory communications services of the state-run monopoly, Pakistan Telecommunications Corp. (PTC).

Our discussions with private sector organizations have shown that there is a very significant demand for an efficient electronic mail service. This unfortunately cannot be provided in an efficient manner by PTC, and is the first service that BERDNET should provide. It is therefore suggested that a Consortium of Users (Business & Financial Institutions, Education & Research Establishments, Multi-nationals, Donors, International Organizations, Government, NGOs, Consultants etc) be formed to run a Public Data Network in the private sector. This network would be run along commercial lines allowing all kinds of traffic to flow through it. Based on the survey and discussions, about 50 organizations have been identified for linkup with BERDNET during its pilot phase. See Appendix 11. We expect that a large number of commercial companies and financial institution will also want to utilize BERDNET. Some of the profits accrued will be channelled into subsidizing access by those who would otherwise not be able to afford such services.

Through BERDNET, ngos will be able to access the services offered by member networks of the Association of Progressive Communications and the Internet (see Section 3 & Appendix 1). The Ministry of the Environment & Urban Affairs, the government department responsible for the implementation of the NCS would also greatly benefit from such networking. The lack of information in electronic form within Pakistan will mean that users will rely solely on such foreign sources initially. The usefulness of information gained through the networks by this government department and others is bound to create pressure within the government itself to make its information readily available in electronic form. Indigenous data and information available through the networks would greatly facilitate intra- and inter-sectoral analysis, planning and implementation -- this is one of the goals of BERDNET. SDN has had discussions with the Ministry to assess their needs. A summary of their programme and what SDN can do to help their effort is presented in

APPENDIX 12.

SDN collaborates closely with the Netherlands Library Development Programme (NLDP) -- its coordinator is in fact a member of SDN's Steering Committee. NLDP has launched a wide ranging programme of training librarians to become computer literate, and to create an infrastructure in the Library Associations which would facilitate electronic cataloging of the major book collections in the country. Networking between libraries is part of NLDP's plans and here BERDNET can play an important role. SDN has formed a CDS-ISIS users group which now has a membership of about a dozen librarians and systems analysts. This activity supplements the work of NLDP.

BERDNET intends to provide access to bibliographic and full-text information on CD-ROMs, and to downloads from USENET (see Section 3) etc. Until full Internet connectivity (see Appendix 10) is possible such economical means will be explored, and even afterwards CD-ROMs will remain the most appropriate source for information that changes slowly. Already mastering of CD-ROMs is affordable, and SDN should explore the development of a CD-ROM product on sustainable development when sufficient indigenous data and information becomes available.

There can be no doubt that a network such as this, providing efficient and cost-effective service will be a godsend. For the financial viability of SDN in Pakistan, this scheme is essential, without which, SDN will continue to be dependent on donor support, which is undesirable -- SDN can hardly preach sustainability effectively without become self-sustaining itself! BERDNET will make SDN self-supporting very soon, and the profits will spawn other SDN activities such as CD-ROM mastering. The time is ripe for electronic communication in Pakistan, and with support from UNDP and its partners, the SDN can help to form BERDNET which could become central to the timely, rational implementation of the NCS and the national Agenda 21 -- based largely on the NCS.

It may be recalled that UNDP helped start ERNET, India's data network in the 1980s. Now that UNDP has its SDN in place, BERDNET, a project similar to ERNET but with a wider range of users, can be started in Pakistan. More information about ERNET appears in Appendices 5 and 10.

We would like to see the UNDP and other organizations who value the role of communications in development to play an important role in facilitating reform in this sector. The setting up of this network would be a significant achievement and the time for it is ripe.

3. WHAT DOES PAKISTAN NEED?

What Pakistan needs immediately is a national network of academic and research institutions, government and non-government organizations and business and industry -- hence our proposed BERDNET. Historically, each of these sectors have set up their separate physical networks. Later, when inter-sectoral communication became necessary, these networks became interconnected. But keeping in mind the existing situation, as illustrated above, it would be desirable to go for a single network capable of handling traffic from all these sectors.

The network should have a sufficiently reliable and high data capacity link nationally and with the international network of computers. The national network and the international connectivity go hand in hand -- without a national network to back it up, international connectivity is only of benefit to very few users and turns out to be forbiddingly expensive; on the other hand, a national network without having an electronic conduit to international networks is at best of limited utility if not entirely meaningless in the context of the global village scenario.

To promote networking in Pakistan, or for that matter any other country where it is in its primitive phase, access to USENET, albeit partial in the beginning, is a must. The USENET with more than two thousand newsgroups discussing everything under the sun is one of the biggest, and certainly the most popular network in the world. As one gets in to his favourite newsgroup -- which can cover anything from politics to art, science to literature, esoterica of computers to environment -- one is transported to a new dimension of human communications (mediated by computers) and inexorably pulled into its beneficial

orbit. There is such a large potential for learning (directly from the experts in each field) and sharing one's knowledge and experience, that almost any problem which is not amenable to an easy solution can be put on the "net" (as it is popularly referred to). Without fail one is bound to receive the best solution from someone who might be sitting thousands of miles away. To a lesser degree, the same functions are performed by the various mailing lists, again on wide-ranging topics. Besides, one can also subscribe to many electronic journals and also contribute to them. Then there are specialized networks to cater for the needs and requirements of business and industry dedicated exclusively to financial services and banking, stock and commodity markets, retailing, manufacturing etc.. Queries from a fast growing list of databases provides another incentive for networking. And of course, there are the fast expanding networks like GREENNET, PEACENET, ECONET, GEONET etc. that generally serve NGOs, peace and environment movements and other special advocacy groups. Such networks are grouped together under the umbrella of Association for Progressive Communications (APC) which have public areas quite similar to newsgroups on USENET called 'conferences'. These conferences have become fora for most spirited discussions on topics that are of relevance to the NGO and development community the world over.

There is now extensive literature on the resources available through these network, with particular reference to NGOs, e.g.

i) Ecolinking -- Everybody's guide to Online Environmental Information, Don Rittner, Peachpit Pr., CA, 1992.
ii) Communications for Progress, Graham Lane, Catholic Inst for Intl. Relations, London, 1990.
iii) Sourcebook on Sustainable Development, Intl. Inst. for Sustainable Dev., Winnipeg, Manitoba, 1992.

Most of the above services can be had offline with only e-mail and news feed from the USENET (though a full news feed becomes very expensive on a dial-up international line), but access to some specialized networks and databases is more convenient (and in some cases, possible only) interactively. To access these online services one would need a fairly large bandwidth (capacity for carrying data) which would be economical only if there is a shared leased line. We are going to look at these different options, one by one, in the following section.

SDN and IUCN have recently had a most enlightening experience in getting information about the disposal of a toxic chemical through the international networks. See Appendix 3.

Recently, it has been shown by the experience of Eastern Europe (Czechoslovakia and Romania in particular) that once full access to the network is achieved -- INTERNET, EARN/BITNET, USENET etc. -- the traffic rises at a very brisk pace indicating that the country is fast integrated in to the global network with all it great advantages. We predict the same for Pakistan once full Internet connectivity becomes a reality.

4. OPTIONS FOR BERDNET

We outline here the various options for setting up the BERDNET. Starting with an e-mail network with 'offline' services (as a short term solution), we proceed to explore the options for a dedicated WAN supporting a multi-vendor, multi-protocol environment. The estimates for hardware are approximate, and could be refined later. Estimates of other costs for setting up the network operation and providing training and maintenance are provided.

The basic ideas for the first step to be taken in setting up BERDNET was based on the following conditions:

- It should satisfy the basic needs of e-mail economically.
- Set-up and maintenance should be inexpensive and easy.
- It should be expandable.
- If expansion required new technology, the existing hardware and software should be usable in the new system.

The simplest system that we initially conceived required a 486- based machine, with large storage capacity set up in each of the five major cities of Pakistan -- Karachi, Lahore, Faisalabad, Islamabad and Peshawar. These could be accessed by other computers in these cities at local phone call rates using a simple modem. Electronic mail collected at each BERDNET node (which would run a Bulletin Board and act as a mail-box) would, after compression, be send to the other centres using PAKNET, the packet-switched network of PTC. The addressee, in another city, would dial up the local mail-box and pick up the mail. Using the PAKNET was thought to be a way of overcoming the high tariff rates for inter-city dialing. It is shown in Appendix 6 that PAKNET would in fact be an expensive method of obtaining inter-city connectivity. The network configuration we now propose would be the same as for the one based on PDN, technical details of which are in Appendix 6.

We have also explored the possible use of leased lines in Appendix 7 and have found this option too expensive under present tariffs. BERDNET in its initial phase will have its nodes linked by fast modems connected over dial-up lines nationally. An international leased line may be a possibility depending on the amount of traffic generated by BERDNET.

The provision of e-mail services between the major cities of Pakistan and international networks at a basic level is merely the beginning of a longer term plan to provide wider and more extensive communication services. After the simple terrestrial network mentioned above is in place, BERDNET intends to set up a satellite based network.

The satellite option provides as much bandwidth as we require at very reasonable rates (as compared to the PTC) and is not very expensive to set up. In our opinion, the VSAT (very small aperture terminal) satellite technology provides the optimum solution for the networking needs (at least insofar as its national component is concerned) of our proposed BERDNET. Although it can also be used for telephony (voice communication), this technology is ideally meant for data applications offering economical and reliable data services and is fast replacing terrestrial data networks. Technical details are provided in Appendix 9.
The very important technical issues of international connectivity using leased lines or satellite technology are discussed in Appendix 10.

Although we would propose going for the VSAT network right away with its reasonable costs and fast installation time, there is a possibility that we have to work for a while under the first option of a dial-up network. In such a case, switching over to VSAT would save some of the hardware cost of the nodes by incorporating the already existing computers in the new network.

To conclude, there is no better option for the BERDNET or for any similar network in Pakistan, than the VSAT satellite system. The only question mark that hangs above this promising scenario is the attitude of the government. We are sure that once the government deregulates the setting up of public data networks in the private sector, there would be many investors lining up, and especially for data networks based on the VSAT technology. BERDNET has the opportunity to become the trail-blazer in this field.

5. CONCLUSIONS

This proposal attempts to lay out the need, and the mechanism, for setting up a digital data network in the private sector, supported by various sectors, principally from Business, Education, Research and Development. What we propose is to start working on an e-mail network on dial-up lines immediately. It neither needs any change in the GOP's regulation policy nor a huge financial outlay. But it is only a short term arrangement, which can be later incorporated into a full-fledged VSAT satellite network once the GOP allows such a network to be established. The tide of computer networks cannot be stopped. If BERDNET is not set up, there is no doubt that before long purely commercial networks will begin to provide services in Pakistan. While we would welcome such a development, by their very nature such networks would not be able to cater for the large number of ngos and others who operate on a shoe-string budget. With the vast treasures of information on environment and development now available

through the networks, and the potential of this for transforming the working of many groups, it is necessary that the opportunity to set up BERDNET be seized immediately.

The Consortium with its diverse membership and differing needs will need to be flexible and adaptable in its planning and management strategies, allowing parts of the profits from the network services to broaden the user base of the network to include the less-advantaged groups. SDN is aware of the difficulties that it could face in setting up BERDNET, and many of them would be insurmountable if it were not supported strongly by UNDP. UNDP's role will be crucial in persuading the government in allowing a network such as this to operate, particularly the satellite component. Advice and equity inputs are sought from potential users/partners and donor agencies.

6. BUDGET

Jul 93 - Dec 1994 (Pilot Phase of terrestrial system)

The estimates are for setting up 5 BERDNET nodes, one in each major city.

1. Hardware & Software $ 100,000
2. Phone line setup $ 10,000
3. Communications Charges $ 80,000
4. Personnel
   (Total 16, with 3 per node + manager) $ 96,000
5. Rental and Utilities $ 45,000
6. Publicity, Stationery & Mailings $ 15,000
7. Travel -- inland $ 10,000
8. Travel -- overseas $ 18,000
9. Miscellaneous $ 30,000

Part Total $ 404,000

Training for about 50 organizations listed in Appendix 11

1. Provision of Modem & Network Training
   (35 Organizations at $700 each) $ 24,500
2. Basic Computer Training in addition to
   Network Training & Provision of Modem
   (15 Organizations at $1000 each) $ 15,000
3. Training Software and Hardware $ 10,000
4. Travel and other overheads $ 5,000

Part Total $ 54,500

Total (Jul 93 - Dec 1994) $ 458,500

Jan 95 - Jul 96

1. Maintenance of BERDNET
   (as above except no hardware cost but
   slightly higher communication cost) $ 358,500
2. Training $ 50,000

Part Total (Jan 95 - Jul 1996) $ 408,500

Jan 95 - Jul 96 (Pilot phase of the VSAT component)

This period marks the start of the VSAT installation and operation. The above setup will continue to exist for this period and would be phased out after the VSAT system is fully operational.

1. VSAT terminals $ 200,000
2. Routing and Multiplexing equipment $ 250,000
3. Hardware and software for nodes $ 100,000
4. Modems $ 50,000
5. Line set up $ 5,000
6. Satellite rent (?) $ 80,000
7. International leased line to USA $ 300,000
   (Satellite Link through Asiasat may
   be cheaper)

8. Infrastructural & Personnel Costs, etc. $ 750,000
   (To be worked out in detail)

Total (Jan 95 - Jul 96) $ 2,143,000

Note: As BERDNET begins to attract users, it will start generating income, slowly at first, but we expect it to rise sharply. We are presently not in a position to estimate with confidence the income over the three year period budgeted above.

APPENDIX 1

Summary of the

IRDC/UNDP SDN Starter Kit Workshop
Feb 8-12, 1993
IDRC, Ottawa, Canada.

Some points brought out by Chuck Lankester, Director, SDN, in his opening address and as part of on-going summaries are worth noting:

- Sharing Information is Power
- SDNs globally are the process of change
- We should gather information to share and thereby empower people to be able to participate as equals in the developmental process
- SDN is owned by national SDNs and not UNDP or IDRC
- The canvas on which SDNs operate is vast; it can be one of the most effective tool for national capacity building as envisaged in the charter for Capacity 21.

Contacts were established with several experts in the area of information sciences and social development. All these persons are keen to help the effort in Pakistan. They seemed particularly pleased at the speed at which we had taken-off and the scope of the SDN in Pakistan. The Pakistan SDN Brochure was particularly appreciated and was pointed to as a model for other SDNs. There was interest shown by the representative of the Association for Progressive Communications (APC) to made our SDN one of its nodes. If this happens, it would connect us electronically to a vast array of resources and experts. Among the projects and ideas discussed as part of our programme were:

- Formation of a "Directory of Directories" which would allow easier access to information nationally
- Setting up of a Bulletin Board in Islamabad and elsewhere as a means of exchanging information
- Assisting or being the main player in developing a national CD-ROM covering all areas of sustainable development
- Assisting government departments, federal chamber of commerce, NGOs and others in making their own resources easily accessible to themselves and others
- Collaborating with organizations such as the JRC-IUCN, IUCN, and SDPI in increasing awareness about the environment
- Training potential users of information technology, but being conscious of non-electronic means of information access and sharing
- Explore the formation of a Consortium of users of SDN, with attention paid to the oft neglected, but potentially very useful partners, the business and corporate sector. This is particularly important if the SDN in Pakistan is to become self-sustaining
- Help in developing national data communications policies that would facilitate the exchange of information within and between all sectors, and also internationally
- Networking is primarily a means to connect people to each other and to useful information; technology is only a means toward achieving this end. Our SDN will serve the needs of all sectors of the country.

The administrative role of UNDP, Pakistan, and the vital, technical support of IUCN in running the pilot phase of the SDN was highlighted. It will be necessary for both these organizations to garner support from other agencies, bilateral and multinational, and the government when the SDN enters the operational stage -- a point emphasized by Chuck Lankester.

APPENDIX 2

TELECOMMUNICATIONS AND DEVELOPMENT

There is considerable empirical evidence that investment in telecommunications in the less developed countries (LDCs) leads to development. The evidence is summarized in a recent book by Edwin Parker and Heather Hudson, Electronic Byways: State Policies for Rural Development Through Telecommunications, Westview Pr., 1992.

That there is a strong correlation between the number of telephone per capita in a country and the state of its economic development has been known for a long time. What had not been clear, at least until the early 1980s, whether high telephone installations lead to economic development or vice-versa. In 1980, through sophisticated statistical analysis it was shown that there are significant correlations in both directions, including specifically a strong relationship between the number of phones per capita in a LDC in one year and the per capita GDP in the following year. It was found that both business and residential phones contributed to that effect. The magnitude of the effect was greater for countries with a lower density of telephones per capita. This is particularly significant for countries such as Pakistan with about 10 telephones per 1000 citizen (the figure for Malaysia and Argentina is eight times this, and Europe and the USA have one telephone for every two persons).

As part of the above study the relationship of number of radios per capita to GDP was examined and was unable to find any significant statistical relationship. This was a particularly disappointing result for the advocates of the use of mass media for national development. These statistically significant results suggest the superiority of telephony over broadcast media to achieve economic development, a result proponents of two-way communication have known all along.

An important conclusion, relevant to our economic development, that can drawn from these studies is that telecommunications is basic infrastructure that is a complement to and often a catalyst for economic growth. Constructing electronic highways allowing telephony and digital data communications should be accorded a higher priority than it has been by this and the previous governments. It is no less important than roads, and a lot more environmentally friendly. In countries with efficient electronic communications networks, several tasks can be accomplished by either using the telephone or the networked computer, thereby reducing road travel, decreasing pollution and increasing efficiency.

State controlled Telecom. Depts in most LDCs have been found unable to cope with the fast moving technology of electronic communications. Absence of adequate number of trained personnel in these departments, and a lack to competitive pressure have caused over-priced services and glaring inefficiencies. The private sector in Pakistan is very keen to provide electronic communication services but are prevented from doing so because of out-dated government regulations. This government, obviously so keen on motorway construction, should begin to take the high- tech road to revolutionizing telecommunications in this country.

[Text of a letter to editors of several newspapers]

APPENDIX 3

TOXIC DUMPING AND E-MAIL

In the month of May, an unscrupulous operator had dumped about 2.5 tons of a highly toxic chemical substance, meta- dinitrobenzene near a railway station in Karachi. It was picked up by an unsuspecting godown owner as probably something useful. This person and his driver died as a result of inhaling the toxic fumes from the chemical. The local police impounded the material, and not knowing what it was -- they were lead into believing that it was potassium or sodium cyanide from the toxic effects that it had caused -- dumped it into the Lyari river, which has increasingly been turned into more of a sewage channel than a river. But by then the story had been reported in a national newspaper causing great concern among the environmentally conscious public. The IUCN Pakistan played a key role from then on in highlighting the potential hazards and the need for the safe disposal, or at least the detoxification of the material. It was taken out from the river and a sample of it tested under the IUCN's auspices in a well known research institute of chemistry. It was identified as meta- dinitrobenzene, a highly toxic and potentially explosive chemical. The various government and non-government agencies that were involved in this operation had little idea about the safe handling and disposal of the substance.

We now come to a part of the story which is both heart warming and an indicator of what can be achieved through the medium of electronic mail (e-mail). The SDN Pakistan, on receiving this information from the IUCN sent an SOS via e-mail. This appeal for information and expert advice was put in some of the conferences, like en.toxics on PeaceNet and en.alerts on EcoNet of the Association of Progressive Communications (APC). The response was nothing short of overwhelming -- both through fax and e-mail. Though it was a rather technical question needing very specialized knowledge, more than 50 individuals and organizations responded with concrete suggestions and offers of help. There were responses from places as diverse as Brazil and Finland, New Zealand and Switzerland apart from more "expected" places like US, UK, Germany etc.. The respondents not only included US organizations like Environmental Protection Agency, American Lung Association, National Institute of Environmental Health and Sciences and experts in related fields, but also a number of students and concerned individuals, including Pakistani expatriates. Some of these concerned individuals went to the extent of searching commercial databases to retrieve useful information, while others sent comprehensive fact sheets (more than 20 pages in one instance) covering topics like the properties of the substance, how to handle it, known effects on human beings and possible ways of detoxification and disposal. Such information which is still trickling in is enough to compile a small book on the subject. The story had a happy ending when the toxic material was safely incinerated under expert supervision. This episode highlights the importance of e-mail and other data networking services and ties nicely with what we have stated in the section, titled, "What does Pakistan need?". Very few people in Pakistan have so far the opportunity to use e-mail, and because of the absence of any networking initiative like the one we are proposing here, it turns out to be quite expensive for those who use it. As for news feeds and conferences, they are unheard of, and very few people have the resources and means (mainly for expensive international dial-up lines) to query the thousands of commercial databases even if they are aware of this vast resource of knowledge. Pakistan with its very narrow knowledge base needs to make an extensive use of all such resources. Expert knowledge has always been difficult to come by, but now it is well within one's grasp at a price which is not very high.

It also brings into sharp relief the role for which the national SDNs have been created under Agenda 21. It is a far potent real life example of the necessity and effectiveness of SDNs than many hypothetical ones cited in the promotion literature. With this proposal, the SDN Pakistan aspires to move into the centre stage of wide area networking services in the country. It is planning to become both a major catalyst and an important player in promoting and implementing networking initiatives in Pakistan.

[Based on a letter to editors of several newspapers]

APPENDIX 4

WIDE AREA NETWORKING IN PAKISTAN

4.1 PAKNET

1. At present there is only one public data network in operation in Pakistan. Called the PAKNET, it is run by the Pakistan Telecommunication Corporation (PTC). It is an X.25- based Packet Switched Public Data Network (PSPDN or simply PDN), set up as a pilot or experimental project in the beginning of 1991. No further expansion has taken place since then. Even the initial level of services is hardly being maintained with reliability. It can cater for up to 300 users at a time, whereas there are about 120 subscribers currently, though very few who use it actively. The hardware and software for the network was acquired from Telenet Inc., USA which runs a similar network in the US. At the moment, there are PADs (Packet Assembler and Disassembler) in Rawalpindi/Islamabad, Lahore, Karachi and Peshawar, but the plans for setting up more PADs in other cities like Faisalabad, Multan, Hyderabad, Quetta etc. have not materialized so far. It has two dedicated international lines linking with the public data networks of BT in Britain and MCI in the USA.
2. The PAKNET started functioning about two years ago. It induced a lot of enthusiasm and expectation among people who had felt the need for some cheap and reliable means of data communications within and outside Pakistan. But it's performance has so far been disappointing. Apart from the problems that it shares with the PTC in general -- like inefficiency and lack of initiative -- the PAKNET is beset with some peculiar ones of its own. In our opinion, the fundamental problem is a lack of technical competence and appreciation of the task they are supposed to perform. The PTC has not done its home work regarding data communication probably because it never gave it the importance it deserved. There is a tendency to believe that it is not profitable as compared to voice communication, which might be true at present, but this short-sightedness would cost the Corporation in the long run, and as a result, Pakistan as well. Here are some of the more specific limitations and problems of the PAKNET:

- It has a very limited functionality. All it does is to provide you a remote login facility in another computer (which itself should be on the network), if you have access rights to it. No electronic mail service is provided (though it was expressly set up for this purpose), neither can you transfer files between two computers unless they are running their own X.25 software which supports such a function.
- Even these limited services are highly unreliable. Time and again the network goes down without advance warning. Recently (March '93), there was an outage of 17 days in Lahore -- something unheard of for an operational network in any other part
- of the world. The "down time" for a network, by international standards should never exceed a small fraction of a percent.
- The dial-up service, for some curious reasons has been discontinued. Now one must get a dedicated line to the nearest PAD, for which a delay of several months is the norm rather than the exception. So this strange condition has robbed the users of a certain flexibility of operation and ease in getting a quick connection, and also increased the cost considerably.
- Coupled with the above condition, the PDN authorities have set exorbitant rental charges for the modems that they supply-- typically about $1000 per annum. They discourage their clients from using their own modems.
- Although one can get a connection at transmission speeds of 300, 1200, 2400, 4800 or 9600 BPS (bits per second), the higher speeds can never be achieved if there are a number of users logged into a single PAD. Since the PADs themselves communicate at 9600 BPS, with all the control information included, the throughput for the users falls accordingly, if there are more than one logged into a particular PAD. It is again ironic that the PTC explicitly forbids clients on two-wire and four-wire leased lines to go beyond 1200 and 2400 BPS respectively, the physical medium for data transmission (copper wire cable for local and microwave circuit for long distance communication) being the same as used by the PDN PADs.

- For asynchronous connections -- by far the majority -- the communication parameters like parity, character length etc., once set, cannot be modified by the user. Each time one has to make a minor change, like from E7,1 to N8,1, or vice versa, one has to contact the PDN personnel. And the nature of their service is such that it takes days rather than minutes to bring about this minor adjustment. This applies to synchronous connections as well, though one doesn't need to make such frequent adjustments in this case.
- The user interface is extremely unfriendly. It doesn't even have a HELP, say on commands, parameters and addresses. In fact, the only command it accepts is CALL, and that too only, if it is entered as C.
- The recent upward revision of PDN's international rates have also put a damper on this part of the service which was attractive for being cost-effective. Besides, one cannot call just any international X.25 address as it should be. One has to register with the PDN the numbers that one is going to call and still may not be able to call until there are more users who desire access to the same number. To one subscriber who wanted to access the X.25 address of UUNET, PTC asked this user to bring another 9 subscribers before it could be fed into the routing tables.
- The central switching computer that they use is a PRIME, the manufacturers of which have ceased to exist. We wonder how they tackle the problem in case it malfunctions, the long shutdown periods pointing to a continuing malaise. The Telenet equipment that they bought is also second-hand, and quite old to boot. For a long time now there has been no back-up computer available.

3. But things have begun to improve lately with the induction of a new Director. The network down time has reduced and the news is that they have signed a contract with SPRINT for technical training of their personnel, something which was sorely needed. Expansion plans for the network which earlier had been shelved have been reinitiated. Recently, the PTC has increased the cost of leasing a line by 600% (not affecting the PDN users needing barely a few kms, as much as those who acquire it for long distances) which would make them unaffordable for all but the richest of multi-nationals and banks for long haul communications. If the services of the PDN don't become reliable enough for many leased line users to shift to it, it would spell disaster for data communication in Pakistan.

4.2 PROPRIETARY NETWORKS

1. Over the last decade or so several organizations have set up wide-area networks of their own. The biggest is that of the Pakistan International Airlines (PIA). Some other notable organizations who have their networks include the Associated Press of Pakistan (APP), multi-nationals like IBM and ICI, and financial institutions like Citibank, American Express and Bank of America. They lease lines from the PTC to communicate within Pakistan, and some of them have overseas lines as well. But all these networks are proprietary in nature, established to cater for the data communication needs of their respective organizations and not permitted by PTC to carry data for others.

2 The wide-area networks of the various national and international organizations mentioned earlier, are of no use for those outside these organizations. Certain organizations have shown a willingness to share their lines, leased at exorbitant rates, but are forbidden to do so under the leasing contract with the PTC.

4.3 EDUCATION & RESEARCH NETWORKS

1. The academic and research institutions of Pakistan were rather late in adopting the new technologies and options in networking. However, there are, at the moment, three institutions that have a dial-up UUCP (Unix-to-Unix Copy Protocol) link with the UUNET in the USA. The HEJ Research Institute of Chemistry, University of Karachi was the first Pakistani academic institute to establish this link wherein they were able to send and receive e-mail from all over the world. They were followed by the FAST (Foundation for the Advancement of Science and Technology) Institute of Computer Science, Lahore and the UGC (University Grants

Commission), Islamabad with similar set ups. The UGC has also established similar UUCP-based dial up links with five Pakistani Universities. Hence the node at UGC acts as an e-mail gateway to the ones at these universities. Recently, the National University for Science and Technology (NUST), Rawalpindi, which is still in its formative phase, has established a PDN-based link with the Michigan State University.

2. When we look at the state of electronic networking among the academic and research community in the country, it cuts an even sorrier figure. Even by the low standards of the less developed countries, Pakistan ranks fairly low in E&R (education and research) networking. The phenomenal growth of computer networks in the West (and especially so, in North America), owes a great deal to universities and other academic or research institutions -- not only in terms of their extensive use but for introducing many innovative technologies. From information retrieval on highly specialized subjects to active research collaboration, computer networks have opened new vistas for fruitful academic activity. Spawning innovative trends like submission of research papers through e-mail (in standard word processing formats) speeding up their publication many times over, the academia is probably the greatest beneficiary of electronic networking.

3. But these benefits are yet to be achieved in Pakistan. Lacking resources and not sufficiently exposed to the networking technologies, the Pakistani E&R community can not be blamed much for this sorry state of affairs. The three dial up e-mail nodes presently available are used sparingly because of the very high costs involved in such an international access. Besides, the presence of three nodes essentially duplicating what could have been done from one of these is another sign of lack of coordination among these institutions. However, the charges of long distance dialing within Pakistan (after a major hike last year) are only marginally less than for overseas dialing, and this inhibits dial-up data communication between academic/research institutions of the country. The PDN had the potential for setting up a national E&R network but it never fitted the bill for some of the reasons cited earlier. We do not see the possibility of it ever actualizing in Pakistan without a strong government support and funding from either the GOP or some donor agency. The necessity of such a national network, however, hardly needs to be underlined.

4.4 NARGIS

1. This brief description of wide-area networking in Pakistan would not be complete without mentioning the commercial services of the Incorporated Technologies Corporation, Lahore. They have set up commercial e-mail services by the name of NARGIS (Network Accessed Regional and Global Information Services). In fact, they are also managing the addressing domain for Pakistan on the Internet, though none of its interactive services is available so far. They have set up Bulletin Board Systems (BBS) in Lahore, Karachi, Sialkot and Islamabad which can be accessed either through interactive login or the UUCP for sending and receiving e-mail. They charge about $0.80 for a two thousand byte (2KB) international e-mail message. The rate falls up to 50% if sufficiently high volume of data traffic is ensured by a user.

2. The e-mail services provided by NARGIS have a great advantage over other arrangements in that they provide local nodes to their subscribers in major cities of Pakistan. Besides, it is extremely easy to subscribe to them -- all one needs is a modem and some communication software; within a day one is enabled to send, or receive e-mail from across the world. But they also leave much to be desired. Charging for both incoming and outgoing mail this commercial service becomes very expensive for organizations with relatively large volumes of data -- concessionary rates notwithstanding. The academic institutions are quite naturally reluctant to subscribe to it; since academic data traffic has a tendency worldwide to grow exponentially for which these resource-starved institutions don't have the contingency budgets to cope with. Most of them are running on rather meagre fundings from the Ministry of Education and have difficulty maintaining their present level of activity what to say of expansion, especially in an unknown area like data communication. And again, not only that NARGIS does not provide full Internet

connectivity, with all its wonderful interactive services, it does not even have the provision for the USENET news feed. This is understandable for they also dial to the US for transfer of data in both directions. Many business organizations, on the other hand, are reluctant to use these services for reasons of privacy which cannot be ensured unless the data is in the encrypted form. In spite of all these limitations and problems, NARGIS is the only true public e-mail facility available in Pakistan.

This brings us to the more general issue of setting up public data networks in the private sector for providing value-added services like e-mail and database queries. To date the Government of Pakistan (GOP) has maintained a monopoly in this area for the PTC, which like all government bureaucratic set ups is inefficient and lacks the dynamism and initiative for introducing state-of-the-art technologies even if they are affordable. And lacking the vision to anticipate the importance of data communication, the PTC is one of the main causes for Pakistan's backwardness in this area. The GOP would do well do break this monopoly and allow setting up of public data networks in the private sector for even with all the good intentions, the PTC cannot conceivably cater for the growing needs of Pakistan in a fast developing field. These public data networks could use the PTC's infrastructure (thereby generating profit for it), and provide the much needed value-added services.

APPENDIX 5

INDIA'S COMPUTER NETWORKS

Most Pakistani computer buffs recognize the great strides India has made in software development. Development in this important field has, in addition to bringing large amount of foreign exchange, helped to create one of the best and largest computerized railway system in India. When the London Underground Railway and British Rail were looking for a new software to control and run their systems they settled for an Indian company. This remarkable progress software/systems development has been helped by computer networks, and in turn has spawned more networks.

Unlike Pakistan, India has a large number of WANs catering to the needs of different users, ranging from bankers and government officials to developmental workers and academics. A listing of a few of the representative networks with short descriptions will help to suggest the range of networking activity in India:

RABMN: The Dept. of Telecom. established its Remote Area Business Message satellite-based network connecting 21 cities and 400 districts in 1988, designed to provide reliable and economical data communication to remote areas. The State Bank of India was the first bank to become its customer. Several major industrial firms such as Tata are also on this network. RABMN will eventually have 120 subscriber organizations using over 1000 small satellite dishes (VSAT) to connect to the network.

NICNET: This National Informatics Centre's network, also satellite based, is for decision support system of government departments. This network has improved centre-state-district communications, and has made grass-roots data retrieval easier. It is expected that this network will assist in better management of funds at all levels of planning and implementation.

INDONET: This is India's first commercial computer network using a wide range of technologies, including satellite, to link its users. Through this network intra-city, inter-city and international connectivity is possible for any user. Overseas commercial data network services and databases can be accessed using INDONET. There are a number of smaller WANs set up to service the need of organizations with nationwide operations. Among these are:

ERNET: This network was started in 1986 with assistance from the United Nations Dev. Prog. (UNDP) linking about 8 premier educational and research institutions. The network which continues to receive support from UNDP has allowed academics in these institutions to be communicate with each other as well as their colleagues internationally. Other more sophisticated services such as database access, "file-transfer" and "remote login" are possible. This network is one of the strongest tool helping the Indian researcher to keep abreast with the international developments, either through informal contact using e-mail, access to network conferences and computer bulletin boards or database searches.

SIRNET: The Council of Scientific and Industrial Res. (CSIR) has over 40 labs located throughout the country involved in a wide range of activities. [PCSIR is the parallel organization in Pakistan] SIRNET provide networking between all the laboratories and also acts as an important gateway to ERNET helping researchers in these labs to benefit from all the facilities of ERNET.

CALIBNET/DELNET: This is a project of the Natl. Info. System for Science and Technology (NISSAT). CALIBNET will network 38 libraries in Calcutta and DELNET 30 libraries in Delhi. At each of the libraries a composite database consisting of the union catalogue, subject profiles, abstracts, etc. will be maintained which will provide services such as fund accounting, serials control, creation of bibliographic databases and circulation to all users. A global database will also be maintained in a central computer.

While the scene for WANs in Pakistan remains sadly dormant, they are the fastest growing sub-sector in the Indian telecom/computer industry. In early 1992, the demand for WAN hardware and software in

India was estimated at $ 49 million with an expected growth rate of about 40%. Attention to networks is long overdue in Pakistan.

There are several step that the government can take to improve the situation, not the least of which would be a study of the Indian experience. It could immediately start improving the services offered by its PDN, and allow businesses to offer value-added services on their PDN lines as well as their lease-line connections.

There are a number of companies in Pakistan who have PDN connections and also lease dedicated lines at exorbitant costs. Even though these are both under-utilized, these companies are forbidden by Telecom. regulations to offer the use of their lines to other users. Once the business sector realizes power of the data networks and the opportunities they offer, there is no doubt that these antiquated regulation will be discarded. The government should however not wait for the floodgates to break loose; instead it should encourage a speedy reform allowing the widest possible access to the communications networks. This will involve reducing tariffs and inviting private sector investment in setting up and running of networks.

[Based on a letter sent to editors of several newspapers]

APPENDIX 6

IS BERDNET POSSIBLE USING PAKNET?

1. In Appendix 4 we have taken a critical look at PAKNET (PTC's PDN). With all its limitations and problems, it is still thought to be the cheapest mode of data transfer both within and outside Pakistan. This impression is erroneous, as will be shown in para 8. Most subscriber of PAKNET have not done a thorough comparison of cost of its cost versus dial-up with new high-speed modems, and have concluded wrongly in its favour. In paras 2-7 we explore the possibility of using the PAKNET for setting up an e-mail network, assuming that PTC lowers the tariff in the future -- only then would it be a viable medium.

2. One can use the PDN for setting up a national network which is also connected to the international network of computers. This is possible even with its present limited functionality. The only condition for it to be used reliably would be a drastic cutdown in its down time, i.e. it should be available for data transmission when required. Since lately there have been strong indications of improvement and expansion of PDN's services, we can assume that it'll acquire the desired level of reliability.

3. With this assumptions we set about to explore the possibility of establishing a network using PDN. What we envisage is to set up nodes in five major cities of Pakistan viz., Karachi, Lahore, Pindi/Islamabad, Peshawar and Faisalabad. These nodes would be connected to the local PDN PADs over dedicated lines and thus would be linked up with one another. In this scenario, we are essentially going to provide only the e-mail service to the network users. However, through these nodes it would also be possible to access computers on packet- switched networks interactively. This might be needed under certain circumstances, say to retrieve data from an online database.

4. In this set up each of these nodes would be acting as a local post office. A user would call a local node through UUCP (or any of its DOS based versions) on a dial-up line, and by doing so would be able to collect and send his mail. This mail would be forwarded to its destination node (the central node in case of an international address) where it would be directed into the mail box of the addressee. The latter can collect it whenever he dials to his own local node.

5. So this would form a UUCP network in Pakistan and all its users would be able to send and receive e-mail among themselves and anywhere else in the world. The computers acting as local nodes in different cities would be running X.25 (packet-switching standard used by the PDN) software to better communicate among themselves over PDN connections. This would allow file transfers between nodes and interactive messaging between network managers at these nodes, something that is not possible with mere asynchronous links with the PDN. The hardware platform for the nodes should be so chosen that it would either be able to run UNIX and X.25 or a UUCP supporting BBS (Bulletin Board System) like Waffle and X.25 at the same time. The advantage with a BBS would be that users can also dial into a node interactively, and apart from the e-mail services would also be able to participate in discussion groups or post notices for all to see.

6. In this option the international connectivity would also be achieved through the PDN. All international traffic would first be directed to the central node at Islamabad (this could be the SDN node itself) which would collect it, and connect itself to an international host (preferably a gateway) for onward delivery. Connection with UUNET which has an X.25 address as well, nicely fits the bill. Every time that one makes a call on PDN's international lines there are "connection" charges as well, apart from the data charges and those for the time for the use of the line. So the international data traffic should be optimized for minimum possible calls. To further cut down the cost of data communication, it could also be compressed at a node before routing.

7. Such a network could also be set up using dial-up telephone lines for communication between different nodes and also for transporting data to UUNET for international traffic. Recently much of

the trunk and junction network in major cities of Pakistan has been converted to digital working (using pulse-code modulation on fiber optic cables) though the local line network is still analogue in nature working on the conventional copper cables. This has improved the quality of the telephone lines -- the twin menace of noise and cross-talk has been substantially reduced. With state-of-art modems one can go up to 14000-15000 BPS on this partially digital network. However, one still thought that like anywhere else in the world data transfer through PDN would be much cheaper than on the Public Telephone Network (PTN).

8. But when we made some calculations about the volume of data transfer in the light of our discussions with people from NARGIS and FAST-ICS, who use state-of-art modems for bulk data transfers to the US, a rather surprising picture emerged. It takes them about 10 minutes to transfer 1 MB of data which costs about $20 on telephone lines. But according to our calculations the same volume of data would cost about 10 times more if transported over the PDN even with the highest claimed speed -- the PTC charges $0.60 for call set up, $0.12 for using the line per minute, and $0.012 for each 64 bytes segment of data to the US. Nobody probably had made such a calculation before and the results were counter-intuitive. But when we look at the PDN rates, the charges for data volume turn out to be the culprit. In any case charging for the data volume when also charging for the time for the use of the line (apart from the call set up) itself seems unjust. Similar calculations made for data volumes within Pakistan also gave unfavourable (though not so startling) results vis a vis the use of smart modems on ordinary telephone lines.

9. Hence we propose to scrap the idea of using PDN altogether (unless its tariffs are reduced) and instead, go for a dial-up connection between our nodes using smart modems.

APPENDIX 7

BERDNET on Leased Lines?

1. We now take a look at a more comprehensive option of setting up a national network on leased lines with full international connectivity. This would in principle provide interactive services --- remote log on, file transfer, online database query etc. The whole issue of international connectivity for this network would be taken up in a separate section. The rent for the international leased line is however included in the estimates.

2. The PTC has recently increased the rates of its two-wire (single pair) leased lines by 600% (if this sounds unbelievable, the charges for four-wire leased lines have abruptly been increased by twelve-fold). This has suddenly made this option very expensive. The new rates to lease a two-wire line are about $60 per kilometre per annum. So if we set up this network in the same configuration and topology like the previous one, viz. in the first phase to have nodes in only five major cities of Pakistan, we would have to lease a line of about 2000 km. This would itself entail a yearly rent of $120,000 -- a huge sum by Pakistani standards which is difficult to justify unless there is sufficient traffic to use all this bandwidth. At present the Pakistani market in data communications, though potentially lucrative, is not big enough to make it cost-effective right away.

3. Looking at this option more closely brings out the fact that such a set up would entail setting up a PDN in the private sector. To provide interactive services to the users of this PDN would require switching and routing their calls and then forming and maintaining logical links for all inter-connections for the duration of the call. Such a function can only be performed by using some packet-switching technology. In short, one will have to install devices like PADs, switches or routers (these technical names are often used interchangeably for devices that essentially perform the same function depending upon the kind of networking technology in use). Such devices typically cost between $10,000 - 20,000 for 8 -24 ports. The multi-protocol routers which provide flexibility and ease of operation to the users would cost between $20,000-50,000, again depending upon the number of protocols supported by them apart from the number of ports.

4. Value-added services like e-mail can be implemented on this network plus all the Internet technology based on TCP/IP suite of protocols. In this network the subscribers could either dial in or get a dedicated line to their local router or PAD. Apart from the switching equipment, we would still need the local nodes (with enhanced capabilities) for collecting and distributing e- mail in the same manner as discussed in the first option. The big users going for the interactive services would have to install the communication software (based on any of the well known set of protocols like X.25, DECNET, SNA or TCP/IP) on their systems. The network would provide multi-protocol routing.

5. The cost for setting up such a network in its minimum configuration roughly comes out to be:

   i) Routers, PADs and Switches $250,000
   ii) Hardware and software for nodes $100,000
   iii) Modems $50,000
   iv) Line set up $5,000
   v) Line rent (national) $120,000
   vi) Line rent (international) $200,000

   Total$725,000

   Add to it the cost of training to the users as well as the network managers, the cost of management, infrastructure and incidental costs like air-conditioners, electricity and last but not least, maintenance and repairs and one gets to the figure of about 1.2 million dollars for setting it

up and running it for the first year. The annual recurring charges would be of the order of 0.5 million dollars. In this scenario we are assuming our users to access their local nodes either through dial-up lines or through dedicated leased lines for short distances.

6. Even if one goes about setting up this network despite the costs, one has to get permission from the government which is not ensured. But as the network grows to a level of about a dozen frequent interactive users, it would turn out to be a great anti- climax. The online services would become too slow for users' comfort. The reason for such an eventuality is obvious: the analogue telephone lines that we are proposing to use would never go beyond 14000-15000 BPS (although the PTC forbids its users to go beyond 1200 BPS for a single pair leased line) even with the smartest of modems, and this bandwidth, though sufficient for a single user for most applications would reduce proportionately to a torturous level if the number of users increase beyond 4 or 5.

7. So in the absence of any high bandwidth lines provided by the PTC, one reaches an impasse with regard to using the telephone system. There is a possibility that the PTC starts renting high bandwidth digital lines on fiber optics, but even if this actualizes, the rates would be unaffordable, unless there is a dramatic change in PTC rates.

APPENDIX 8

RENTAL ON INTERNATIONAL LEASED LINES

The rental per month for international leased circuits from PTC's Tariff Book as they apply for the Pakistan share only:

Australia $12296
Bangladesh $5108
Bahrain $8683
Canada $12240
China $14188
France $15134
Hong Kong $11352
India $9459
Iran $4600
Italy $11785
Japan $12769
Netherlands $14831
Oman $8683
Philippine $16798
Saudi Arabia $8702
Turkey $7567
UAE $8683
UK $11352
USA $12240

(these are the only countries mentioned)

Additional payment is required for connection at the other end, e.g. annual connection rate for the USA is $50,000.

APPENDIX 9

BERDNET ON VSAT SATELLITE SYSTEM

1. In the 1980s VSAT technology was shot into prominence in the West and gained special attention from leading satellite industries and telecommunication user communities. The driving forces behind rapid VSAT developments are as follows:

- deregulation;
- low cost of VSAT technology;
- high cost of terrestrial leased lines;
- fast installation;
- reliability;
- private networks independent of telephone companies;
- market demand for new data communication networks and voice connectivity in remote areas of developing countries or for industries with remote branch offices.

2. Some of the areas where VSAT technology is being used currently include hotel reservations, stockbroker activities, credit card verifications, sales data (hourly, sale-by-sale), ATMs (automatic teller machine), various financial industry day- by-day activities, car manufacturers, corporate private data and voice networks and video receive-only applications.

3. The major technical parameters in designing a large VSAT system are users' application, network configuration (star, mesh, or combination), multiple access technique, transmission power requirement, modulation technique, coding rate, data format, network management and required addressing method. These parameters are a function of application and satellite characteristics such as beam coverage and power. It would not be possible for us to go into detail about all these technical matters, but we would like to make a few remarks at the outset.

4. The launching of ASIASAT I has put Pakistan in a very favourable position vis a vis satellite telecommunication. It lies in one of the regions where ASIASAT I beams down at maximum intensity. This reduces the cost and increases the effectiveness of the satellite receiving equipment. This is a godsend and should be made maximum use of in data communication and not merely confined to beaming television programmes. Our proposed network would initially be using only about a sixtieth of the bandwidth used for television transmission and still cater for nearly all data communication needs of our targeted sector in the first phase -- demand will determine whether we will need a higher bandwidth towards the end of the three year period of the contract. It is worth mentioning that the Pakistan Television Corporation has hired a full transponder having a bandwidth of 36 Mbps (million bits per second) for transmission of its PTV 2 channel programmes.

5. We propose to start with just five VSAT satellite terminals each capable of both transmitting to and receiving data from the satellite. Although VSAT systems are generally configured in a star topology where a large number of VSATs transmit to one large station (hub) which in turn can transmit to any of these terminals, we would go for a mesh configuration in the beginning. This is necessitated by the very high cost of the hub typically $ 1-1.5 M. The terminals in a mesh topology wherein each of them can communicate with any other cost around $40,000 each.

6. So logically they would form a similar network as discussed earlier with each terminal situated in a different city acting as a node. Not only would it bypass the PTC's telephone network in communication between these nodes, it would provide a bandwidth of 64000 bps to each of them which is more than four times of what one can get on a telephone line with the best of modems. We could also multiplex this bandwidth into multiple channels allowing multiple users. And all the packet switching equipment that we had proposed for the leased line network with multi-protocol support, could also be used here. In this configuration the total bandwidth that is to be allocated

for the network comes out to be about 0.6 Mbps, the cost of hiring of which would be about $40,000 per year. This is one third the cost and five times the capacity of the leased line.

7. But unlike the terrestrial network the VSAT network, once it is in place, would have a great chance of expansion. We envisage that more and more users would be joining in every year; and the nature of VSAT technology is such that they would not be content to merely access the local nodes on telephone lines, but many of them might prefer to set up a terminal of their own or jointly with some others. This is more likely than not; for it would also solve the notorious problem of the "last mile" so acute in countries like Pakistan. We believe that within two to three years there might be as many as 200-500 terminals. This figure may seem exaggerated, but all a new user would need will be his ability to invest about $15,000-20,000 to have a separate terminal of his own; and a reserved satellite bandwidth for which to pay an additional few thousand dollars per year. The VSAT network has also the capability of supporting multi-media services. Even with the bandwidths allocated in the first phase, both voice and data can be handled; and though full ISDN (Integrated Services Digital Network) cannot be implemented at this stage, it is reasonable to expect this happening with the fast advancement in VSAT technology.

8. A VSAT terminal in a star configuration with a hub costs much less than one in a mesh. Once a hub is set up, a VSAT terminal can cost as low as $10,000. So at a certain stage of development, the network will have to switch to a star configuration -- or a mixed configuration to incorporate the already existing mesh terminals. At this stage an investment of $ 1-1.5 M to set up the hub station would have to be made, a substantial but by no means a huge amount as a one-time investment. There is also a possibility of going for a star configuration right away with a mini-hub which some vendors of VSAT equipment market. This can supposedly service about 200 terminals, but probably not as effectively as a hub of the normal size. We found the price of a mini hub quoted by a vendor (it seems though there are not many that manufacture them) as $120,000. If such a mini-hub can serve our network adequately, we might go for a star configuration thus making a double saving -- in the costlier mesh terminals as well as the hub. But we can put off these questions to a later stage, because even with this mini-hub and the less expensive terminals, the cost of setting up the network in its initial phase barely changes.

APPENDIX 10

FULL INTERNATIONAL CONNECTIVITY

1. The setting up of a wide-area network with full international access confronts one with a peculiar situation. Here we are not talking of huge networks, but a small network like the BERDNET in its first phase. The cost of setting up such a network is generally not much different than its recurring expenses -- it can even be lower. Sometimes the hardware and software is already in place, and one needs very little investment in these areas, in which case the network can be put in place at only a few percent of the cost of running and maintaining it for a year. The major recurring expenditure is the cost for hiring a line. We have highlighted this problem for the terrestrial national network, but when it comes to an international leased line, it becomes all the more acute.

2. This is a situation faced by all developing countries, but thanks to the PTC, the one for Pakistan is many times more serious. Not only does the PTC neglect data communications, its tariff rates also need to be rationalized, especially those for international leased lines. Typically, the total rent for leasing an international line -- 64000 bps is considered to be the minimum for data circuits these days and we take this as the standard -- in the developed world is about $100,000 per year. This itself is a huge sum for a country like Pakistan, or for that matter India, where similar rates apply. But in Pakistan, lines that PTC offer have a much lower bandwidth (we have discussed this in the previous section) at rates that are much higher. The cost for leasing such a line to US is around $150,000 per annum -- and that too only for the Pakistani end. Adding about $50,000 for the US end and the sum becomes twice that for a line that is about 6 times less in capacity. If we consider only the charges at the Pakistani end, they are about three times those in the West (and also a country like India) for an inferior line. So in effect, the line rates become 15-20 times more if we also consider the capacity. The effect of such exorbitant tariff rates on data communications is obvious -- it becomes an unthinkable option in the absence of some kind of aid or subsidy.

3. Though we have mentioned the leased line rates to US, the ones to various countries in Europe are in most cases even higher -- UK and Italy are exceptions, but here too, the difference in cost is only marginal. Leaving aside Iran (the rates to which are the minimum), Bangladesh and Turkey, the costs go down only about 20-30% for even the countries in Asia (the rates to some of which are even higher than to Europe and US). If tariff rates continue at present levels, a lease line to Iran would be worth exploring. Iran has a BITNET connection and with speedy improvement in their data communications infrastructure they are likely to be connected with the other international networks faster than Pakistan is. See Appendix 8 for the monthly rental for international leased lines to various countries.

4. We would like the BERDNET to have a leased line connection to the UUNET node in the US. Not only is this node the most connected on the planet providing gateways to all the different international network of computers, the UUNET provides very reliable services at extremely low rates being a non-commercial organization. The rates for a dial-up UUCP connection and full TCP/IP connection are $432 and $6000 per annum respectively.

5. India's ERNET which we have mentioned earlier was set up with UNDP's help as an experimental networking project interconnecting computing resources at leading academic and research institutions in the country. The model which they adopted was of academic and research networks such as ARPANET, CSNET, CYCLADES, DFN, JANET etc. established in the developed countries. The inland component of the network is on satellite, and beginning with a dial-up UUCP connection to the UUNET, it now has a full international leased line connectivity on a 64000 bps line running the TCP/IP (Internet) protocols. The UNDP allocated $6 million for ERNET under Country Programme-III spread over a four year period, starting 1986. The Indian government has also been a major supporter. The charges for the US end of the line, about

$50,000 per annum, are still borne by the UNDP. We would like BERDNET to have a similar support.

6. We also looked at the option of connecting BERDNET to either Iran or Turkey to save on the cost of the international leased line. Iran has a BITNET node which does not support Internet protocols, and whereas Turkey has full Internet connectivity on a 64000 bps line from METU, Ankara, they may be reluctant to carry non-academic traffic -- we have however not explored this possibility in detail. The option for connecting with India, say with the ERNET, cannot be exercised for political reasons. Besides, the rates to India are not very favourable, and again the question of non-academic traffic would arise.

7. Here we would like to mention an intriguing possibility. Since places like Hongkong and Thailand figure prominently on ASIASAT's southern footprint and they have full Internet connectivity on high bandwidths, we could beam our international traffic to one of these places for onward delivery on the Internet. If this comes about, there is a chance that we save a substantial amount, or at least get a higher bandwidth for our international traffic, which we can't conceivably get from the PTC's leased lines.

APPENDIX 11

EXPECTED USERS OF BERDNET IN THE PILOT PHASE

ISLAMABAD
- Ministry of Population
- Ministry of Planning and Development, Environment Section
- Ministry of Environment and Urban Affairs Division
- Federal Bureau of Statistics
- National Conservation Strategy (NCS Unit)
- Federal Environment Protection Agency
- Export Promotion Bureau (EPB)
- National Documentation and Library Information Network (NADLIN)
- Pakistan Institute of Development in Economics (PIDE)
- Pakistan Science and Technology Information Centre (PASTIC)
- National Center for Technology Transfer (NCTT)
- National Institute of Population Studies (NIPS)
- National Energy Conservation Center (ENERCON)
- Pakistan Agricultural Research Council (PARC)
- Pakistan Council for Research in Water Resources (PCRWR)
- Federation of Pakistan Chambers of Commerce and Industry (FPCCI)
- Quaid-e-Azam University
- University Grants Commission
- Capital Development Authority (CDA)
- Sustainable Development Policy Institute (SDPI)
- Trust for Volunteer Organisations (TVO)
- Asian Development Bank (ADB)
- Swiss Development Corporation (SDC)
- Netherlands Embassy
- NORAD - Dutch
- CIDA - Project Support Office and Small Projects Office
- UNICEF
- UNDP
- United Nations Industrial Development Organization (UNIDO)
- Food and Agricultural Organization (FAO)
- International Labour Organization (ILO)
- International Union for Conservation of Nature (IUCN)

LAHORE
- Lahore Chambers of Commerce and Industry (LCCI)
- Lahore University of Management Sciences (LUMS)
- University of Engineering and Technology (UET)
- Punjab University
- Environment Protection Agency Punjab
- Planning and Development Board Punjab
- Shirkatgah
- Water and Power Development Authority (WAPDA)
- World Wide Fund for Nature (WWF)
- Abacus (Pvt) Ltd

KARACHI
- National Institute of Oceanography
- NED Engineering University

- HEJ Institute
- Environmental Protection Agency Sindh
- Planning and Development Department Sindh
- Karachi Chambers of Commerce and Industry (KCCI)
- Overseas Chamber of Commerce
- Journalist Resource Center/IUCN
- Urban Resource Center
- SCOPE

PESHAWAR
- Sarhad Provincial Conservation Strategy
- Forest Institute Peshawar
- Environment Protection Agency NWFP

FAISALABAD
- Agricultural University
- Forest and Wildlife Research Institute
- Agriculture Research Institute
- Faisalabad Chambers of Commerce and Industry

APPENDIX 13

COLLABORATION WITH THE MINISTRY OF THE ENVIRONMENT & URBAN AFFAIRS

The Ministry has recently been allocated about $ 100,000 for the setting up of a computer data centre. This allocation for the a 15-month period will cover the purchase of some hardware, personnel cost and the setting up of a database in the field of housing and human settlements. During the second phase a database on the environment will be started. It is planned that during the third phase this centre will be linked with national, regional and global networks.

The data in printed form available in the Ministry will first be entered into the database. After entry in an appropriate manner, and followed by careful analysis, urban planners will be in a better position to retain or reject the existing data. There is concern that much of this data is unreliable. The rejected data will necessitate the gathering of new, more reliable data. Most importantly, there is the need for institutionalizing the process of data-gathering, analysis, sharing of data, planning and monitoring of projects and plans.

Recently the SDN was contacted to advise on the hardware requirements of this projects. Several suggestions were made for the efficient utilization of funds. In addition, a plan for the proper training of the senior staff was strongly recommended. The tendency of such high-ranking officers keeping away from computers and relying on more enthusiastic but poorly trained junior staff has generally mired computerization in our organizations. We have also suggested that networking with BERDNET and hence with Internet should not wait till the third phase; also entry of environmental data should be started concurrently with housing and human-settlement data.

Proper training and access to studies from other countries that have set up such units will be useful for this centre. SDN, for example knows of the extensive experience of International Development and Research Centre, Ottawa, in this area, and it is expected that we could help create useful linkages between it and the data centre. As plans for the centre evolve, SDN will be able to better assess its role in helping it. Budgeting for the SDN's services cannot be estimated presently.

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Without the help of these friends and many others we would not have achieved the little bit that we have. Thanks a lot.

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