

# APPLICATION OF THE INTERNET IN KNOWLEDGE SHARING: CASE STUDY OF GLOBAL ENVIRONMENT FACILITY INTERNATIONAL WATERS LEARNING EXCHANGE AND RESOURCE NETWORK PROJECT.

## Abstract

Ukwe, C.N. UNIDO GOG-LME Project, c/o FEPA P..M.B 3150 Surelere , Lagos.

The Internet is the largest electronic network in the world. It is really a global network of networks. Some sources estimates the Internet currently interconnects over 40,000 different network in over 100+ Countries. It is believed that over 5 million computer hosts take part in the internet and provide service for between 35 to 40 million users worldwide. In Africa , the Internet has continued its rapid growth over the last year and only three countries remained without local access by the end of 1998-Eritrea ,Somalia, and Libya. Most African capitals have more than one Internet Service Provider (ISP) and in late 1998 there were almost 400 ISPs across the region (300 excluding South Africa). The Global Environment Facility (GEF) has financed over 25 projects in the area o International Waters with over 251 million US Dollars in its four Operational Areas. These programs provide incremental financing to address a wide range of transboundary water needs. Taken together, GEF initiatives and their Associated co-financing represent the earth's single largest source of financing to protect transboundary waters systems. By the year 2001 GEF and its partners will have launched 40+ international water projects, representing nearly \$1 billion in total financing. GEF's rapidly expanding project portfolio represents an enormous range of institutional experience. In order to bridge this gap in sharing knowledge and experiences GEF is currently financing a project on International Waters Learning Exchange and Research Network (IW:LEARN). IW:LEARN is an innovative distance learning programme that uses new communications technologies, including the Internet ,to expand knowledge sharing among International Waters Projects.

## Introduction:

Almost everywhere you turn today, you read, watch or hear something about Internet. If you are in Education, Government, or Business and use a computer, you probably have been asked the following question, "What is your Internet address?". The beginning of the Internet dates back to the year 1969. A network was developed by Bolt, Beranek, and Newman (BBN) for the advanced Research Projects Agency of the U.S. Department of Defence. This network became known as ARPANET. This new network connected university, military, and defence contractors who were working on ARPA projects . The Internet was to allow researchers at these organisations to share information. From this early research network the Internet traces its history.

In 1973 , ARPA, renamed DARPA for Defence Advanced Research Projects Agency , started a programme called the internetting project. This project was to study how to link various packet networks to each other. This internetting project evolved into what is known today simply as the Internet.

The Internet is the largest electronic network in the world. It is really a global network of networks. In 1985, there were only 100 networks within the Internet. Four years later, in 1989 the number of networks had risen to over 500. The defence Data Network Information Centre reported 2,218 networks were connected by January 1990. While the National Science Foundation's Network Information Centre estimated 4,000 networks connected by June 1991. Some sources estimate the Internet currently interconnects over 40,000 different networks over 100+ Countries. It is believed that over 5 million computer hosts take part in the Internet and provide service for between 35 to 40 million users worldwide. Using these figures the Internet is growing at a rate of better than 15% a month. Paul Glistler, author of the Internet Navigator estimates that in 1995 the Internet could reach over 40 million people and if that growth rate continues would top 100 million by 1998.

The Internet has spread rapidly through Africa over the last 18 months – at the end of 1996 only 16 countries had access, now over three-quarters of the 53 capital cities are online and soon almost all of the remaining capital will have full Internet facilities. By the end of 1998, only three countries- Eritrea, Somalia and Libya remained without local access. Both Eritrea and Libya are expected to establish Internet facilities in early 1999, leaving Somalia to be one of the very last nations on earth without local coverage.

However internet services are still largely confined to the capitals and major towns, and in contrast to more developed regions, this does not provide local access for most of the population, 70 – 80 % of which reside in rural areas in Africa. To address this situation some countries have made the decision to provide local Internet access across the whole country. So far 10 countries have adopted this policy – Burkina Faso, Gabon, Malawi, Mauritius, Mauritania, Niger, Senegal, Chad, Tunisia, and Zimbabwe. The service is supplied by the local telecom operator which sets up a special area code for internet access providers that is charged at local call tariffs, allowing the internet providers to immediately roll out a network with national coverage.

Reflecting the increasing numbers of subscribers outside the capital cities, a growing number of countries (Angola, Benin, Botswana, Egypt, Ghana, Kenya, Morocco, Namibia, Tanzania, Tunisia, Zambia and Zimbabwe) have POPs in about 70 locations. Nevertheless, limited coverage still means that for most people it is prohibitively expensive to use the network for anything but important e-mail, especially where local calls cost over US \$ 10 an hour.

### **Internet Providers in Africa:**

Most African capitals have more than one Internet Services Providers (ISPs) and in late 1998 there were almost 400 ISPs across the region (300 excluding South Africa). Six countries had more than 10 ISPs but 14 countries will have only one ISP. The total number of computers connected to the Internet in the region, excluding South Africa, was estimated by Network Wizards (<http://www.nw.com>) at around 8,000 in mid 1998

(up from 290 in 1995), but the figure may be closer to 9,000 or 10,000 due to the measurement technique which does not count hosts which are not fully referenced in domain name servers. In any event this represents about 20 hosts per 100, 000 people, compared to a world average of 605 per 100,000 and a high income country average of over 3,000 (Jensen, 1998). The average

also obscures the impact of the high density in North and South Africa, which if excluded, reduces the total to less than 1 host per 100,000. In addition, Internet growth worldwide has been so rapid (12 percent per month), that the regions share of host per sites worldwide was only 0.022 percent by the beginning of 1998. Excluding South Africa, the sub – Saharan region has about as many Internet sites as Latvia with its population of 2.5 million (Jensen, 1998).

As far as multinational ISPs are concerned, Africa Online, now a subsidiary of UK- based Africa Lakes, ([http:// www.africaonline.com](http://www.africaonline.com)) is the largest operation. The group provide Internet services in Zimbabwe, Tanzania, Ghana, Kenya, Senegal, Mali and

Cote d' Ivoire. Other multi-national ISPs include UNNET with services in South Africa, Swaziland, Zimbabwe and Namibia, and Swift Global in Kenya, Tanzania and Uganda. The bulk of the service providers are small businesses, often started by technicians who learned the skills at university who find a local entrepreneur to partner with. Some national ISPs are operated by universities (such as ZamNet) and others have been established by large companies, mostly those already associated with the ICT industry.

The opening up of Nigerian Internet market will likely change the picture as he national telecom operator (NITEL) has big plans to provide Internet countrywide. With a fifth continent's population, Nigeria has been one of the slumbering giants of the African Internet world which until mid '98 only had a few dialup e-mail providers and a couple of full ISPs operating on very low bandwidth links – few were able to afford the \$130 000 a year for an international 9.6 KBPS leased line. Nitel has now established a POP in Lagos with a 1-MB link to Global One in the US and plans to put POPs in 3 other cities by early next year. The telecom regulator has recently licensed 38 ISPs to resell the service and about 12 are currently active. Table 1 summarises the major ISPs in the different countries.

Table 1: Country summary of ISPs and cost

Country	ISPs	Users	Internet KBPS	Internet ISP	Call Cost \$/hr	Population (M)	Population ISP/U	Users/Int Bandwidth (#/1Kbps)
Algeria	3	750	64	CERIST		28.5	57000	12
Angola	5	1500	192	PTO	6.00	11.2	7467	8
Benin	6	1750	196	PTO	4.80	5.5	3143	9
Botswana	6	500	640	PTO	0.60	1.4	2800	1
Burkina Faso	3	700	256	PTO	1.10	10.4	14857	3
Burundi	1	75	19.2	ISP	0.75	6.3	84000	4
Cameroon	4	2000	256	PTO	1.55	13.5	6750	8

Cape Verde	1	?	19.2	PTO				
Central African Republic	1	200	64	PTO	6.90	3.2	16000	3
Comoros	0	0	64	PTO	0.20	0.5	0	0
Congo	0	0	0			2.5	0	0
Congo Kinshasa	1	100	64	ISP		44	440000	2
Djibouti	1	400	128	PTO	1.00	0.43	1075	3
Egypt	28	20000	2000	RITSEC	1.20	60.7	3035	10
Equatorial Guinea	1	200	64	PTO		0.42	2100	3
Eritrea	4	300	28.8	ISP	0.60	3.7	12333	10
Ethiopia	4	3000	512	PTO	2.60	60.8	20267	6
Gabon	2	1000	512	PTO	13.90	1.2	1200	2
Gambia	4	150	28.8		1.20	0.99	6600	5
Ghana	9	4500	640	ISP	1.34	17.8	3956	7
Guinea Bissau	1	200	64	PTO		1.1	5500	3
Ivory Coast	3	1000	256	ISP	4.80	14.8	14800	4
Kenya	16	5000	2000	ISP	1.36	29.1	5820	3
Lesotho	1	100	9.6	ISP		2	20000	10
Liberia	0	0	0			3	0	0
Libya	0	0	0			5.2	0	0
Madagascar	5	700	256	PTO	0.43	13.9	19857	3
Malawi	3	400	128	ISP	1.56	9.7	24250	3
Mali	5	400	128	PTO	2.80	9.4	23500	3
Mauritania	2	100	128	PTO	6.60	2.3	23000	1

Mauritius	6	960	896	PTO	1.00	1.1	1146	1
Morocco	17	6000	2000	PTO	0.85	29.2	4867	3
Mozambique	6	3500	384	ISP + PTO	0.80	18.4	5257	9
Namibia	6	2000	1000	ISP	1.00	1.7	850	2
Niger	2	200	192	PTO	1.31	8.9	44500	1
Nigeria	6	1000	1152	ISP,PTO soon	0.40	101.2	101200	1
Rwanda	1	100	128	PTO		8.6	86000	1
Senegal	9	2500	1000	PTO	1.90	9	3600	3
Seychelles	1	1000	128	ISP		0.08	80	8
Sierra Leone	1	50	128	PTO	1.50	4.8	96000	0
Somalia	0	0	0			6.8	0	0
South Africa	75	600000	40000	ISP+ PTO	1.60	39	65	15
Sudan	1	300	128	ISP		30	100000	2
Swaziland	3	900	64	ISP	0.95	0.97	1078	14
Tanzania	14	2500	1098	Datel,SITA, Wilken	1.94	28.7	11480	2
Tchad	3	50	64	PTO	10.50	5.6	112000	1
Togo	2	300	196	ISP	1.60	4.4	14667	2
Tunisia	4	3500	512	ATC		8.9	2543	7
Uganda	4	2000	256	ISP	8.40	20.4	10200	8
Zambia	3	2000	256	ISP + PTO	1.60	9.5	4750	8
Zimbabwe	12	10000	2000	PTO	4.00	11.1	1110	5
Total	255	683935	604276		2.70	718.49	1051	11

					Average			Ave
--	--	--	--	--	---------	--	--	-----

"Call Cost" is converted to US\$/hour

"Others" refers to store-and-forward email hosts.

"People/User" is the number of people per Internet User

"Users/Int KBPS" is the number of Internet users for every 1 Kilobit per second of the total International.

### **Ranked Internet Access Cost Comparisons July '98**

Costs based on 5 hours a month of dialup access time, and includes cost of local calls during office hours.

<b>Country</b>	<b>Annual cost in \$US</b>
Botswana	136
South Africa	226
Burkina Faso	288
Senegal	290
Mauritius	300
Mozambique	348
Ethiopia	384
Gabon	440
Mauritania	582
Sierra Leone	600
CAR	616
Djibouti	640
Burundi	645

Morocco	660
Guinea	780
Algeria	880
Cameroon	965
Uganda	1105
Benin	1247
Madagascar	1341
Kenya	1681
Angola	1740

Average Annual Cost:722

USD

Ave Monthly cost 60 USD [afcosts.gif](#) Bar Chart

### African Network Wizard's Internet Host Survey

The data below is extracted from Network Wizard's mid-year Internet host and domain count for 1998. (Note that there is substantial under-representation in some countries due to limited use of reverse name service configuration resulting in some countries with no identifiable hosts even although there are local ISP services present. There also appears to be more virtual shared IP addresses with multiple domains and virtual hosting which is also not taken into account)

Domain Hosts	Level 2	Level 3	Domain
--------------	---------	---------	--------

Domains	Domains	World Total
---------	---------	-------------

All 36739151 1949865 1306262

Africa 148540 259 13569 Africa Total

za 140577 25 10899 South Africa

eg 2043 7 196 Egypt

zw 836 4 135 Zimbabwe

ke 692 4 60 Kenya

na 665 6 71 Namibia

bw 578 27 480 Botswana

ma 478 5 360 Morocco

sz 397 8 73 Swaziland

mu 370 1 370 Mauritius

ci 265 6 17 Cote D'ivoire

gn 241 1 6 Ghana

zm 236 13 208 Zambia

sn 189 14 187 Senegal

tz 137 4 9 Tanzania

bf 93 4 93 Burkina Faso

ng 91 4 11 Nigeria

tg 83 3 50 Togo

mz 83 12 79 Mozambique

et 76 1 1 Ethiopia

st 64 45 45 Sao Tome Principe

tn 57 6 57 Tunisia

ug 41 7 18 Uganda

mr 22 6 22 Mauritania

dz 19 2 18 Algeria

mg 18 2 18 Madagascar

ls 17 2 17 Lesotho

gw 13 4 10 Guinea Bissau



bj 13 2 13 Benin  
km 9 3 8 Comoros  
cd 8 5 6 Congo DRC  
sc 7 3 4 Seychelles  
ne 5 3 5 Niger  
cm 5 5 5 Cameroon  
ao 2 1 2 Angola  
re 1 1 1 Reunion  
ml 1 1 1 Mali  
ly 1 1 1 Libya  
lr 1 1 0 Liberia  
ga 1 1 1 Gabon  
cv 1 1 0 Cape Verde  
cg 1 1 1 Congo (Republic)  
zr 0 0 0 Zaire  
td 0 0 0 Chad  
so 0 0 0 Somalia  
sl 0 0 0 Sierra Leone  
sd 0 0 0 Sudan  
nw 0 0 0 Rwanda  
mw 0 0 0 Malawi  
gq 0 0 0 Equatorial Guinea  
gn 0 0 0 Guinea  
gm 0 0 0 Gambia  
er 0 0 0 Eritrea

dj 0 0 0 Djibouti

cf 0 0 0 Central African Republic

bi 0 0 0 Burundi

### **Involvement of Private Telecommunication Operators:**

The rapidity with which most African public telecom operators (PTOs), have established Internet services is noteworthy. In the last three years PTOs have brought full Internet services on stream in 31 countries and similar moves are afoot in two others (Liberia and Tanzania). This follows trends in the developed countries where almost all of the PTO operators have established Internet services. In many Francophone countries the PTO operates the major value added service provider as a joint venture with France Cable and Radio, usually called Telecom-Plus.

In most cases the PTOs only operate the international gateway and leave the re-sale of end-user Internet access to the private sector. In a few countries the PTO operates the gateway in competition with the private sector, namely Cote D'Ivoire, Mozambique, Nigeria, South Africa and Zambia. Currently the only countries where the PTO is not currently supplying services are Liberia, Ghana, DRC, Uganda, and Namibia.

Using a shared International link is having a significant positive impact on the cost and accessibility of the Internet in some countries, given the much larger economies of scale that the PTOs can apply to the provision of the services. However this has been offset in other countries which have not adopted cost-based tariffing of the services or have lacked the commitment and technical skills to manage the service efficiently.

While Ethiopia and Mauritius are the only countries where the PTOs have officially adopted the position of 'sole supplier' of Internet services (i.e. where private companies are barred from reselling Internet services), there are other countries where the practice still continues, predominantly in the Sahel sub-region – Central African Republic, Equatorial Guinea, Niger, Rwanda, Seychelles, Sudan and Tchad.

### **Constraint of the African User:**

Since the Internet depends on the quality of the underlying telecommunication infrastructure, the lack of national penetration and poor quality of the network still remains a basic impediment to rapid growth in Internet use. While most African countries are experiencing some extension and modernisation of their telecommunication networks, Sub-Saharan Africa's overall teledensity is still less than one per 200 inhabitants, most of the telecommunication network is analogue and many sections are highly unreliable, especially during the rainy season. In addition 50% of the available lines are concentrated in the capital cities, where only 10% of the population live. In some countries such as Eritrea, Guinea-Bissau, Central African Republic, Sierra Leone, Burundi, Tchad, the ITU has found that 80-95% of the lines are in the main city. On a worldwide basis, Africa has the least developed infrastructure with only 2% of the world's telephones and 12% of

the population, compared to other developing regions – Latin America has 6% of the lines and 8% of the population and Asia has 13% of the lines and 57% of the population.

Access to sufficient international bandwidth for carrying out interactive services over the Internet is still a major problem in most African countries. A few of the International connections to the global internet still operates on analogue circuit rated at 9.6Kbps, often pushed to 14Kbps and sometimes to 24Kbps. Few of the countries outside of South Africa had International circuits larger than 64Kbps until recently, but 128Kbps are becoming increasingly common. However more than 256Kbps of outgoing bandwidth is currently only present in Botswana, Egypt, Ghana, Kenya, Mauritius, Morocco, Namibia, Senegal, South Africa, Tanzania and Tunisia.

Most of the other international connections are carried via satellite, aside from the marine optical fiber link from South Africa to the hub in the Canaries, and the nations of Djibouti, Egypt, Morocco and Tunisia which have access to the SEA-ME-WEA cable. Also countries having borders shared with South Africa benefit from the PTO, Telecom's tariff policies for the neighbouring country connections which means these have lower cost terrestrial links, resulting in most of the ISPs in the neighbouring countries connecting to the South African Internet infrastructure.

By far the majority of international internet circuits in Africa connect to the USA, with a few to the United Kingdom and France, (as well as two to Italy). The major International Internet suppliers to Africa are AT&T, BT, Global One/Sprint, UNNET/AlterNet, MCI, NSN, BBN, Teleglobe, Verio and Franc Telecom/FCR. A rapidly increasing number of other links are provided by Panamsat and Intelsat direct to Private and PTO ground stations in the US and UK, circumventing local PTO infrastructure.

Because of the high cost and low international bandwidth available in many African countries, increasing attention has recently been drawn to the possibility of using satellites for Internet service using very small aperture terminals (VSAT). It offers reasonably high bandwidth (64K – 8Mbps) and substantially lower costs than most PTO supplied international leased circuits. However regulatory barriers have stymied most attempts to use this technology so far, except in Ghana, Mozambique, Tanzania, Uganda and Zambia, where the telecoms market has been substantially relaxed. ISPs in these countries have rapidly adopted the VSAT technology, VSAT hubs in Gabon and Ghana are looking to bring in regional traffic, and the PTA bank is also planning a VSAT based network to link institutions in the COMESA countries.

## **Global Environmental Facility International Waters Learning Exchange and Resource Network Project (IW:LEARN):**

**The Global Environment Facility (GEF) has financed over 25 projects in the area of International Waters. These projects fall within four Operational Programmes: Waterbody-based Operational Program (OP#8)**

**Integrated Land and Water Multiple Focal Area (OP#9)**

**Contaminant-based Operational Program (OP#9)**

**Coastal, Marine, and Freshwater Ecosystems (OP#2)**

**These programs provide incremental financing to address a wide range of trans boundary water needs. Taken together, GEF initiatives and associated co-financing represents the earth's single largest source of financing to protect transboundary waters systems. By the end of Fiscal Year 1998, GEF will have invested about 215 US Dollars in these activities, with roughly equivalent co-financing from national governments, other development donors, private sources. By the year 2001, GEF and its partners will have launched 40+ international waters projects, representing nearly \$1 billion US in total financing. These projects will involve conservation and management activities and implementation of regional strategic action plans in nearly every Large Marine Ecosystem (for instance the ongoing Golf of Guinea Large Marine Ecosystem Project in West Africa) and in most major freshwater systems that touch upon or impact developing countries.**

**GEF's rapidly expanding project portfolio represents an enormous range of institutional experiences. GEF projects address virtually every major theme and every area of cutting – edge scientific enquiry in the field of International Waters. They cover a full range of participatory planning processes, new approaches to regional management of resources, and innovative applications of a wide range of new technologies.**

Nevertheless, GEF projects are normally not efficient at building upon and recycling the knowledge that they produce. Despite the richness of experience and wealth of ideas, loss of knowledge is a consistent and cost weakness across the system. When projects end, institutional knowledge is generally dissipated. The results of hands-on learning is rarely accessible to projects under formulation. Lessons that have been learned are likely to be boiled down to aphorisms for presentation at conferences, but meaningful interactive exchanges rarely take place. Project Directors have scant opportunity to get to know their counterparts beyond reputations or occasional international meetings even though all GEF projects follow a similar Project Cycle. Junior or mid-level personnel almost no systematic opportunities for exchange visits beyond their local projects. Peer to peer technical assistance, cross-project internships, apprenticeships, collaborative research among projects seldom takes place. Above all there is little or no collaboration by the three GEF implementing Agencies of World Bank, UNEP and UNDP in project execution. They tend to view projects as "theirs" restricting information sharing at the top level of management. Beyond exchanges of documents, few concrete means are in

place whereby proponents on the ground can meaningfully benefit from each other's learning and experience.

Potential of the Internet to Improve Knowledge sharing:

Growth of the Internet has created a new capacity with which GEF can address weakness in their inter-projects and inter-institutional knowledge sharing. Three trends are at work:

Geometric Internet growth beginning in developing countries. All GEF projects and the overwhelming majority of associated government agencies, NGOs and Universities are likely to be well connected to the Internet on a day to day basis within the next three years. That evolving Internet will be far more interactive, multilingual, multimedia, graphic, information-rich, searchable than even the Internet of today.

Significant GEF investments in information technology is opening access to a wider range of stakeholders. GEF international waters projects have typically invested no less than 15 percent of their project budgets (often more) in computer-related hardware and associated training. In the meantime, global investment in telecommunications continues to expand and the cost of computer-related hardware continues to drop.

A creative boom is underway in the field of distance learning. In educational programs around the globe, information technology is revolutionising the content, assumptions, cost factor, and methods of learning. Nowhere is the potential impact greater, than in developing countries. Within the next three years, unprecedented opportunities for education and knowledge sharing will become accessible to those who live in and manage the world's major water systems.

Recognising the inherent potentials of the Internet in facilitating knowledge exchange among its international waters projects, GEF extended financing and support to International Waters Learning Exchange and Resource Network Project. IW:LEARN is an innovative distance learning program that uses new communications technologies to expand knowledge sharing among International Waters Projects. The Gulf of Guinea Large Marine Ecosystem project (GOG-LME), a regional initiative by six West African Countries of Benin, Cameroon, Cote d'Ivoire, Ghana, Nigeria and Togo is a major participant in IW:LEARN. This innovative idea will also be put to use by the GOG-LME in enhancing communication between all stakeholders as it moves into its second expanded phase involving 16 Countries from Guinea-Bissau to Angola.

IW:LEARN will over the next three years, (1) train and implementation team to undertake distance learning in at least 20 GEF and European Community financed projects; (2) develop and test an array of knowledge products in partnership with the World Bank, UNEP, and national partners; (3) create an internet – accessible "Knowledge Commons" consisting initially of 8 "support sites", 30 "learning hubs", and 180 "portable classrooms"; (4) evaluate new methods and models and present a plan to scale up successful activities at a global meeting of project managers, scientists, and policy makers to be held in the year 2001.

**Conclusion:**

It is expected that with the opening up of the Internet markets in most African countries, exchange of knowledge among GEF and Non GEF financed projects will be significantly enhanced and strengthened for the involvement of the Grassroots and all pertinent Stake holders in Project management. This will reduce areas of friction and improve collaboration /co-operation in project implementation. This will also encourage country ownership and introduction of best practices leading to the protection and conservation of the marine and coastal ecosystems.