

**United Nations Economic Commission for Africa
Pan African Development Information System**

**PADIS/IDRC Project
Computer Networking in Africa
Project no. 89-0193**

Final Report

23 December 1992

Introduction

1. The project IDR/90/001 "Computer Networking in Africa" began in March 1989 to allow PADIS to co-ordinate a regional Africa investigative and experimental based networking effort to support the advancement of data communications information technology in Africa and to improve the flow of information for socio-economic development in Africa and the timely utilization of existing information systems. This report will present the project's activities as they relate to the achievement of objectives set out in the project document.

Improving the flow of information for socio-economic development in Africa Timely utilization of information systems through electronic linkages

2. At the beginning of the project some time was spent in ordering equipment, recruiting a project officer, and contacting selected institutions to secure their participation in the project. Following the receipt of equipment the initial project meeting convened in Addis Ababa (25 February - 1 March 1990) which highlighted to the participating institutions that, the project, beyond being investigative, was set up to improve the flow of information for socio-economic development in Africa and for the timely utilization of existing information systems through development of electronic linkages between them.

3. In response to this objective the initial meeting devised a mechanism for information exchange by dividing the region into various sub-regional groups based on geographical distribution and made plans for communications experiments. These groups were: the Addis Ababa group, the North Africa group, the Ghana group, the East and Southern Africa group and the West Africa group. Each proposed concrete projects involving experimental communication within the framework of the objectives of the project. The initial meeting also provided training in computer-mediated communications (cmc). The training covered topics such as modem settings, cabling, international access using Fido and other communications software.

4. All institutions participated in the workshop have succeeded in effecting computer-mediated communication to PADIS and to each other either through PADIS or other networks (see table p. 2). There are also other institutions which were not trained during the workshop which have been able to participate in the network.

5. Those institutions accessing PADIS through GreenNet in London are the African Regional Centre for Technology (Dakar); Kagera Basin Organization (Rwanda); The Council for the Development of Social Science Research in Africa (CODESRIA, Dakar); The Council for Scientific and Industrial Research (CSIR, GHASTINET, Accra); the Centre National de Documentation (CND, Rabat); the Association of African Universities (Accra); and the RECOSCIX-WIO project (Mombasa). Organizations which dial PADIS directly on their modems include the Environment Liaison Centre International (Nairobi); the International Livestock Centre for Africa (Addis Ababa); the National Scientific and Technological Documentation Centre (Addis Ababa); the Ethiopian Standards Authority (Addis Ababa); the School of Information Science in Africa (SISA, Addis Ababa); the Institute for Agricultural Research (IAR, Addis Ababa) the African Regional Organization for Standardization (Nairobi) and the Arab League Documentation Centre (ALDOC, Cairo). The Council for the

Development of Economic and Social Research in Africa is accessing PADIS through GEONet in London. The Eastern African Universities Research Project (ESAURP, Dar es Salaam) accesses PADIS through ELCI in Nairobi.

Institutional modes of access to PADIS	
Institution	Mechanism of link to PADISnet
ELCI	<i>FidoNet</i>
CODESRIA	GEONet
ARCT	GreenNet
GHAISTINET	GreenNet
AAU	GreenNet
RECOSCIX-WIO Project	GreenNet
IAR	Direct
ILCA	Direct
School of Information Studies in Africa	Direct
National Scientific and Technology Documentation Centre	Direct
Centre National de Documentation	Greennet
Arab League Documentation Centre	Direct (GreenNet)
Eastern and Southern African Universities Research Project (ESAURP)	ELCI (FidoNet)
Kagera Basin Organization	Direct
Ethiopian Standards Authority	Direct
African Regional Organization for Standardization (ARSO)	Direct

6. Most of these institutions are still at the beginning stage in the use of electronic mail while other institutions made a stride towards exchanging socio-economic information. There is still much to be done to improve the flow of information for socio-economic development in Africa and for the timely utilization of existing information systems. The major

impediment towards more information exchange that hindered the proliferation of networks for timely use of existing information systems are numerous. The major problems include:

- **lack of institutional support**

Most efforts at networking have not enjoyed management support. It was assumed that all institutions participating in the project possessed the necessary information and were ready to exchange it using networks. Such initial assumption was beset by the lack of commitment of management of certain institutions to use the electronic network for the exchange of socio-economic information. The major reasons for this include:

- most institutions and especially their management, are still unaware of the potential of electronic communications.
- most of the institutions were not able to use networks, due to lack of qualitative and quantitative information management systems.
- others lacked the necessary infrastructure to maintain and exchange data and information.

- **lack of appropriate skills**

Network building in any institution involves a number of skills including knowledge of communications, computer skills and basic skills in information management. It was observed that most institutions participating in the project lacked either one or all the three basic skills for network building. A few institutions which had computer skills lacked basic knowledge on information management and telecommunications. Such basic problems hindered not only the overall execution of the project, but also left some institutions frustrated.

- **incompatible systems and lack of advanced data transfer skills**

Non-standard and incompatible systems, hardware and software in the region coupled with total absence of skill in formatting data bases in standard transferable format has prevented the movement of data across institutions. Standard data bases formats such as ASCII and other ISO exchange formats exist for exchange of documents. It is also possible to write interface codes between different formats existing in Africa. There are also numerous shareware programs available for data base management software networking. There is still complete absence of knowledge in the region about possibilities of using these available tools, due to lack of knowledge of their availability and lack of appropriate skill in using them.

- **lack of information culture**

The absence of an information seeking culture in the region remains the major barrier towards the movement of data across the region, between institutions and users. The African information environment leaves much to be desired and should be the subject of further research. In a region where telephone calls are regarded as poor substitutes for in-person visits, both within and between institutions and countries, it may be difficult for the impersonal culture of e-mail, bulletin boards and teleconferencing to permeate. Cultural barriers of this type will continue to delay implementation of networks in the region specially in the area of substantive information exchange.

- **inability of the major data base software to support networking**

Most available data base software does not support networking. The need for a frontend between data bases and communication programs is still important. Software such as CDS/ISIS, DBASE, PARADOX used by most of the institutions is much more dependent on standalone systems than networked systems. Networking data bases built using this software requires programming skills to port data from one format to another. Even if the software supports Wide Area Networking, the efficiency of their protocols to deliver information over poor telecommunication line is still a problem. Such a major problem requires attention in order to move information across the region. Several solutions were proposed and used to deal with these issues, including:

- Using an interactive bulletin board programme on a PC to allow a remote user equipped with a computer and terminal emulator to log on and issue a command that calls up any type of data base programme residing on the host machine as if it were running on the remote user's PC.
- Using mailer software through file transfer or the attached file option in order to send data base search and hitfiles. Such type of access was successful during the execution of the project.
- Using the operation of a mail server data base system on the host. The server accepts Fido format messages to a 'virtual' user called 'Data base' - periodically the bulletin board system exits and runs a program which scans for messages addressed to 'Data base' and performs a keyword search on the data base file specified in the message. The keywords to search for are simply listed in the body of the message and the interface between Fido software and the data bases system creates a message containing the results of the search in the body of the message for pick up when the next user calls.

- Using direct online access to regional information systems such as PADIS, ALDOC, ILCA, etc.

7. The project employed all the above techniques to broaden the exchange of information between participants and PADIS. Most institutions were not able to use these techniques due to lack of training. Users in Addis Ababa were able to use the first and the second techniques and direct access to data bases due to their proximity to PADIS and low telecommunication costs which only involve local polling. In order to automate information exchange under the existing infrastructure the techniques enumerated above and specially mail server technique indicated above should be explored and used. Similar techniques proved effective in NGO networks worldwide co-ordinated by Interdoc (Antenna).

Promotion of exchange of information for development Improvement of information infrastructure in African member states

8. Despite the above enumerated problems, PADISnet made some headway towards promotion of exchange of information for development and the improvement of information infrastructure in African member states. Several Fido based nodes have been installed and polls made to prove the possibility and potential of networking in the region.

9. Institutions involved in the project and others participating in other projects were assigned Fido numbers, networks were setup and communication began between PADIS and others. At PADIS for other institutions and individuals who wanted to directly access PADIS from their microcomputers for e-mail, bulletin board or online searching, the public data access number was set up both for e-mail, online searches and BBS. One of the most areas of interest of users under the project the possibility for access to PADIS information using electronic networks.

Online access to data bases

10. Through the *PADISnet* project, PADIS set up public online access to the data bases maintained on its HP3000 mini-computer. PADIS system users with appropriate Hewlett Packard terminal emulation software (*Reflections* or *Advancelink*) can dial data access number +251 1 51 43 41 to access these data bases. A one day workshop for the Addis Ababa network participants was conducted in mid March 1992 at which a demonstration was made and training given to institutions. A copy of *Reflection* software was also distributed to potential institutions. Project participants were also given hands on training during the final workshop on how to access PADIS data bases. Most institutions requested data base formats, software and access accounts on HP3000.

11. Besides institutions participating in the project, PADIS received considerable outside interest from various institutions concerning online access to the data bases. The following lists some of the institutions which are interested in online access.

Organization of African Unity
International Energy Foundation

CICIBA

Economic Commission of the West African States

Preferential Trade Area Eastern and Southern Africa

CRIC/CEAO

Several European and Latin American commercial firms

12. Such interest in online access enabled PADIS to increase its commitment to provide access to its data bases and set up more new data bases depending on users' need. The project helped the creation and maintenance of a data base on telecommunications infrastructure in the region whose product is being published and widely disseminated.

13. Other data bases to be created and information requested include:

- data base on available networks and interconnection mechanisms (addressing format, logon procedures, etc.).
- data base of expertise in networking to promote technical co-operation among developing countries,
- data bases on various situations in Africa, policies, equipment, appropriate frequencies, etc. used for different situations in the region,
- troubleshooting information related to selected African situations including documentation of experience in every country in the region.

14. Data bases which are currently accessible online on the mini-computer system are: **PAD-DEV** (18,500 bibliographic references on socio-economic aspects of development in Africa); **POP-IN Africa** (1500 bibliographic references on population matters in Africa); **Industrial Development Abstracts** (bibliographic reference on industrial development, produced by the United Nations Industrial Development Organization); **LABORDOC** (bibliographic references on labor and related issues produced by the International Labor Office); **DEVSIS** (8,000 references on development, produced by the International Development Research Centre); **ILCADO** (8,000 references on livestock development and related fields, produced by the International Livestock Centre for Africa); **PADexp** (PADIS' referral data base of African experts); **PADpro** (PADIS' data base of research in progress in African countries); **PADinst** (PADIS' referral data base of research and development institutions in Africa); and **PADstat** (ECA Statistical data base of nearly 200,000 records).

15. A number of data bases acquired under the project in a CD-ROM format can be accessed online as well as offline. Currently the appropriate hardware for online search of CD-ROM data bases is not in place. CD-ROM data bases can be used for off-line search to be sent using electronic mail. The project, however, promoted the acquisition of several data bases in a CD-ROM format including:

- | | |
|------------------------|---|
| - Development Activity | Information on development activities |
| - DOCPAL | Latin American socio-economic development |

- LILACS	Latin American Literature on medical science
- CGIAR	Food and Agriculture
- CEPAL	Latin America, economic and planning
- Popline	Population, health care, social trends
- UNESCO	Multidisciplinary
- McGraw-Hill	Scientific and Technological terms
- Distance Education	Distance learning
- SESAME	Food and Agriculture

Utilization of information technology for data communications

16. The project made significant progress towards the appropriate utilization of data communications information technologies in Africa in e-mail, bulletin board systems and computer conferencing.

E-Mail

17. The project developed an electronic mail service. More than 5200 messages were exchanged via PADIS during the project. The number of local users of the e-mail system grew considerably over the last three months of the project. Currently there are more than thirty users of the e-mail system in Addis Ababa. PADIS is still encouraging more users, particularly from academic institutions where interest seems the highest. There were three categories of users.

- Institutions involved in the project
- Individual users
- Institutions which were not involved in the project

18. More than 70 percent of the mail exchanged was between PADIS and institutions involved in the project and between PADIS and other institutions. Twenty percent of the mail was from individual users who requested information from PADIS and wanted to use the network. The existence of a Fido node at PADIS stimulated numerous and varied international users to exchange messages with PADIS and UNECA. The project raised strong interest within the United Nations community and other users which wanted to set up their nodes. Presently, there are more than 40 users of the node.

19. The project co-ordinated three training workshops beginning December 1992 to 25 staff of the ECA. One of the training was to introduce Chiefs of Divisions and Programme managers at ECA on types of connectivity available and over all aspects of electronic communications. The two other training workshops were for ECA potential users of electronic communications on which hands on training provided to participants on the use of hardware and software. Participants request an immediate installation of modems to begin exchange of information. ECA Lusaka MULPOC office was connected to Zangonet in Zambia and started to exchange message to its parent office in Addis Ababa.

Local BBS

20. A local BBS was set up to share information, exchange electronic messages between institutions and request PADIS products. Some of the institutions were using the BBS to request PADIS data bases searches. The BBS currently links both local users in Addis Ababa and external users. It offers an additional e-mail option of posting local messages. In addition it is designed to alert network users to some current issues in information technology. It was organized around four items:

- PADIS news*: developments at PADIS, its activities, programs, plans and products, including the full text of the quarterly PADIS newsletter.

- ECA news*: current developments at the Economic Commission for Africa, including socio-economic reports, surveys, and outcome of meetings.

- Data communications issues*: problems and solutions in data communications in Africa. This discusses problems and prospects and provides answers to network questions which arose during the implementation of the project.

- General news on information systems and technology*: selected issues on developments in information science, documentation, computer software and hardware, etc.

21. The BBS to date has received more than 1200 messages. There are more than fifty regular users including a few external users to the project. It is one of the intensively used services by local users since it provides a 24 hour option for posting messages between local users. The BBS has proved to be one of the best methods of improving local connectivity. The number of users is growing every week. Users prefer the use of BBS over the FidoNet network due to its ease of connection with available software. The BBS also encouraged users to post their files, texts and relevant messages to users in Addis Ababa. A public BBS area was also opened for the general public to post information for other users. One use of the local BBS was the posting of the United Nations Report from the Emergency Prevention and Preparedness Group (UNEPPG) monthly report on emergency situations. This enabled users to obtain substantive information locally and use the BBS enthusiastically.

Some of the lessons gained from the use of the BBS were:

- users of electronic networks should start with simple easy to use systems,
- for the network to persist there is a great need for some central interest stimulating issues of the network.
- diligent support by system operators will help users to use the network.
- system operators knowledge to be able to troubleshoot different hardware and software problems would also help frustrated users use networks effectively.

Computer conferencing

22. As a *FidoNet* node in Africa, the project actively participated in several *FidoNet* online conferences. Among these was the consultation conference of experts in Africa region (Zone 5) known as EXPZONE5 which enables all *FidoNet* participants in the region to share knowledge and discuss various communication problems, such as technical specifications of modems; software configuration; social and legal issues of networks, etc. PADIS found this conference participation tremendously useful, particularly in solving technical problems, such as with the installation of a Trailblazer T2500 modem. (PADIS also receives messages both from network nodes and external users through *FidoNet*.) PADISnet has received more than 150 postings from this conference.

23. PADISnet is also participating in the Global NGOnet electronic conference which discuss overall issues in global networking. PADIS has received more than 120 postings from this conference. Recently the project has participated in an end user software/documentation conference. The software/user documentation project conference is an on-going conference to discuss the development of new software that suit African setting.

Improving Linkages among Researchers

24. The other activity of the project was improving linkages among researchers in Africa, as well as elsewhere, working on development issues and promotion of information exchange between and among participants as well as with those outside of project and to provide information for the region on the utilization of information technologies and on development in general, with PADIS serving as an information intermediary; and improving collaboration with other networks.

Collaboration with other networking projects

25. The *PADISnet* project collaborated with other similar network projects in Africa in order to share experiences and knowledge, the results of which could be used to improve electronic communications and computer networks in the region, and to share resources in order to maximize project investment. Such collaboration with other networks proved that one of the requirements for success of a networking effort was the networking of ideas, users, skill, and resources.

The NGOnet project collaborated in providing training to some PADIS nodes. Collaboration between ESAnet and PADISnet was also been discussed during a meeting held in Addis Ababa between the ESAnet project co-ordinator and PADISnet project officer. PADISnet has collaborated with ARSONet to provide ARSO network users training and support. Future collaboration has been considered with RINAF to mount joint training courses and jointly produce a directory of trainers in 1993.

26. The Ethiopian Scientific and Engineering Society in Washington initiated a USENET link to universities and academic institution in Ethiopia. An AT&T Unix lab was secured and

plans and network architecture for connecting universities is under design. PADISnet is extensively involved in providing data, advising and liaising at local level for the society. As soon as detailed design is completed the connection is expected to begin operating. Apart from the interest from the Ethiopian Scientific and Engineering Society in America much interest has been received from academics in Africa to link up electronically with their counterparts elsewhere.

Training data communications facilitators

27. Several training workshops were conducted to train data communications facilitator in all participating nodes, who then were to train others in order to enhance local/national capabilities. The major training workshop conducted under the project were:

- The initial workshop held (25 February - 1 March 1991) at which hands-on training, including making cables (with RJ11 connectors frequently used on American-manufactured modems), installing both internal and external modems and using communication packages such as *ProComm*, *MTE* and *FrontDoor* was provided. It was attended by project participants as well as representatives of IDRC and the American Association for the Advancement of Science.
- A consultation workshop coordinated by PADISnet and NGO net on electronic communication in Dakar (5-9 August 1991) at which training was given to PADISnet nodes in Dakar.
- A training workshop to North African PADISnet node (15- 19 February 1992) at ALDOC on which training provided to ALDOC and Arab League participants on electronic communication.
- A network demonstration given at ILCA (25 March 1992) in Addis Ababa on overview of networking and the status of networking in Africa.
- Training and advisory mission to ARSO (28 March - 3 April 1992), at which two papers were presented on computers and data communications and training provided to ARSO DISNET network participants.
- Mission to ESAURP and KBO (4-15 July 1992) to install communications software and provide training.
- Installation at IAR in Addis Ababa (23 August 1992) of a modem and communication software.
- Final project evaluation workshop held 1-3 September 1992 in Addis Ababa at which training sessions, including hands on training on FDM.BAT, attached files and incorporated files, online access to PADIS (at which PADIS provided an online access demonstration to its data bases using Reflection software and advanced training on e-mail including sending documents using e-mail file transfer) were given.

Expansion of the PADIS network

28. The project has also endeavored to expand the PADIS network and improve utilization of the PADIS information system and other cooperating information systems and networks in Africa. It participated in several worldwide events and workshops conducted globally. These include:

- Africa Telecom'90 held in Harare, 3-9 December 1990.
- Workshop on the use of micro-computer for handling information held 28 October-1 November 1991, organized by ARCT at which PADIS presented a paper entitled "Computer mediated Communications: What potential roles for Africa?"
- A global electronic networking workshop held in Toronto 1-13 February 1992 at which the project presented a paper entitled "The impact of telecommunication policies on the emerging data communication networks in Africa",
- Internetworking Conference in held in Kobe, Japan, 12-18 June 1992.
- AAAS/AAS meeting held in Nairobi 27-29 August 1992 at which the project presented a paper regarding PADISnet and its future options entitled " PADISnet and the Future Potential of Networking in Africa".

29. These events enabled PADIS to expand its network through contacts and dissemination of information. The project paved ways for further use of PADIS and other co-operative information systems through existing networks by other means as well. The network also improved awareness in Africa of the existence of co-operative information systems.

Investigation of alternative technologies

30. One of the project activities was to experiment with and document different techniques and technologies for data communication in Africa. In this regard several steps were made towards information exchange using alternative technologies. One of the activities in this regard was the documentation of overall experience and problems encountered including investigation of alternative technologies.

31. Regarding telecommunication technologies use the project investigated several link methods to link PADISnet to worldwide networks, viz.:

- Long distance access to BITNET
- BITNET access using a dedicated line
- Dial-up Fido access through GreenNet
- Fido access using dial-up (inter-African)

- Unix-Fido gateway using dedicated line

32. Long distance dialing in Africa is fraught with problems caused by unreliable telecommunications infrastructure. Unreliable telecommunications infrastructure add up to increased communications costs due to line and carrier loss and continuous retries between two modems located at remote sites. One can not only encounter carrier loss but also both modems usually negotiate at low speed and transmit at a very low cps which again adds up to transmission time and costs. In addition there is no tariff structure in Africa which conforms to transmission trials. The trial time is usually considered as connect time in the tariff structure and a minute connection can be considered as up to 3 minute regular connection. A user trial for 0.5 minute can be registered as a 3 minute long distance call as a minimum charge. Such a tariff structure in Africa not only makes it difficult to set up data communication networks but is also costly and frustrating. It is one of the major stumbling blocks for network set up between African networkers and others worldwide. It renders long distance dialing to access international networks inappropriate and impractical for networks in Africa.

33. Access to international network using dedicated lines is one of the practices of store and forward networks worldwide. The major difficulties in Africa in using dedicated line include:

- initial cost of a dedicated line
- limited circuit bandwidth
- huge operating costs

34. The project, however, succeeded in effecting access to BITNET using the United Nations Alternate Voice and Data (AVD) line existing at UNECA. Such access, however, was limited to a piggy back connection to Carleton University in Ottawa. Several difficulties with such access included:

- inability of targeted users from academic institutions in Africa to use available software such as Procomm to access information
- long distance dialing was required from African countries to PADIS in order to pass messages to Carleton which in effect cost more than direct dialing to an European host.
- users and the academic community in Africa were not at a level to use the sophisticated BITNET host, and there was a general lack of understanding of the potential for networks,
- due to high UN voice, fax and telex traffic and other administrative problems the project was unable to provide effective service using BITNET access through the Carleton host.

- given the bandwidth of the line and the speed being limited to 2400 bps, it was generally impractical to effect BITNET and Internet connections. Most connections were at 300 bps.

35. One of the lessons in this regard is that Africa is still far away from a high speed dedicated line connection to Internet. The telecommunication infrastructure is not only unreliable, but also operates with limited bandwidth. Improvement of telecommunication infrastructure in the region will be essential to enable networks to sustain increasing users demand in the future.

36. Use of the Fido mail system through GreenNet was one of the success technological breakthroughs for most African nodes and project participants. The following reasons accounted for the success:

- there was extremely high support by GreenNet system operators to African users both in replying to specific problems and providing training either offline and online.
- telecommunications infrastructure to London was much more reliable than inter-African and intra-African connection through South African gateway, which is also a Fido zonegate for Africa. (Recently connection to South Africa improved after installation of the Telebit Trailblazer; PADIS was then able to connect at 1000 cps).
- the GreenNet gateway was able to deliver reliably Internet and Fido mail.
- users were able to obtain Internet and RFC addresses on GreenNet in the format user@host such as (user@padis.gn.apc.org).
- since GreenNet is part of the Global NGO Network under the Association for Progressive Communications (APC) it was easy for the NGO community in Africa to get cheaper links to NGOs worldwide and other institutions which are involved in global development issues. Such possibility created communities of interests to be linked through promotion of networks in the region.

37. Fido-to-Fido links in Africa are not used as much as connection through GreenNet. The major problems include poor line quality, lack of high speed error correcting modems and insufficient training by system operators within Africa. Lack of motivation and support was also another problem. There were no poll studies to facilitate the best topology for Africa. Undertaking polling studies is one of the major requisites to improving inter-African communication.

38. After discussion between GreenNet and the project to cut overall telecommunications costs the project was able to use several other cost reduction measures. It was suggested that the project set up a Fido-Unix gateway software and poll the Institute for Global Communications (IGC) located in San Francisco in California USA. Technical work for running the gateway software was completed using the UN Alternate Voice and Data line. The gateway was operating on an experimental basis for two months under which all

technical problems such as software bugs were being worked out through contact with IGC. Software problems have now been solved, and the gateway is ready to operate on regular basis. The gateway is able to cut the project telephone charges to a negligible cost. ECA has authorized a daily window for the use of the line. The gateway will be able to serve Southern African users.

Document delivery technologies

39. It is acknowledged fact that users in Africa are not at the same level of technological skill to experiment with data communications as users in developed countries. There are also variations in user needs. In order to adapt this reality more rapid transmission of documents through the use of facsimile, scanning and CD-ROM was investigated. The following activities were undertaken after the meeting.

- collection of free data bases on CD-ROM. More than ten CD-ROM data bases were collected and added to the PADIS complementary file.
- investigation on pre-mastering of PADIS data bases was undertaken in collaboration with the International Livestock Center for Africa (ILCA). Currently this collaborative effort has been extended to include the Egyptian Scientific and Technological Network (ENSTINET).
- distribution of free CD-ROM materials to nodes.

40. The result of activities in document delivery technologies indicate that the use of CD-ROM technology for document delivery in Africa should be evaluated from several points of views. For those users in scientific community who are eager to receive data bases containing huge amount of information, cut down storage space and search time, CD-ROM is enthusiastically awaited. However the quality of information for development available to meet immediate need of researchers in Africa is still in question, as most CD-ROM products have not yet paid attention towards the useful information for development and improvement of African life. On the other hand CD-ROM faces the same cultural problems as that of libraries since it mainly meant for libraries and libraries themselves are used to a very minimal extent in the region. Lack of hardcopies at users' disposal after searching CD-ROM data bases also hinders the usefulness of the technology. There is a great need for text-based data bases, including graphics, maps and charts and the immediate availability of full texts for bibliographic searches. Numerical (factual) CD-ROM data bases will be in the forefront of needs for African planners and decision makers.

41. The instability of the technology, its lack of immediacy, and the amount of labor and precision involved in text digitizing projects makes CD-ROM technology lag behind electronic networks in users interest. However, there is great enthusiasm in Africa to obtain CD-ROM data bases on African development. Such endeavor was proved to involve major costs. The advent of new inexpensive personal mastering workstations indicates that cost of CD-ROM may be justified at least for mastering instead of given the activities for pre-mastering do not take much effort. CD-ROM mastering in Africa requires not only high

skills but also patience and continuous efforts to collect, process and prepare scattered and un-harmonized data bases for pre-mastering. One of the major issue in this regard was the usefulness/noise (quality) ratio of the available data bases. Most data bases are outdated and lack timeliness.

Project publications

42. In order to disseminate information on network technologies a column was added, on information technology in general and on the project specifically, to the PADIS quarterly Newsletter issued in English and French. The newsletter is online in the PADIS system and available to participants by traditional means as well. Improvements have been made in the newsletter mailing list to include those interested in data communication for socio-economic development. In collaboration with the RECOSCIX-WIO project the project has also published an article entitled "PADIS Electronic Network" in the WINDOW newsletter.

43. The following articles were published on the information technology section of PADIS newsletter since the beginning of the project.

Vol 5. No 3. Project Mission to BITNET.

Vol 5. No 4. Africa Telecom 90 and the Prospect for Information Networks.

Vol 6. No 1. PADIS Establishes Electronic Node.

Vol 6. No 2. How PADIS Electronic Network Works.

Vol 6. No 3. Electronic Communications Network and Fido Software.

Vol 6. No 4. Data Communications Peripherals.

Vol 7. No 1. FidoNet technology and uses.

Vol 7. No 2. Potentials for networking in Africa.

Vol 7. No 3. Project activities (mission).

Vol 7. No 4. Growth in PADISnet.

44. One major impact of the newsletter was to stimulate interest in networking by African institutions and others worldwide. A large number of requests have been made to PADIS for workshop documents and project reports after being publicized in the newsletter. The project produced a number of document which were widely disseminated and are continuously being requested from African countries and worldwide. The request statistics shows that more than 130 institutions and individuals have enquired to date for project documents.

Documents produced under the project	
Progress made in the implementation of the project "Computer Networking in Africa"	ECA/PADISNET/91/2
Suggestions for project design	ECA/PADISNET/91/3
Introduction to Wide Area Networks	Paper presented at ARSO workshop
Introduction to Computers	Paper presented at ARSO workshop
Impact of Telecommunication Policies in Africa on emerging Networks	Paper presented at Global Networking workshop in Toronto
Data Transmission across lines of Inconsistent Quality	Paper for Global Energy Information Conference in Libya
Mission Report on Global Networking Conference	Toronto 1-13 February 1992.
Mission Report of Training Workshop at ALDOC	Cairo, 15-18 February 1992
Mission Report of Training Workshop at KBO and ESAURP	4-14 July 1992
PADIS Information resources	ECA/PADISNET/91/4
An Introduction to Data Communications	ECA/PADISNET/91/5
Introduction to BITNET	ECA/PADISNET/91/6
Compact Disk - Read only memory (CD-ROM)	ECA/PADISNET/91/7
Social, legal and cultural issues in data communications networks.	ECA/PADISNET/91/8
A Glossary of Computer Terms	ECA/PADISNET/91/Inf.7
Data Communications: User's Guide (in three parts)	ECA/PADISNET/91/Inf.9
Project Report	ECA/PADISNET/92/01
Introduction to Network Addressing	ECA/PADISNET/92/02
Document Delivery Technologies	ECA/PADISNET/92/03
Online access to PADIS	ECA/PADISNET/92/04
Mission Report of INET'92	Kobe, Japan, June 1992
CMC: Potentials for Africa	Paper presented at ARCT workshop in Nairobi
PADISnet: and potential for Networking in Africa	Paper presented at AAAS/AAS workshop in Nairobi
Introduction to Standardization for Network Development	Paper presented at fifth meeting of the Standing Committee for Standardization and Harmonization of Information

45. Apart from day to day operations of the project advisory services and training on electronic networking were given to a number of PADIS users including participants

attending numerous PADIS and ECA meetings and to a number of institutions and individuals who would like to set up data communication networks.

Evaluating operational, fiscal and social aspects of electronic data communication

46. Another objective of the project was to evaluate the operational, fiscal and social aspects of the project in order to gain knowledge to be shared in the region and elsewhere in the world. It was found that the major operational and social aspects of the projects were related to the socio-economic situation of the continent. The project encountered several problems. The linkage of some of the institutions has been fraught by difficulties. Among the problems encountered to date have been:

- **lack of skilled personnel to install and configure data communication equipment and software.** The inability to set up communication software and equipment such as modems has been the major reason for nodes failing to communicate. This problem is by no means limited to Africa - the lack of telecommunications standards means that the biggest hurdle new modem users must face is divining the "initialization string" required to get the modem to work with a particular communications software programme. Regrettably there seems to be little progress in the area of standardization. Technical know how of new users is also frequently limited in such areas as cabling and installing jacks. There is a need for transfer of advanced technical skills to indigenous users. Users should also be encouraged to probe in and learn technicalities of data communications through continuous training and advice.

- **insufficient mastery of computer-mediated communications software.** Some of the nodes have failed to communicate due to improper configuring of their software to match parameters between both ends. Lack of appropriate knowledge on how to go about computer communication left most of the institutions in Africa helpless and frustrated. Some institutions were very much frustrated due to lack of basic knowledge to configure modems and solve the simplest problems such as modems connection and internal configuration.

- **unavailability of direct telephone lines** for communication links. At some nodes the difficulty in getting a direct telephone line connected to a microcomputer has hindered communication.

- **poor communication lines.** In some cases telecommunications lines between different countries in the region were found to be of poor quality. This was due to poorly dimensioned switching equipment and incompatibility of signalling systems between countries, lack of trained and adequate human resources and poor operation and maintenance. One of the major stride against this direction during the project was the improvement of connection on poor telecommunication lines through the availability of HST modems in Africa. They are now installed at main hosts in Africa operating 24 hours. Users were able to get error free connection due to PEP (Packet

Ensembled Protocols) from Telebit modems. The breakthrough in this direction is not only to be able to achieved connection but also to improve line throughput. The newly introduced WorldBlazer, a V. 32 bis/TurboPEP modem achieves throughput speeds in excess of 70,000 bps. The use Telebit modems on Fido nodes can also enhance experience in upgrading towards uuop and other networks. It is highly recommended not only for host institutions in Africa but also for those who need international links with Africa.

- **unavailability of basic data communications supplies and equipment.** Efforts by some institutions in the project have been hindered by lack of very basic data communications supplies and equipment such as modems, serial cables, telephone jacks and step-down transformers. Inability to procure such vital parts and equipment led to delays of up to seven months in implementing the project. Institutions need to acquire the necessary data communications equipment before beginning networking efforts. The experience of the project indicates the following equipment should be available both at host level or user level.

Host Level

- Telebit (Trailblazer or Worldblazer) modem
- RJ-11 cables and socket
- line tester
- RS-232 (DB 25 -25 +9) cable
- RS-232 gender changer
- stepdown transformer
- telephone wire

User level

- at least V.42 2400/9600 modem
- RJ-11 cables and socket
- line tester
- RS-232 (DB 25 -25 +9) cable
- RS-232 gender changer
- telephone wire
- stepdown transformer

- **loss of equipment.** One node reported that the modem donated by the project was stolen during the course of a break-in at the institution.

47. PADISnet handled some of these problems within the resources of the *PADISnet* project. For those who lack skilled personnel for installation, PADIS provided on site-training and systems' configuration. Those encountering software difficulties was encouraged and assisted by frequent communication through other means, such as facsimile transmission, to specify parameters and deliver advice. Some management and administrative problems were solved by verbal and written communication at the local level. Problems with poor telephone lines were combatted either by sending messages to PADIS via external gateways

such as Greenet (GnFido gateway in London), from which PADIS could collect and return messages or by using high quality error correcting modems employing Microcom Network Protocol (MNP) class 1 to 5 or PEP modems to provide error free transmission over standard public lines. Regarding lack of vital supplies and equipment, the problem relates to larger issues such as trade and communications policies of African countries as well as to their overall economic situation. In the case of equipment loss, it can only be recommended that institutions take appropriate security precautions to protect valuable and difficult-to-replace communications equipment.

48. The solutions are not easy to some of the other initial problems *PADISnet* encountered. Many of these problems relate closely to overall African development problems. Efforts towards adoption of information and informatics policies in African countries would certainly contribute *inter alia* to sensitizing managers to the importance of computer-mediated communications. Organization of training courses for top managers in information technology would also help in this regard.

■ Other problems in *PADISnet* computer-mediated communications

49. In addition to problems experienced by users, PADIS encountered other more general problems that had impact on the question of the future of computer-mediated communications in Africa. Among these were:

Guaranteeing security of computer systems. The initiation of online access requires appropriate computer security measures. However, the cost of security software is high (averaging US\$2500) and frequently beyond the means of small or medium-size institutions maintaining data bases. With the advent of cheaper Unix based workstations and very large storage capacity (up to 16 Gbytes) and robust software including the upcoming MINISIS version "H" there will be a great potential not only for introduction of secured data bases system but also for efficient and shared data bases. Institutions in Africa should hence reconsider re-engineering of their systems in order to update and standardize their systems. One of the forces to shift towards this direction is the availability of client-server computing as opposed to standalone systems.

Telecommunication structures. With switching systems still linked to formal colonial powers and the general absence of packet switching networks¹, intra-African communication remains difficult and costly. In addition, some countries don't "talk" to others, even in telecommunications, thus preventing taking advantage of cost-effective links. PADIS has found that the most efficient connections presently available are through London or South Africa. When one talks of regional economic integration and an African Economic Community, telecommunications are an inextricable part of efforts in this direction. Continuous effort is hence necessary to change both the physical and political structure of African telecommunication

1. Although the July 1991 issue of the *ACCIS Newsletter* (Advisory Council on the Co-ordination of Information Systems, Geneva) reported that 20 African countries have packet switching systems, it appears that the number actually in operation is about one-third of that figure.

systems. International events should stress networks, their cost benefits, and impact on development. Backup evidence should be generated in order to convince policy makers the overall impact of communication.

Import restrictions. Many countries "ban" or put heavy restrictions on the import of equipment for computer-mediated communications, including reserving their sales and distribution as a telecommunications authority monopoly.

Financial considerations

High costs: Communication costs between African countries remain exorbitantly high, with telecommunications authorities frequently imposing one or three minute minimum charges. In such cases the potential cost savings of CMC over other technological alternatives such as fax can not be realized.² Per minute costs are generally high for intra-African calls; in the case of calling Addis Ababa, most locations in the *PADISnet* project reported costs falling in the range of US\$2-\$6.00/minute. This combined with minimum usage charges clearly constrains even experimental efforts at computer-mediated communication. This also discourages the possibility of online searching especially where many users are unskilled in search strategies; it favors messaging and other short communications as modes of accessing external data bases, if tariff structures would permit billing for actual connect time. Since many areas charge lower costs for night calls, methods using asynchronous logons are thus more cost effective.

50. The project telecommunications costs improved over time. By applying different techniques such as cost measures including using scripts in software, continuous observation, programming, troubleshooting different aspects of the software and hardware, changing configuration and applying more effective techniques costs can be cut by a large amount. The following table shows difference between various techniques applied and the resulting telecommunications cost cuts. One of the major findings was that cost improvement is proportional to the degree of knowledge of networking systems. Thus training of users to effectively use a system is critical to cost savings.

Cost comparisons for transferring files to North America using different techniques		
Link Method	Non-PEP Non- HST modem	PEP-Modem
Direct Fido link	0.2 minute connection time + 100 cps	0.5 minute negotiation time + 900 cps
Using GreenNet passing messages through GnFido gateway	0.3 Minute connection time + 200cps	0.4 minute negotiation time + 1000cps

2. With faxes frequently being sent at 300 baud, the time ratio for transmission of fax to CMC is 6:1, at a minimum.

Cost comparisons for transferring files to North America using different techniques		
Using direct dial with communication software such as Procomm	0.2 minute connection time + 80 cps in average	0.3 Negotiation time +230 cps
Using zonegate in South Africa	0.2 minute connection time + 100 cps	0.4 minute connection time +930 cps
Using Unix gateway software over dedicated line	0.2 minute connection time + 90 cps	NA

51. It can be seen that the connection time for low speed non-pep modems is shorter due to the shorter negotiation required. However, communication costs are 10 and more times higher. Line breaks and loss of carrier can occur frequently with low speed modems. Users were sometime able to achieve higher throughput than the above mentioned under certain condition. Since poll studies were not done in the region it is difficult to qualitatively describe the current situation in Africa. Thus the primary task in this direction is the conduction of poll studies from different countries, settings, and conditions. In addition to poll studies to cut costs in Africa, the need for transfer of skill and acquiring high speed error correcting modems is critical.

■ Lessons and future orientations

52. Even though electronic communication spreading in Africa, the sustainability and localization issue still remain to be solved. Over the last three years number of nodes were set up and training was provided to institutions participating in PADISnet and other network projects. Most of the nodes were experimental. Few nodes appeared to be sustainable partly, mostly because the only system operator concerned appeared to keep the node alive. The majority of these nodes need much to be sustainable. Apart from the problems mentioned above there are number of other observations and problems of further activity from the lessons learned from PADISnet execution.

53. PADISnet was established with the aim to enhance the development of PADIS network and built around network building for timely use of existing information between institutions participating in the project. Such general goal was not fully attained. There are number of reasons for this.

54. The overall approach lacked clear understanding on what to deliver and who delivers it and how to deliver over the network. PADISnet was conceptualized by selecting potential institutions in Africa, providing them with a communications fund and training with the aim that institutions exchange data and information. Most institutions participating in the network were unable to do so. They were faced by the multitude of problems described above. One of the major problems was the premature nature of networks and information and data available by and to the institutions. The building of capacity will be one of the key factors for the success of future attempts. Building information capacity does not mean the

availability of computers and libraries but the availability of information needed by all types of users. Marketing of available information still needs to be improved.

55. Lack of standard formats for communicating with each other also hindered inter-communication. The initial survey indicated that all institutions used different data base handling formats, software, hardware and policies to exchange information. Some of the institutions did not have their own data bases or guidelines for handling data and information. It was unclear for most of the institutions to what extent the network helped their information exchange. There is a need for standardization to harmonize the flow of information between institutions in the region.

56. Electronic networks are more feasible for pooling information resources than all other media put together. The platforms in which information is organized, the level of technology, software and hardware compatibility needs a lot of work to pool the resources available. Initial surveys of the available data in Africa is essential to tackle the problem. Without sound information on the nature of data available to users in all sectors there will be difficulties in establishing networks between them. Lack of motivation was a clear setback to the overall effort. The initial project design which grouped countries sub-regionally did not evolve due to lack of motivation.

57. There was a general absence of institutional support. Most of the work of the established nodes were not appreciated by officials of concerned institutions. Most of the efforts were confined to system operators and individuals. Some institutions were unable to pay attention to the technology and its potential due to their own internal problems and lack of clear understandings as to what they wanted from the project. As a result not much information any form was unable to circulate among institutions.

58. Even though little attention was paid to data transmission by institutions, there were a number of requests for PADIS data base searches. This shows that the institutional base of PADIS is far better than that of other institutions. The critical background for institutional support is the presence of information culture. The value attached to information in Africa leaves much to be desired. There is also lack of knowledge of the potential of networking. Most institutions are still unaware of the importance of the telecommunications sector to the information sector. An awareness campaign is necessary not only to educate users on the technology but sensitize management to the value of information. This needs study and continuous work.

59. Some institutions have not yet recognized the potential of electronic mail. There is a general misconception of electronic mail as mere automation of mail delivery. E-mail is not a fire-and-forget technology. It is a mechanism for the exchange of viable information. E-mail can transfer information which can be used as a management source and as a powerful vehicle for the development. In this regard the concept of information exchange via e-mail needs to be encouraged beyond informal communications using networks. Demonstrations, training and soliciting exercises are very critical.

60. There is also a need for a network to pool not only inter-African resources but also all types of information needed. The limited information resources of institutions, their quality and quantity available to users called for requests for more information which was usually external. The need of external information is great. Information should flow from South to North and vice versa. Even though more focus has been given to pooling information resources from North to South, the use of international networks for dissemination of information has yet to begin.

61. Collaboration with NGO networks worldwide such as Internet, APC, Interdoc (Antenna), Geonet, IGC, etc. has been initiated in order to exchange experiences and discuss technical and policy based problems. PADISnet participated in some NGOnet conferences and disseminate some of the conferences postings to its network nodes. Alternative network software and online data base management systems developed by NGOs needs to be explored to benefit African institutions and nodes.

62. The relation between the project and institutions elsewhere in the world showed that there are several dimensions by which the growth of networks can be enhanced through such institutional co-operation.

- Firstly, links should be established between networks to promote the network itself. Link tests, informal communications between peers, interest groups and individuals should be encouraged. Networking of this type is a key factor for the success and sustainability of nodes.

- Secondly, information links are critical for the success of networks. Flow of information is essential. All forms of information should flow between networks at minimum costs using efficient transfer methods. In addition to informal messaging networks should be built around the exchange of scientific, technological, bibliographic and referral information.

- Thirdly, a network should be established for sharing knowledge on networking. A number of individuals and institutions have gone through various experiences and excel in network building. Networking to share knowledge and learn from one another is very important for the success of future networks.

63. It was found that networking efforts can be successfully achieved if users, systems, resources and infrastructure are linked.

64. There is also need for evaluation of the available information in Africa. The need for factual information was found to be greater than for bibliographic and referral information. Such requirement leads to a re-evaluation of the information content of institutions participating in the project and PADIS itself. Request for online services indicate that users in the area of development information are very much interested in online immediate information. The requests for online services vary between three main data formats namely, statistical, referral and bibliographic. Statistical or factual data the most demanded followed by referral information. Bibliographic information received little attention. Such rating of

information by users indicated that for information to be networked it is necessary to be based on facts and to satisfy users need. However, this low regard for bibliographic information could change if copies of documents could be made available.

65. Online service is the most costly of all computer resource sharing services. Most available software can not support networking efficiently. Even if it does support networking it does not work efficiently over unreliable telecommunications lines. The design of interfaces between data base servers and networks is very important.

66. One of the major difficulties for the success of PADISnet project was the approach to training, i.e., the quantity and quality of training provided to system operators. PADISnet participants were unable to setup their nodes after they returned from the initial two days training workshop. Troubleshooting missions were proposed in order to reinforce the initial training. Due to lack of funds and other resources it was not possible to cover all the nodes to transfer to them the necessary skills for network setup and management. The end of project survey was also indicated that the nodes needed more training on information management and data base access (see Annex). Emphasis in future efforts should be given to phased approach training. Three levels of training are generally needed:

- basic training in data communications hardware and software
- intensive training on information management and its dissemination over networks
- high skill transfer in all aspects of data communications, including the set up of national networks.

67. In most of the institutions the basic skills in data communications is still lacking. There were cases where delay of network implementation occurred due to lack of basic computing skills. These basic skills meant lack of skill on Disk Operating System and basic configuration of software. Training should not only focus on e-mail but should transfer basic skills in computing where necessary.

68. The other two types of training should be undertaken on-site in order to transfer critical knowledge to every node in every country. The transfer of knowledge should not be limited to individuals but should reach groups of each institution. Thus the system can be sustainable in face of the frequent staff turnover in institutions in Africa.

69. The above observations show that the approach to building a sustainable network must be wide and dynamic, both in its implementation stage and in the strategy to build the infrastructure (human, institutions, etc.). Major infrastructure building is necessary. In order for infrastructure building to take co-operation and compatibility of efforts are very important. The lessons learned from network execution and set up indicate that the task facing electronic networking in Africa is not simply node set ups but overall infrastructure development.

70. The project indicated several areas of future consideration for the success of African networking efforts. One major consideration is that networks should be sustainable and localized. Ensuring a sustainable network is a function of several parameters which mainly be applied in consideration with the African socio-economic environment.

71. Specialized projects are important, however; small and dispersed efforts will not be able to provide considerable results either in the short or the long term. Larger projects will be more useful. There will be considerable difficulties in executing larger projects due to socio-economic constraints and other issues including cultural and political factors. Difficulties include the magnitude of resources required to cover the whole region and the elaboration of a strategy to deal with specific national and institutional issues. While in most cases the bottom-up approach is easier and produces results, in other cases it does not work. Therefore projects and efforts in Africa needs to share resources. Sharing of human and material resources is necessary as well as sharing of techniques and strategies. The complex socio-economic nature of the region requires different networking solutions for different conditions. Academic networks, NGO networks and others should co-operate in order to produce results and establish sustainable networks in the region.

72. The sharing of resources should not end at project and donors or operators level. It should reach users. Users can share resources if they are able to form user groups at national and institutional level. National network users group should be encouraged. Experiences indicate that one can not force network groups, but can promote conditions for the network group to be formed. Some preconditions for the network group to arise by itself include the need for cost sharing, discussion of different technical problems and improvement in network links. In order to set up a user group a critical mass of users is necessary. User development is a pre-requisite for user group formation.

73. Users are the roots of networks. For a network tree to ripen and produce fruit cultivation of the root is indispensable. The development of users will not only help network users themselves but also enables cost sharing for sustainable networks. Experience indicates that user development should accompany user need satisfaction and sensitizing. Some of the key considerations in this regard include:

- operation of an easy-to-use network
- flexibility of the system to satisfy diverse users' needs
- continuous dedicated support
- training of "helping hands" especially at proximity to users.
- encouraging users through demonstration of viable connections
- minimization of costs
- operation of a reliable system

74. The need for skill transfer courses including advanced level techniques will contribute towards user development especially if users are computer literate. Most computer literate users do not like to sit for software courses but need advanced troubleshooting courses either online or offline. Such courses should cover areas such as:

- power supply
- wiring and cabling
- modem internal setting (commands)
- software commands such as scripts and macros
- modem troubleshooting
- switchboard (PBX) setups
- node operation ethics and etiquette

75. In order to keep a network growing and flexible the concept of cost sharing is important. Networks should be defined as service providers with considerable impact.

76. Overall it can be said that the project laid the foundation of awareness of possibilities of greater information exchange, sensitized policy makers and other PADIS network members, users, member states and individuals to a large extent and established links to other networks. Such overall project efforts have not only contributed towards the advancement of data communications information technology in Africa, but have also enabled PADIS and other networks in Africa to participate in the worldwide networking effort, adding the region to the global map of networking. Surveys conducted at the initial stage final stage of the project indicated that certain restrictions in importing telecommunications were reconsidered. This indicated that networking was not only used for transmission of information, but also for attitudinal change. Perhaps most importantly the project created awareness and brought about telecommunication policy reassessments in a number of countries.

Results of end of project questionnaire survey of nodes

Participating node	BBS and other Networks available in the country	Problems encountered in project execution	Difficulty in Fido software
AAU	Ghastinet	Software	no
ALDOC	EARN, PADISnet	-	needs good documentation
ARCT	PADISnet, ORSTOM, NGO net	Hardware	no
ARSO	PADISnet, NGO net, ESAnet	Hardware and lack of time	no
CND	EARN, PADISnet	poor line	no
CODESRIA	PADISnet, ORSTOM, NGO net	Hardware	no
ELCI	PADISnet, ESAnet, NGO net		no
ESAURP	Healthnet, NGO net, PADISnet	Hardware and software	continuous line failure
IAR	PADISnet	Hardware and telephone	no
KBO	PADISnet	Telephone line	no
NIR	PADISnet	Hardware	no
NSTIDC	PADISnet	Telephone	no
SISA	PADISnet	Hardware	no
ILCA	PADISnet, CGnet	Telephone line and hardware	no
RECOSCIX	OMnet, GreenNet, PADISnet,	Poor telephone line	yes
CSIR	Ghastinet, PADISnet	Poor line, hardware and software	no
WADIS	PADISnet, Orstom	Poor line, hardware and software	yes

**Results of end of project questionnaire survey of nodes:
Additional training needs, attitudes**

Participating Node	Self-assessment of additional training needed	Institutional position on networking	Users education recommended
AAU	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	more training of users.
ALDOC	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
ARCT	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
ARSO	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
CND	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
CODESRIA	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
ELCI	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
ESAURP	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
IAR	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
KBO	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
NIR	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information

Participating Node	Self-assessment of additional training needed	Institutional position on networking	Users education recommended
NSTIDC	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
SISA	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
ILCA	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
RECOSCIX	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
CSIR	general on networks, Conference setup, modem configuration, network maintenance, advanced training	they appreciate networking and its potential	users should be trained how to access information
WADIS	general on networks, Conference setup, modem configuration, network maintenance, advanced training	the technology for networking is well understood, but they appreciate networking and its potential	more pamphlets and brochures describing networks needed

**Additional training needs, attitudes
Evaluation of PADISnet**

Participating Node	Intention to continue communication with PADIS	Aspect of networking regarded as most important	Overall evaluation of the project
AAU	yes	Online access, E-mail, BBS	too short to enable sufficient experience
ALDOC	yes	Online access, E-mail, BBS	very encouraging
ARCT	yes	Online access, E-mail, BBS	good
ARSO	yes	Online access, E-mail, BBS	breakthrough for network development
CND	yes	Online access, E-mail, BBS	breakthrough in networking
CODESRIA	yes	Online access, E-mail, BBS	should continue
ELCI	yes	Online access, E-mail, BBS	success
ESAURP	yes	Online access, E-mail, BBS	success
IAR	yes	Online access, E-mail, BBS	it is important
KBO	yes	Online access, E-mail, BBS	good
NIR	no	Online access, E-mail, BBS	encourages networking in the region
NSTIDC	yes	Online access, E-mail, BBS	very important
SISA	NA	Online access, E-mail, BBS	success
ILCA	yes	Online access, E-mail, BBS	very important
RECOSCIX	yes	Online access, E-mail, BBS	it helped access to knowledge and networks
CSIR	yes	Online access, E-mail, BBS	success
WADIS	N/A	Online access, E-mail, BBS	success