

**“Development of research networking in Africa:
the point of view of the RINAF technical support unit established in Pisa”**

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ABSTRACT

The RINAF (Regional Informatics Network for Africa) project, conceived by UNESCO's Intergovernmental Informatics Programme (IIP) in 1989 and mainly financed by the Italian Government, is aimed at supporting the interconnection of academic and research institutions within Africa and to the international research community through the provision of computer equipment, basic network services and training activities. Starting from a description of the project status, this paper gives an evaluation of the changing network environment in Africa and of its impact, providing some remarks on the set up of an independent African management capacity for research networks.

KEY WORDS

Telematics, development, information society, communication technologies, networking

Index

- 1- Introduction
- 2- Historical notes on RINAF
- 3- The structural/organizational approach adopted by RINAF
 - 3.1 The hierarchical structure
 - 3.2 The nodes selection process
 - 3.3 The African Committee
 - 3.4 Some latest achievements
- 4- The changing environment on networking and its impact in Africa
 - 4.1 The data communication infrastructure
 - 4.2 Capacity building
 - 4.3 Content development
 - 4.4 Funding models
- 5- The role of the technical support unit in Pisa
- 6- Concluding remarks

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1- Introduction

In occasion of the next meeting of the RINAF co-ordinators, which will take place in conjunction with the CARI Conference to be held in Dakar in October 1998, we have judged useful the submission of the present paper which offers our contribution to the discussion on the prosecution of the RINAF activities and on the future developments of the reasearch networking in Africa.

This paper also intends to offer an evaluation of the RINAF project, elaborated by the technical support unit estabilished in Pisa, within the context of the development of research networking in Africa, taking into account the comprehensive external evaluation report of Mr. Mike Jensen, commissioned by UNESCO, dated May 1998.

This paper starts with a short description of the project history, of the organizational approach adopted to achieve the project objectives and of the role carried out by the technical support unit. Subsequently, an analysis of the changing networking environment in Africa, along with some other remarks on the set up of an independent African management capacity for research networks, are given.

2- Historical notes on RINAF

The RINAF (Regional Informatics Network for Africa) project was conceived by UNESCO's Intergovernmental Informatics Programme (IIP) in 1989 and launched in 1992. Mainly financed by the Italian Government, with a limited contribution from the Republic of Korea, the project was aimed to support the interconnection of academic and research institutions within Africa and to the international research community through the provision of computer equipment, of basic network services and the organization of training activities for technicians and for end-users.

A RINAF Steering Committee, formed by the project Technical Coordinator, by representatives of UNESCO, of the Italian Ministry of Foreign Affairs and of the African sub-regional nodes, was created in order to take decisions regarding the available grants and to supply a supervision on the achievement of the project goals. A RINAF African Committee, formed by the RINAF regional coordinators, was also set up to approve all actions taken by the Steering Committee.

The CNUCE Institute of the Italian National Research Council (CNR) was nominated as technical support agency for the project with Mr. Stefano Trumpy as project Technical Co-ordinator having the task of proposing a set of initiatives and investments to the African Committee and to the Steering Committee, based on the knowledge of the networking infrastructure and computer usage in the African countries. The project Technical Co-ordinator has been supported by the staff set up in collaboration with the Consorzio Pisa Ricerche, and by the networking department of CNUCE, which have constantly provided assistance for the project management.

A further financial contribution of the Italian Ministry of Foreign Affairs has allowed the prosecution of the project activities, so-called RINAF Extension, which are presently implemented in four different countries: Ethiopia, Eritrea, Angola and Nigeria. UNESCO has also contributed with more internal funds to enlarge the initial objectives.

3- The structural/organizational approach adopted initially by RINAF

3.1 The hierarchical structure

The original hierarchical structure adopted by UNESCO was meant to establish five regional nodes, one for each region (north, east, west, centre and south) and ten national nodes. The regional nodes (Algeria, Kenya, Senegal, Nigeria and Zambia) should have had the task of managing and coordinating the project activities of the national nodes belonging to the same region, establishing regional connectivity and its connection to the worldwide network.

The RINAF Steering Committee decided in Paris, on July 1992, to start implementing eight RINAF nodes in the following countries: Algeria, Egypt, Guinea, Kenya, Nigeria, Senegal, Swaziland and Zambia. Since the beginning, the nodes of Algeria, Kenya, Senegal and Zambia were intended to have regional functions while the nodes of Guinea, Swaziland and Egypt were intended to be national nodes. The node of Nigeria was planned, at the beginning, as a national node and a migration to regional functions would have been realized later, according to the situation's development.

Although the project succeeded in getting substantial results in almost all 15 countries selected, the regional topology adopted was not effective, sometimes causing remarkable delays in the achievements of the project goals. This was mainly due to the incapacity and lack of commitment of certain nodes in playing a regional coordinating role promoting interregional communications. On the contrary, direct interactions between the regional/national coordinators and the project technical support unit, showed to be much more effective. Given the difficulties quoted above, the technical support unit has encouraged, since the beginning, the establishment of direct Internet connections for the most advanced focal points providing technical tools which have allowed users to interact in the best cost-effective way with any other user in the network, regardless of the physical path followed by the data. This approach has proved to be particularly positive in almost all cases.

Furthermore, the different networking infrastructure available in each focal point along with the diversity of the local technical expertise and internal organization, has led to the adoption of a peculiar approach for the implementation of the project activities which has taken into account the specific needs and requests of each RINAF node. In certain cases the project has infact decided to support the initial costs for the start-up of connectivity to the Internet through the local ISPs.

3.2 The nodes selection process

The selection of the RINAF focal points has been carried out adopting a top-down process implying the designation of research and academic institutions made by the UNESCO National Commissions, in collaboration with the local government authorities, often through the use of questionnaires.

This approach has been successful whenever the choice of "politicians" fell on efficient centres of excellence with a good TLC infrastructure which received a closer assistance and consideration from the local authorities which produced a faster growth of the node selected.

However, a number of focal points designated showed a lack of capacity in guaranteeing the necessary professional profile. Furthermore, the choice of the project focal points (with their national/regional coordinators and technical responsible) has sometimes led to a sort of competition among government authorities which has produced remarkable delays in the start-up of the project activities, as was the case of Nigeria, Kenya or even Burkina Faso where an official focal point has never been appointed.

To produce effective results, the top down approach should infact be supervised by an external structure capable of making a careful analysis of the different local situations from a technical and organizational point of view. The same structure should then offer its evaluation of the most appropriate focal points which should be subsequently supported by the local government authorities.

According to the original plan, the national coordinators were encouraged to promote the constitution of National Committees composed by those interested in constituting a national network of access points. The constitution of National Coordinating committees has not proved to be particularly successful since the committee members showed difficulties in organizing their meetings and in subsequently coordinating their strategies at a national level.

3.3 The African Committee

A RINAF African Committee was conceived at the beginning of the project in order to create a group of RINAF coordinators and policy makers who would gather to approve all actions taken within RINAF and to define the status of utilisation of the information technology means in their countries and the specific requirements in terms of TLC infrastructure. Furthermore, the constitution of an A.C would have lessen dependency of the African representatives and coordinators from international donor agencies.

From a practical point of view, the African Committee limited its action to monitor the activities carried out by the project, failing to provide a global planning for the development of African research networks. This was caused by a number of reasons among which the lack of specific funds. In the meanwhile, some other coordinating African groups with similar objectives were created outside the project but they have not been able to achieve practical results and to obtain a general acknowledgement so far.

Although the project did not succeed in deploying the potential of such a structure, the presence of an African Committee should be promoted, representing a forum whereby the African countries should:

- produce a common strategic plan for the development of continental research networks
- increase and maintain relationships with international support agencies
- study common actions for raising awareness on the importance of research networks
- interact with local PTO's and governments authorities to facilitate the supply of Internet services, especially to the research sector

3.4 Some latest achievements

The countries directly supported by the technical support unit in Pisa are: Algeria, Mauritania, Morocco, Kenya, Tanzania, Ethiopia, Nigeria, Cameroon, Central African Republic, Senegal, Ivory Coast, Zambia, Swaziland, Namibia and lately Zimbabwe and Niger. The RINAF Project Extension, is active in Angola, Eritrea, Etiopia and Nigeria.

The following is a description of the satisfactory results which have been recently obtained in the following three countries where several management problems were encountered at the beginning:

a) NIGERIA

The RINAF project started operating in Nigeria in 1992 at NACETEM (Obafemi Awolowo University (OAU) in Ile-Ife), where the power supply and the telephone lines were really bad. For this reason the initial main node was moved to the Yaba College of Technology (Lagos), immediately after the RINAF regional training course held in April 1993. Regular dial-up connections were made by CNUCE for uploading and downloading e-mail messages for other three years. The interaction of the RINAF node with the technical support unit in Pisa was initially scarce. Big efforts have been made by both the RINAF staff of Pisa and the RINAF node of Nigeria in solving some problems of project management. A sensitization was also necessary to increase the awareness on networking in the country and RINAF has succeeded in doing this role. It is important to note that, at that time, there were no networking initiative in the country and most of the latest achievements in the field have been fulfilled under the umbrella of RINAF.

NIG (Nigerian Internet Group), the leading NGO coordinating the Nigerian Internet development which holds several educational institutions, Universities, NITEL

(Nigerian Telecom), NCC (Nigerian Communication Commissions), and others, was created after a follow up of a workshop held by Yaba College of Technology for promoting the RINAF project activities.

At present there are several Internet Service Providers operating in the country and many of them received assistance from RINAF in setting up their services, in registering domain names and in solving some technical problems of system running. SCANNET, which is one of the ISP's in Ibadan initially assisted by RINAF, is now providing connectivity to the RINAF network at a very low cost.

Under the framework of the NUNet (National Universities Network) capacity building project, coordinated by National Universities Commission of Nigeria and ICTP (International Center for Theoretical Physics) located in Trieste - Italy, a 3-week academic computer networking workshop took place in October 1997. The technical assistant of the RINAF technical support unit in Pisa, participated to both the Campus Networking in Ile Ife and to the National Networking component of the workshop as a lecturer for setting up UUCP network and the Network Information Center (NIC). He also assisted NACETEM in setting up a working UUCP network, trained the NACETEM technical assistant who presently runs the RINAF network and initially connected four Nigerian institutions.

The main RINAF node is presently installed at the computer laboratory of National Center for Economic Management and Administration (NCEMA) in Ibadan, 80Km from Ile-Ife.

The organizations which have been initially connected to the main RINAF hub system are the following:

- National Center for Technology Management (NACETEM), Obafemi Awolowo University, Ile Ife (ssanni@nacetem.rinaf.net.ng)
 - The Federal Ministry of Science and Technology (FMST), Abuja (user@fmst.rinaf.net.ng)
 - Nigerian Building and Road Research Institute (NBRRI), Abuja (user@NBRRI.rinaf.net.ng)
 - Obafemi Awolowo University (OAUIFENET), Ile Ife. (user@cs.rinaf.net.ng)
- The RINAF network has been configured to act as a backup for the OAUIFENET, which is now connected through ICTP, and vice-versa.

Other sites added by the NACETEM staff to the main RINAF hub system:

- A second site at the Federal Ministry of Science and Technology (FMST), Abuja (Permanent Secretary). (user@pmfmst.rinaf.net.ng)
- National Institute for Pharmaceutical Research and Development (NIPRD), Abuja (user@niprd.rinaf.net.ng)
- African Centre for Development and Strategic Studies (ACDESS) (user@ACDESS.rinaf.net.ng)
- Prof. Lekan Oyebande, Hydrology Laboratory, Department of Geography and Planning, University of Lagos, Lagos State (oyebande@rinaf.net.ng)
- National Centre for Economic Management and Accounting (NCEMA), Ibadan, Oyo State (user@NCEMA.rinaf.net.ng)

The remarkable success recorded lately by the project has produced a growing demand from public and private organizations wishing to be connected to the network. RINAF is also interacting with NIG and NACETEM for the organization of the ISOC Chapter of Nigeria.

The Nigerian Top Level Domain (TLD) “.NG” was registered by the RINAF project at the Internic, in March 1995. The only registered domain by that time was yaba.edu.ng and since then the TLD “.NG” is managed by the CNUCE Institute. The whole domain structure and regulations have been defined and a Whois database has also been installed to facilitate new domain registrations and provide information to domains already registered.

Procedures have started to transfer the TLD management to the NIG, following to the request made by the Nigerian Government through the NCC, which is the body regulating the Internet in Nigeria. In the meanwhile, the NIG Secretary General, Mr. Lanre Ajayi, paid a one week visit to CNUCE to learn the procedures and the technical aspects of the TLD domain management.

Given the great need of training in UNIX system administration and network management, RINAF will continue giving assistance for capacity building, contribute to the extension of the network connectivity to several research and academic institutions, and will provide technical assistance to the sites maintaining and using the network.

b) KENYA

The Eastern RINAF regional node was situated at the Faculty of Information Sciences Moi University in Eldoret. Infact there has been a great delay in the first phase of the project implementation due to customs clearance and installation of the equipments. Many interactions and contacts has been kept by the RINAF staff with UNESCO ROSTA in Nairobi, the Italian Embassy and Moi University to solve the situation. On that basis an out of area switched line has been installed at Moi University by the RINAF project and installed a UUCP connection over a PPP line with AfricaOnline, a local ISP. The project is covering the communication costs since February 1997, giving an e-mail access to a wide number of researchers of the computer science department of Moi University.

The late sucess of the project in Kenya was mainly connected to the strategy adopted by RINAF in making agreements with the local Internet service provider. The Computer Science Dept. has gained a long term working experience in running the system and it is now in a position of extending the service to some other University departments. The possibility of joining the separate connections available at the University Library and at the Faculty of Medicine (FIDONET connections) would allow Moi University to have a full Internet connectivity. RINAF could play a relevant role in coordinating this effort and in introducing the use of the network services to the whole University, supplying advanced technical training to its staff and users.

c) ZIMBABWE

The RINAF regional training course for the Southern region has been successfully held at the focal point of NUST (National University for Science and Technology) in Bulawayo, Zimbabwe, from 19th to 28th August 1998.

Two participants from each country were invited (Mozambique, Malawi, Zambia and Namibia) along with other 9 people from Zimbabwe. It was an intensive high level technical course of eight working days. Fourteen Pentium PCs were made available for training purposes. The course was mainly based on hands on sessions on Linux systems and was divided into the following tracks:

- Installing Linux and UNIX system administration
- Host based networking
- Backbone networking
- Network services

A new 64Kbps leased line (it was impressive to see how fast was the PTT in bringing the line) was installed for the training using a Cisco router which was functional for the network services track held on the closing days of the workshop.

Documentation prepared by the course lecturers on all subjects presented has been distributed to all participants. In addition the latest Linux CD, the INET'97 Network Technology Workshop CD and eight O'Reilly books on various subjects, have been distributed to all the participating countries.

4- The changing environment on networking and its impact in Africa

The inception of RINAF and its first implementation phase happened at a time which preceeded the explosion of the Internet phenomenon. If for personal computers we have already reached the fifth generation, in the field of networking the evolution has been even faster therefore, if we look back to ten years ago, when the idea of RINAF was first conceived, we find a substantially different environment, such to justify today an approach which is drastically innovative if compared to the one conceived a decade ago. In this paragraph, we point out the main evolutions of the networking environment providing our suggestions on how to link the results achieved by RINAF with the evolving environment.

4.1 The data communication infrastructure

The communication costs represent by large the most expensive part of a research network. The cost of setting up a national research network is also determined by the necessary computers and I/O devices, by the software and procedures for realizing the end-users telematic services, and finally by the cost of running an organization where a number of technicians manage the services, provide assistance to end-users and carry out the training activities. With comparison to the most technologically advanced countries, in the African continent the cost of manpower is significantly lower, while the cost for the communication infrastructure is normally much higher, also in absolute figures.

There are a number of national research networks which have recently grown up in Africa in a different environment to that present in Europe and America which sees

these organizations growing in presence of a strong interest for the commercial Internet which is a worldwide phenomenon. The research networks in Africa have more difficulties than in Europe in sustaining themselves, since the government authorities do not support them as they do in Europe, nor support adequately the TLC costs of local universities and research institutions. As a consequence, a number of African research networks are going commercial in order to support the service infrastructure and they have to rely on commercial services, provided by the local PTT's or by the local ISP's, for the transport of data.

Looking at the data communications infrastructure, the situation in Africa is fortunately very mobile; although it started with a very poor situation with high inefficiencies, high costs, and very poor coverage, we are assisting at present to a number of efforts, starting from fiber optics cabling around the continent, aiming at connecting initially the capitals of the African continent. The pressure connected to the realization of the Information Society and the commercial interests related to it will allow, in the short-medium term, the national research networks to profit of more efficient and less expensive data transmission capacities.

Another peculiar aspect of Africa is that, in many cases, the international links only reach the capital cities and some other urban centres while the rural community is left isolated. For this reason, there is space in Africa for radio links and satellite connections, to overcome the lack of local communication infrastructures.

Looking at the protocols used to transport the data, in recent years the Internet technology has gained worldwide acceptance and the African continent should take advantage of this technology. We may affirm that today the Internet represents the first approximation of the Information Society and there is no doubt that the African continent wants to be an active partner of this epocal changement. When RINAF was starting its first implementation phase, the situation was very different: the European Union was still pushing the ISO standards and was running the COSINE (Cooperation for OSI Networks in Europe) project as an initiative to develop new generation research networks. UNESCO was also aligned to this direction, following the interests of the telecom industry. Later on, the EU, also following the pressure of the national research networks which had already adopted the Internet solution, turned to adopt the TCP/IP and the Internet protocols and so did, slightly later, also UNESCO. The RINAF technical support unit established in Pisa always encouraged the Internet approach, as the instrument allowing African countries to be inserted in a really global environment.

The advantages for Africa deriving from the adoption of the Internet technology are:

- to rely on standards which are widespread, low cost, interoperable, scalable, etc.;
- to utilize low cost entry level solutions which are robust and supported by the main providers;
- to be inserted in a global technological effort thus opening to the interesting commercial opportunities of the African ISPs.

4.2 Capacity building

The peculiarities of the African labour market are: low salaries for the employees and for routine work, low salaries for academic and research staff (virtually compelled to do

external work in the commercial environment), lack of skilled technicians. There is not much that can be done for changing the labour market for technical personnel involved in informatics and telematics for research. What can be done is to keep a constant effort towards capacity building, possibly supporting universities and research institutes for the maintenance of the services in order to let them save some funds to be devoted for paying some extra salaries to the most qualified personnel.

The aim should be to train a much bigger number of trainees than what RINAF was capable to do with the allocated funds.

There are different models for capacity buildings which may be taken into account. The most successful are those put up by the Internet SOCIety (ISOC) and by the Trans European Research and Education Networking Association (TERENA).

ISOC is known for organizing large workshops for developing countries in conjunction with the annual INET conferences. The latest ISOC Workshop for Developing Countries, which took place in July 1998 at the University of Geneva, was divided into five tracks, of which one for french speaking participants, and was attended by nearly 200 trainees for an average number of 40 participants per track. The number of attendees coming from Africa was very significative representing about 40% of all participants.

From a financial point of view, such a workshop has a cost of over 1 million dollars taking into account a strong non-paid effort of the hosting institution, and extensive donations from the sponsors in terms of equipment and logistics. With this sum, it is possible to partially support the participation of the attendees which are asked to do their best to finance at least a part of their expences. Only recently ISOC has started organizing "regional workshops" like the one that took place in Brazil Just before the ISOC'98 conference. The idea is that, with regional dedicated events, the costs are reduced, the group of attendees is more homogeneous and the courses may be addressed in the language which is spoken in that area. The course was attended by about 150 people and it is reported to have had a good success. It is clear that, being ISOC a non-profit organization which relies on contributions from members, the crucial aspect remains the research of sponsors to support these important training initiatives.

TERENA is undergoing a capacity building effort which, up to now, has been addressed to countries of central and eastern Europe; the amount of funds employed and the size of the TERENA events are smaller than those organised by ISOC. The ideal class is composed of 30 trainees which are trained as network system operators capable of configuring a local area network, to interconnect it to the Internet and to manage the Internet basic services. The training courses are organized in different European countries, depending on the capability of the hosting country to offer logistics arrangements. The budget needed for such events, which have been sponsored so far by NATO, is in the range of 100K\$ per course which allows covering all costs including travel and living expenses of all attendees.

Both ISOC and TERENA could collaborate in supporting capacity building in Africa.

A training course for networks managers and decision makers was recently organized by TERENA in Russia supplying very valuable materials to participants and giving suggestions and ideas on how to launch or strengthen the often weak national research networks organizations. The workshop proceedings are being prepared. RINAF should

take lessons from such initiatives and should participate to the organization of similar events in Africa.

When organizing training courses, particular evidence should be given to the selection of trainees. The ideal candidates are those motivated by the course programme with a sufficient technical background to follow the courses, and with a defined qualification inside their network organization once they will be back to their countries. Attendance of candidates attracted by per-diem allowances, or of frequent travellers not directly involved in the services management, must be discouraged.

As far as RINAF is concerned, the formation of a group of technicians in charge with the management of the RINAF nodes and with the training of the potential users, has been considered a key factor for the success of the project which has contributed to train more than hundred technicians.

RINAF has dedicated a considerable part of the funds allocated for the first project phase to the organization of regional network training courses (held in 5 different African sub-regions). Other training courses have already been and will be organized at a national level in different African countries.

The programme followed for the RINAF training activities was initially concentrated on developing basic networking skills for non-expert, in the latest years more focus has been given to high level technical training, distinguishing two different tracks for network managers and for end-users. Particular attention has been given to the selection of candidates for the advanced track for network trainers and system operators, giving priority to the technical staff belonging to the RINAF nodes in charge with the networking management within their institutions.

Furthermore, while network administration skills are more easily available in the capital cities, there should be more support for basic technical training at a national level for the provincial centres. RINAF has started moving in this direction organizing regional networking courses in provincial areas such Ile-Ife (Nigeria) and Eldoret (Kenya). Careful logistic and organizational work is needed to realize regional training courses (selection of candidates, invitations to participants belonging to the region, issue of prepaid tickets and entry visa, distribution of per diem etc.). For this reason and for the fact that participants belonging to the hosting countries are usually those who gain the maximum benefit out of the course, we recommend the organization of national training courses.

4.3 Content development

Since its inception, RINAF intended to promote content development on Africa for the benefit of Africans and for “selling the African product” to the rest of the world. In this respect, not much has been done up to now. It is extremely important, from now on, to promote a plan specifically dedicated to encourage and guide the local content development getting ready for the realization of the “Information Society”. The technological gap today is not only present in the telecommunications infrastructure but also in the information produced and made available.

Some sources claim that 90% of the available information about Africa is produced and residing out of the African continent. Furthermore, the telematics newcomers residing

in Africa are mainly interested in accessing North American and European data bases rather than building and sharing local information with other African countries. This is also justified by the fact that African countries still have relevant commercial interests in common with the former colonial countries and they are looking in their direction for acquiring technological know-how.

The experience gained with RINAF leads us to make some suggestions for content development in the interest of Africa:

- promote knowledge and cultural Internet as opposed to commercial Internet which is running without need of incentives
- promote the communication of African people with African expatriates in order to favour the technology transfer and to create the conditions for the return of expatriates to their home countries;
- support the set up of web servers to reach the goals of the above two points;
- promote projects, involving more African countries, aimed at supporting the interchange of data and the set up of common knowledge bases.

Such goals require a bigger effort compared to what has been done in the previous RINAF phases when assuring connectivity was by large the major challenge.

On an implementation level, RINAF should re-orient toward capacity building for content development and for the tools to be used to create the information bases and to access them.

4.4 Funding models

The African research networks structures were born and have developed in very different ways, mainly depending on the different local situations. Some of these structures are relatively self-supporting and stable while many others are weak, unstable and highly depending on external support.

According to our opinion, it is extremely difficult to define a funding model which may be applied to a continent like Africa. Also in Europe the models adopted by single countries differ significantly. Nevertheless, there are some general principles which may assure the success in consolidating a network for research. From the experience gained with RINAF, and also taking into account the development of the European research networks, the following points may represent a key for a smooth development of research networks.

a) each country needs an organization, possibly unique, to run the national research network;

it is important that all the key players interested in establishing a national research network join together to create such an organization to run the network in the interest of the whole research and academic community. Sometimes only a part of the community approaches international funding organizations and subsequently organizes a service addressed to a limited group of interested users while others choose to approach different funding sources. This also happened in some European countries

producing significant delays in the development of a single national plan for research networks. This aspect could be called “unity of intents in the interest of the user community”.

b) each country needs a realistic planning relying on available internal funds and on expected financial contributions coming from external sources;

to start a national research network, the first step should be to set up a National Committee formed by the leading people, having scientific credibility, involved in the national planning of computing and in the funds raising. The Committee should know appropriate official governmental channels for the research of financial support to set up and develop national research networks as necessary instruments for the efficiency of research and of higher education.

The planning should envisage different scenarios of evolution to be adopted according to the financial availability. A balance between internal funds and external financial contributions should be considered taking into account that very rarely external funds come without the presence of funds from the local governments (RINAF was in some cases an exception but the funds were in any case insufficient and the problem of the network sustainability remained). The Committee should therefore have the fundamental task of making a realistic planning, sensitizing local authorities while taking contacts with the international funding bodies and with the African coordinating agencies. Furthermore, the national Committee should be able to set up the organizational structure to run the national research networks.

c) Africa should set up one or more organizations to coordinate international affairs/services and should become an equal partner of similar European research networking organizations (TERENA, DANTE, RIPE, CCIRN etc.);

Africa needs to set up some coordinating bodies to assure a progressive development in the continent. Similar bodies are present in North America, South America, Europe and in the Asia-Pacific region. Africa could well join these regional networking organizations but it is our opinion that the possibility of setting up independent African organizations is the best option aiming at assuring the continent an independent voice in the global scene. It is true though that the European organizations could help and could even accept African partners as part of the organizations, as it has been done.

The research networks in Africa should set up an organization like TERENA aimed at coordinating the development of the services, of the infrastructure and representing the continent in worldwide organizations and towards the international funding bodies. TERENA runs a Secretariat where a group of four technicians assure the progression of TERENA's technical programme and a small number of administrative personnel take care of the overall coordination and services. An association like TERENA has an annual budget of about 1 million ECU and is subsidized by contributions from the national research networks paying their membership according to the Gross National Product. Egypt is already a member of TERENA and contacts have been established to attract other North African countries.

DANTE is an organization established by the European research networks to develop infrastructural services. DANTE is providing the backbone service in Europe (TEN 34 at present and Quantum in the near future). An organization like this might not be needed

in Africa provided that similar functions are carried out by a sister organization of TERENA.

RIPE is the organization which gathers the users of IP networks in Europe, including the commercial sector. From this organization two very important services were created: RIPE/NCC and RIPE/CENTR.

RIPE/NCC is the authority which assigns IP numbers to the networks that want to be recognized in the Internet. The organization is completely self supported by the fees which are charged to the users. During the latest INET '98 Conference in Geneva, the intention to set up an African registration authority was presented.

RIPE/CENTR is the coordinating body of the organizations which assign the Internet Domain Names in Europe. It is widely known the on going discussion about the setting up of the new IANA. In Europe we are very keen of being well represented in the Internet Governance in a period when the US decided to leave the conduction of the Internet to a global independent organization (new IANA). Africa is sensibly behind in the problem of the Internet governance but the explosion of the commercial Internet could accelerate the process of setting up a service like RIPE/CENTR which, at least in Europe, does not have problems of sustainability.

CCIRN (Coordinating Committee for Intercontinental Research Networks) is the coordinating body for the global interconnection of resarch networks and it is divided into regional representations, each composed of seven networking experts. Africa is at present an observer not being formally represented yet.

d) Coordinated approach with the international funding bodies;

The economic situation in Africa is poor with almost no exceptions; at the same time, the costs for data communication are sensibly higher compared to those of the more developed countries. Since Africa needs to rely on external funding more than Europe does, a coordinated approach towards the external funding sources is essential. The funding sources available up to now for research networking in Africa may be classified as coming from:

- global organizations (UNDP, UNESCO, FAO, WHO, WORLD BANK, ITU, etc.)
- regional organizations (UE)
- national initiatives (bilateral agreements between governments, targeted organizations like ORSTOM (France), IDRC (Canada), Commonwealth (UK), special projects like Leland Initiative (US) etc.
- special promotions and donations of multinationals involved in computers, telematics and TLC.

The financial support made available by the above mentioned sources should be devoted to the realization of an agreed global plan for Africa having the scope of accelerating the full insertion of the continent in the global Information Society.

5- The role of the technical support unit in Pisa

The project management has been coordinated by the Technical Co-ordinator with the support of the staff set up in collaboration with the Consorzio Pisa Ricerche (CPR) which included a full time telecommunication engineer and a part-time professional in charge with organizational and administrative matters.

Since the beginning of the RINAF project, the CPR personnel has provided its assistance supplying the following support:

- Evaluation and completion of the regional and national networking plans submitted by the regional/ national coordinators;
- Acquisition, testing and shipment of equipment.
Whenever possible, the purchase of hardware/software has been carried out locally through TLC suppliers available on site. Although this procedure has slowed down the transactions between the project organizing secretariat and the local supplier, it has produced some advantages such as the speed of delivery and the supply of local technical support when needed;
- Organization and participation to training activities;
Several regional training courses and workshops for targeted groups of network technicians have been organized.
- On-site and remote technical assistance;
- Hand over activities;
During the 1st project phase the RINAF staff, in accordance with the decision taken by the Steering Committee, has successfully transferred to the advanced regional nodes of CERIST (Algeria) and CNDST (Senegal) the technical know-how, and project management.
- Registration of top level domain .NG for Nigeria;
- Maintenance of leased line and dial-up (UUCP) connections for Algeria (CERIST) and Nigeria (NACETEM);
- Establishment and maintenance of domain name servers at the CNUCE institute for Algeria, Ghana and Nigeria;
- Management of the RINAF Project Web site (<http://www.cnuce.cnr.it/RINAF>) with the following objectives:
 - Giving on-line information on the RINAF project
 - Giving on-line information on the TLC infrastructure and on the status of networking in various African countries
 - Gathering publications about African networking
 - Improving the Internet information access in Africa

- Management of mailing lists (CAMNET, NGR-MAIL, SENEGA-L, GUINEQ-L) and discussion lists (RINAF-L, RINAF-T, RINAF-R);
- Writing of reports and publications on the project;
- Support the participation of RINAF African specialists to international workshops and conferences on networking;

As specified in the list above, the RINAF technical support unit has worked to start transferring to the most advanced African research institutions the project management. This process will hopefully lead all focal points to gradually take over the project coordinating responsibilities which were initially assured by the technical support unit. Nevertheless the technical unit, which has received the fruitful collaboration of several CNR networking experts and of several willing African students/expatriates residing in Pisa, may continue to successfully contribute to:

- maintain fruitful relationships with centres of excellence for research networking in Africa;
- promote initiatives for the development of capacity building (installation of web servers and mailing lists, production of list of trainers, comprehensive training materials, maintenance of relationships with industries and international donor agencies willing to financially support training activities);
- draw bilateral-multilateral project proposals to be submitted to international organizations;
- promote local content development in Africa.

For the above reasons, the RINAF technical support unit is ready and willing to offer its collaboration for developing countries assistance projects which may be launched in the future within UNESCO's IIP programme.

6- Concluding remarks

The prosecution of the initiatives carried out so far by RINAF may have a significant impact improving the level of information and communication technologies in Africa and in developing the Internet services within the public sector. Since Africa's population is predominantly rural, the next challenge will be to study new low cost solutions (public services for e-mail access, documentation centers connected to the Internet etc.) for allowing rural areas to progressively lessen their present isolation. The achievements of these objectives requires substantial investments which UNESCO and other international donors should constantly seek.

Along this line, the African countries should join the community of the Internet global planners like ISOC, TERENA, RIPE, CCIRN, etc, but should also work to set up independent African organizations aimed at developing an overall plan for deploying a continental infrastructure able to offer the African research and academic sector suitable telematic services.

These continental plans should specifically encourage and coordinate the local content development and the capacity building for advanced networking skills for African network managers, node managers, experts of end-users services, etc. In addition, each country should set up an organization to run the national research network.

The African research networks structures should then sensitize local authorities promoting a coordinated approach with the international funding bodies which should be called to contribute to the realization of this overall plan, accelerating the full insertion of the continent in the Information Society.