

55917



Distr.: LIMITED

E/ECA/PSD.8/25
24 November 1993

Original: ENGLISH

**UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL**

ECONOMIC COMMISSION FOR AFRICA

**Eighth Session of Joint Conference
of African Planners, Statisticians,
Demographers and Information Scientists**

Addis Ababa, 21-26 March 1994

**Computer mediated Communications and
the need for Infrastructure building in Africa**

Introduction

1. Ever since computers have been used as tools for processing information, their application has expanded to cover all areas of information management. Computers have been used for collection, processing, and dissemination of information at different levels. Computer networks grew from ordinary magnetic tape exchanges to worldwide sophisticated high speed networks disseminating millions of documents every second. Since modern society is an information driven society electronic networks have changed the behavior of the world. However in Africa the use of this technology is limited largely to research and few users in academic institutions and NGOs. Electronic communication is becoming a key tool for development of Africa by alleviating the communication and information barrier and reaching the "last mile". In order to use computer communications effectively, computing skills need be developed, information should be available to users quantitatively and qualitatively and telecommunications infrastructure should be developed. The development of these supportive infrastructures for networking is one of the tasks facing African planners. This paper describes some of these elements and the activities undertaken by the Pan African Development Information System in building capacity of Member States in the area of electronic communications.

- Need for communication and networking

2. Africa needs regional integration and networking. It is only through multi-national efforts that the continent copes with its current crises. Against such crises there is need for coordination, communication and exchange of information between African countries to explore the sources of the obstacles to their development, detect signs of future crisis and investigate and pose optimum solutions. **Communication networks will act as invaluable tools for such regional cooperation.**
3. Mankind is expressing a dramatic change in its attitude towards globality. Nations are realizing common problems of mankind. Africa is an integral part of this global environment. There is a need for increased agricultural production and environmental preservation to sustain its culture and social organization. Common markets, free trade area and harmonization of policies are also some areas of cooperation. Structural transformation, including a diversified trade pattern, can only be achieved quickly and efficiently within the framework of a regional strategy for development. Regional cooperation is also essential to build African capacities in research, training and innovation. Information and networks are basic tools for increased efficiency in this context.
4. Cooperation in such areas as regional food security through computer links for early warning systems for food production shortfalls, control of locusts, etc. are a few areas amenable to regional information exchange. The transborder data flow which currently

follows the route of trade linked to Europe and other continents could also be turned to flow in Africa. Through a gradual selective effort African trade could form a regional network which could reduce the severe long term indebtedness of the region.

5. Advances in information technology have also resulted in major impact in structural change of modern economy. Recent advances in electronics, data transmission and processing and related technologies have affected all branches of production. Information and telecommunication industries have converged, as each of them are increasingly dependent on the techniques and services offered by the other. The gap between developing and developed world has widened more by impact of this advanced technology than by any other factors put together.
6. The most significant effects of networks are seen in the achievements of persons for whom computers are tools for other objectives. They have not only changed the way problems are attacked but have also stimulated important activities and research in other fields, research which would not have been undertaken otherwise. One of the amazing effects of networks are the networks themselves. The matrix formed by the global network is one of the most spectacular universal connections ever known to mankind.
7. Researchers, policy makers and planners have realized the importance of information and are coming under constant pressure to provide quality products and services within shorter time-frames. Manual methods that have been used traditionally to collect, classify, cross-reference, package and disseminate information are becoming inefficient and inadequate. It has become necessary for professionals in these areas to start develop strategic plans for the acquisition and utilization of information technology to help cope with the demands for their products and services. They are forced to network not only to solve common development problems but also to interact among themselves on the implementation of the technology.
8. There is a wealth of information available in widely scattered formats for development planners and their implementing agencies to draw on when carrying out their work. Various statistical data, for example, are available in reports issued by central statistical offices of each country in Africa. A wealth of information is documented in various, sub-regional, regional and non governmental organizations (NGOs) dealing with the African socio-economic problems. Another portion of this data is also gathered in World Country Survey institutions, academic institutions and media. Socio-economic data and information is available in numerous reports that result from research carried out by the governments, individuals and consultants, etc. The pooling of these information resources to generate an aggregate regional data base which could be transferred to African countries and disseminated to regional bodies is a task which requires understanding. The advantage to be gained by merging information and data is enormous. The major benefits include sharing of experiences of other countries, avoid purchasing costly information and know how, assistance to the evolution of regional integration process and

promotion of the integration process through the delivery of information to foster co-operative agreement at all levels and strengthen horizontal co-operative networks.

9. The African region is greatly behind other regions of the world in use of data communications technologies. Even though Africa has now clearly acknowledged the need for improved information delivery techniques, there is both infrastructural and technical backwardness which prevents the use of data communication technology. The major infrastructural problem is the poor state of telecommunications services. As characterized by the UNECA *Economic Report*:

The world of today is an increasingly information-driven world where the ability to access and exchange information world-wide has become a key to competitiveness. However, none of the equipment involved with the new technologies of informatics can be used if the basic telecommunication networks are not, as it is in Africa today, in place. While at least 80 percent of the basic PANAFTEL¹ network has been installed, less than 50% is said to be in satisfactory operation. Data communication facilities and, of course, fax facilities have been introduced. However, these facilities are not available in majority of African countries and where they exist, are not easily available to the business community. There is also the fact that in many countries the telephones simply do not function due to poor maintenance and bad or obsolete equipment.²

10. While the use of electronic networks to access computer data bases and to exchange information are everyday matters in many parts of the world, these techniques are virtually unknown in Africa. Development professionals and researchers face severe difficulties in communicating among themselves and with their colleagues outside the region. This has obvious implications for the quality of their work, done in isolation from rapidly changing developments elsewhere. The demand is great in the region for improvements in computer mediated communications and networking capabilities.

- Computer mediated communications

11. Data communications technology is one of the most efficient methods of delivering large amounts of information anywhere worldwide in the shortest possible time. Data

¹ PANAFTEL is a Pan African Telecommunication Network Project for rehabilitating and modernizing African telecommunications infrastructure.

² UNECA, Economic Report on Africa 1990. Addis Ababa. E/ECA/CM.16/3, p. 18.

communication allows users at two remote ends to be connected through computers via telecommunication networks to share resource and exchange messages. The sharing of resources, either computing or information, is known as resource sharing. The ability to exchange messages using computers via telecommunications networks is called computer mediated communication (cmc).

12. Both resource sharing and computer mediated communications can be interactive (on-line) /where users at both ends should be available as with telephone calls/ or batch (off-line) /where users are not necessarily available at both ends/.
13. Computer mediated communication allow people to use computers as a medium to communicate with each other. They can send messages to each another (e-mail); they can also send messages to a distribution list. Many people can look at one computer for information (bulletin board system), or many users can communicate on subjects of special interest by sending messages through a moderator (electronic conferencing). Computer mediated communications can also be carried out in batch mode or interactively. Interactive computer mediated communication (e-mail, BBS, electronic conferencing) are not generally popular since they require users at both ends to be present.
14. Computer mediated communications in the developed world are able to use several transmission techniques and media. Currently available transmission media include:
 - radio waves for wireless data transmission;
 - international packet switching service for packet data transmission;
 - satellite links to transmit large amounts of information between remote sites;
 - high speed leased lines, especially between larger worldwide networks and research computers;
 - fiber optics and other technologies to improve transmission bandwidth;
 - dialup lines between global low cost networks.
15. However, not many of these transmission media are used in Africa because of various difficulties. The following are the major problems:
 - using radio frequencies are difficult due to political and policy difficulties such as obtaining operating licenses.
 - most African countries do not have International Packet Switching Services

(IPSSs). Where they are available they are usually considerably more expensive than in industrialized countries. In addition African telecommunications authorities may have an IPSS that connects only to certain countries and not to others.

- technologies such as direct satellite links often cost much more than countries can pay.
 - other technologies such as fiber optics and high bandwidth transmission media are non-existent in the region or cost ineffective.
 - some of the communications options in developed countries are not available in Africa.
16. Despite its problems, dialup technology has the advantage of being the most obvious transmission media for the African setting. The major reasons include:
- telephony is widely available in most African countries as compared to other media;
 - there are international efforts to improve African telecommunication infrastructure by projects such as the second United Nation Transport and Communications Decade (UNTACDA II) and PANAFTTEL;
 - experience with low cost electronic communications projects indicate that there is great potential for using telecommunications technology for electronic networking with the improvement of hardware, such as high level error correction techniques and highly efficient protocols;
 - with the democratization process and structural adjustment efforts in Africa tariff structure revisions may bring considerable cuts in data communications costs.
17. Using dial-up technology a number of projects, including PADIS, have experimented with the feasibility of electronic networking in Africa. Under these projects low cost electronic communication networks proved to be appropriate tools for development and social change. Due to poor quality phone lines and the cost, long distance interactive calls to remote hosts based in developed countries prevented active participation and were beyond economic means of African countries. The proliferation of NGO networks using electronic mail and interactive data bases including conferences as important tool for exchange of information have resulted in the adoption of low cost networks in Africa.
18. Low cost global communication systems have become basic tools in the direction of network implementation in Africa. Network research projects funded by the International

Development Research Centre (IDRC) utilizing low cost technology have implemented Fido networks in the region. FidoNet uses automated computer software which simplifies communications and reduces on-line costs using a series of small store-and-forward hosts.

19. Fido can operate successfully despite poor telecommunications infrastructure. Surveys indicate that African countries generally operate with poor telecommunications infrastructure due to the low level of technology and maintenance, obsolete equipment and unskilled human resources and lack of efficient telecommunications management. Most countries have more reliable telecommunications links to Europe than with each other. Tariff structures are also not well established. Africa's vast territorial expanses, extending through many time zones also makes easy telecommunication difficult. FidoNet ameliorates such barriers through the use of automatic mailer software which takes advantage of existing international communications infrastructure. Automatic mailers offer capability to compress messages and provide error free transmission over long distances and allow users to route messages through optimally cost effective modes.
20. In addition Fido software offers all three functions of computer mediated communications simultaneously, using what are known as "front ends". Front end software is a program that answers the phone for BBS, e-mail and conferences (echomail). Through a set of internal protocols and calling program levels it switches between conference, BBS and e-mail software. Developed in the amateur and academic environment over the last 15 years, much of this software is in the public domain. Other front end software is free for non-commercial use or very inexpensive to purchase (\$10-\$100), running on any IBM compatible or Mackintosh. Currently there are over 21,000 such systems exchanging messages and files globally.
 - Need for infrastructure development
21. Low cost global communication systems not only introduced the possibility of inexpensive networking to the African community but also indicated steps to be followed based on existing infrastructure. Some observations can be made regarding the steps involved to proceed in networking:
 - in order to expand the user base low cost technology and networking through demonstration is essential.
 - full global connectivity is inevitable and will be the direction of the ultimate goal for African countries.
 - the building of local networks, national hosts and sub-regional backbones are no substitute for global connectivity in the region.

- the user base must be expanded dramatically before international global connectivity using high speed leased lines can be economically justified.
22. There is a general need for the development of supportive network infrastructure. The biggest challenge in infrastructure development is the ability to carry out training in software, including the installation of interactive bulletin board and mailer software and conference setup. Adequate training is also necessary in the installation of hardware such as in the configuration and testing of modems and setup of telecommunication lines which use a diversity of switching equipment. It was also noted that training in basic computing skills (hardware, operating systems, and software) was critical. The major components of infrastructure development are thus:
- development of training modules for on-going training and troubleshooting;
 - user development through continuous sensitizing, technical support and information provision,
 - cost savings through poll studies and cost cutting topology;
 - data bases, research and publications on infrastructure, needs, impact and services.
23. In addition to the need for software development and on-going training, other efforts are also needed in other areas. These include:

Co-operation with on-going networking efforts

24. There are numerous on-going specialized projects and efforts at networking African institutions. While such specialized projects are important, small and dispersed efforts will not be able to produce considerable results either in the short or the long term. Networking projects and efforts in Africa need to share resources. Sharing resources should not only be limited to human, material, resources but should also extend to techniques and strategies. The complex socio-economic nature of the region requires different networking solutions for different conditions. Academic and NGO networks and others should co-operate in order to produce results and establish sustainable networks in the region. Major potential co-operation activities for infrastructure development include:
- enhancing horizontal co-operation between institutions nationally and regionally,
 - establishing co-operation between different kinds of initiatives for networking in Africa,

- reinforcing and establishing vertical co-operation between networks in Africa and those in developed countries,
- investigating the available infrastructure and reachable international gateways to propose a working networking topology.
- liaising with worldwide networks to establish Internet connectivity in Africa.
- cooperative investigation of the most cost effective topology.

Poll studies and the evolution of suitable topology

25. A single gateway in London currently services most of the traffic to Africa. This gateway is overloaded and is not cost effective for most inter-African polling. Cost, assessment of user needs in electronic networking, study of the infrastructure and investigations in the areas of telecommunication and information policies can provide the basic inputs to propose topologies for different countries. A suitable gateway could evolve from:

- ongoing polling studies which investigate and document inter-African polling charges.
- study of line quality and throughput
- development of referral data bases on infrastructure and networks (network types, telecommunications data, human resources, etc.).

Improvement in the quality of information transmitted

26. Besides encouraging all types of electronic communications, access to international networks is important to improve the information content of the network. African institutions could benefit from links to non-commercial co-operative networks, such as APC and other academic and research networks. Through the APC network users can gain access to the community of 10,000 NGOs and individuals working in peace, social development and environmental issues. Connection to researchers on various university computer networks that form part of the Internet, JANET and BITNET networks worldwide and to Uninet operating in southern Africa, is also important.

Research and feed-back on users needs and policies and infrastructure

27. The value of making studies on policies, users needs and infrastructure is important to evaluate the success and failure of networks and to provide continuous feedback for improvement. Regular user studies are necessary to improve communication and information exchange, content of the network, its use and expansion. Regular evaluation

of the network, its products and information resources and its content and services should be undertaken to stay closer to the changing requirements of users and ensure sustainability of the networking in the region.

28. Over the last two years numerous forums have brought forward to the global community the need for development of networking infrastructure. Global workshops on networking stressed that scattered efforts and initiatives could not have great impact on overall African networking infrastructure. PADIS and IDRC collaborated to turn the infrastructure building concept into a project which resulted in a newly funded "Capacity and Infrastructure Building in electronic communications for Development of Africa (CIBECA)" project.

- Capacity and infrastructure building project

29. The Capacity and Infrastructure Building in Electronic Communications for Development of Africa project (CIBECA) arose from the cumulative experience of several research projects funded by IDRC and executed in Africa between 1989-1992 by institutions including PADIS. In addition to dealing with the above infrastructure building components CIBECA was developed to deal with problems in introducing and implementing electronic communication, thus providing equitable access to communication and information in the African region. These include working with unreliable telecommunications systems, low level of network usage, few users per country, high telecommunications costs and little knowledge of the potential of electronic communication.

The overall objective of CIBECA is to develop the supportive infrastructure necessary for sustainable computer-based networking in Africa, accessible at an affordable cost by researchers, planners, policy makers and all kinds of development and private institutions including non-governmental organizations(NGOs) and international organizations.

Its specific objectives are:

- ◆ to improve information and data exchange in Africa by establishing a working, efficient and reliable electronic network in contact with other local, regional and international networks;
- ◆ to train systems personnel throughout Africa in electronic networking;
- ◆ to develop a corps of skilled African system operators which can act as facilitator and technical support personnel for electronic communications in the region and assist users in the region through on-site training, troubleshooting and ongoing

technical support;

- ◆ to develop a sustainable network model for Africa with equitable national, regional and international access that will serve as an efficient channel for the dissemination, re-processing and transmission of information;
- ◆ to expand national, regional and international connectivity through co-operation with other networking projects and networks;
- ◆ to establish referral data bases on telecommunications and networking infrastructure and develop guides on data networks in the region and on telecommunications infrastructure for network users in Africa and elsewhere.

In order to build the capacity of member states in networking, CIBECA will undertake the following activities:

- Training and creation of awareness on network usage
 - national and institutional level training for users in electronic communications and potential of networks including network resources, usage and maintenance of institutional networks.
 - national level training for systems personnel who maintain day to day network operations at national and institutional level in low cost communication systems.
 - sub-regional and national level training for systems personnel in advanced techniques of network management, maintenance, troubleshooting and network design and implementation to assist their respective sub-region.
 - on-line assistance and troubleshooting at institutional, national and sub-regional level in order sustain network operations.
- User development and users' group formation
 - developing on a continuous basis, a network users base through training, meeting of users' needs and operating a sustainable network and reliable nodes,
 - assistance in the formation of institutional and national network users groups to promote national networks.
 - sensitizing managers and policy makers to the importance of network building.

- Provision of connectivity thus provision of continuous assistance for sustainable networking:
 - operation of a network which provides national level cross-links between researchers, planners and users of all types to exchange information locally.
 - operation of sub-regional links to promote regional integration, exchange data and information and effective communication through reliable connections;
 - operation of regional and international links for national nodes through cost effective gateways.
 - Creation of infrastructure data bases
 - creation and maintenance of on-line referral data bases on networking infrastructure (telecommunications, network contact points, initiatives, etc.) available at PADIS, regional and national level.
 - provision of guidelines on low cost networking, directories of telecommunications, (network contact points, network initiatives, etc.).
 - provision of database searches and question and answer service on networking infrastructure, services, contact points, etc.
30. The paper reviewed the state of networking in the region. Many countries in Africa are currently lack widespread access to electronic services. With the development of network supportive infrastructure it is believed that most countries will attain not only access to basic services but be able to move to high bandwidth links to international networks. The next stage of development of networks in the region should hence take a true internetworking approach and look at how people access network services. Sensitization of policy makers, planners and researchers to the technology is one of the areas of focus. In general development of network supportive infrastructure will be a substantial challenge in Africa over the next few years.