PROJECT FINAL REPORT

Grant Agreement number: 246663

Project acronym: **ERINA4AFRICA**

Project title: EXPLOITING RESEARCH INFRASTRUCTURES POTENTIAL FOR BOOSTING RESEARCH AND INNOVATION IN AFRICA

Funding Scheme: **FP7-INFRASTRUCTURES-2009-3.3**

Period covered: from 1st October 2009 to 31st January 2011

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Document Information

Project
Project Title: *Exploiting **R**esearch **IN**frastructures potentiAl for boosting Research and Innovation in **Africa*** (**ERINA4Africa)**

Project Start: 1ˢᵗ October 2009
Project Duration (months): 16
Call: FP7-INFRASTRUCTURES-2009-5
Contract Number: 246663
Document
Deliverable Number: D4.4
Deliverable Title: Final Report

Deliverable Identifier:
Contractual Date of Delivery: 2011-01-31
Actual Date of Delivery: 2011-03-04
Editor(s): Bjorn Pehrson
Author(s): Simon J E Taylor, Margaret Ngwira, Björn Pehrson, Isabel Matranga
Reviewer(s): Mohsen Jahangrian
Work package No.: WP4
Work package Title: Management
Work package Leader: Simon J E Taylor
Work package Participants: ALL
Est. Person-months: 0.75
Distribution: PU-Public Use
Nature: R-Report
Version.Revision:
Draft/Final FINAL
Total Number of Pages: 36
(including cover)
File name: D4.4 Final Report.doc
File folder link
Keywords: *Knowledge society, ICT for development, e-Infrastructures, Euro-Africa collaboration, e-Health, e-Learning, e-Government, AfricaConnect, FEAST, ERINA*

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ERINA4Africa is a project funded partially by the European Union

Log of Changes

Deliverable N° & Version N°	Date (dd/mm/yyyy)	Changes
D4.4-vFINAL	04/03/2011	Final version delivered
D4.4-vFINAL1	26/03/2011	Updated

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Executive Summary

The ERINA4Africa project is a collaboration between the coordinating partner Brunel University (UK), the Royal Institute of Technology (Sweden), the UbuntuNet Alliance (Malawi) and Engineering Ingegneria Informatica S.p.A.(Italy). The initiative created cooperation between the EU and Africa with a win-win perspective so that Africa may benefit from the development of Research Infrastructure policies based on EU experiences and best practices and the EU will have the chance to demonstrate in-the-field benefits of exploiting Research Infrastructure in key ICT areas where public funding would be relevant, namely e-Government, e-Health and e-Learning. The aim of ERINA4Africa is therefore to:

foster knowledge-sharing between e-Infrastructures stakeholders in Africa and the EU in the key ICT areas of e-Health, e-Government, and e-Learning with the overall outcome of accelerating the contribution of e-Infrastructures to societal and economical development in Africa.

The main recommendations of ERINA4Africa are:

Build a Human Infrastructure as well as a Technological one
Identify and support targeted communication activities involving multidisciplinary audiences, focusing on the establishment of specific e-Infrastructures. It was noted that those approached were not fully aware of the opportunities offered by e-Infrastructures not only in term of funding, but also and especially in term of best practices, technology availability and expertise. Linking and reaching out to user communities, funding agencies, universities, decision makers, government, hospitals, scientific communities, etc. can bring an early engagement of communities and help build knowledge and solutions with a focus on supporting social and economically sustainable growth. . In many cases , the data repositories created in a specific e-infrastructure would be of public interest and provide important contributions to the general soft infrastructure of the societies in which they are created.

Sustain a programme for promoting and implementing Lighthouse Demonstrators.
The planning of e-Infrastructures for new virtual research communities should start immediately to become available as AfricaConnect improves connectivity. The case studies analysed by ERINA4Africa can all be turned into *Lighthouse Demonstrators*. These are early adopters of e-Infrastructures or e-Infrastructure-related technologies in Africa which create a showcase to fully demonstrate the impact and benefits of the adoption of advanced technologies in the three information society key areas (e-Health, e-Government, e-Learning) and will act as a draw to e-Science. Unless support is provided to formulate project proposals in response to coming EU Calls, there is a risk that the groups behind several of the identified cases will not be submitted due to lack of know-how to formulate competitive proposals.

Euro-Africa twinning and partnerships
Encourage established European and emerging African e-Infrastructures communities to organise co-operation, e.g. by exchange of researchers, experiences and plans, peer review of proposals, etc, similar to the 'twinning' between established and emerging NRENs organised by TERENA[1]. It is suggested that medium-to-large collaborations of beneficiaries be organized on the basis of peer-to-peer twinned partnerships to develop and sustain collaborations.

It is strongly suggested that these recommendations be implemented through a targeted Coordination/Support Action that builds on the experiences of this and associated projects such as BELIEF[2] (Bringing Europe's eLectronic Infrastructures to Expanding Frontiers), eI-Africa and the EURO-AFRICA ICT Cooperation Forums.

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[1]   www.terena.org/

[2]   www.beliefproject.org

ERINA4Africa Project Highlights

African e-Infrastructure Ecosystem Data Collection and Analysis

A comprehensive overview of the technological supply and stakeholder demand sides of potential African e-Infrastructures in e-Health, e-Learning and e-Government. This contains a comprehensive historical review of relevant African projects.

African e-Infrastructure Virtual Observatory

A convenient repository of African e-Infrastructure projects. Over 60 on-going projects are listed representing over 35 African countries.

African e-Infrastructure Patterns and Best Practices Analysis

A selection of best practices which have been identified after the qualitative and quantitative analysis performed in the project. A set of 15 case studies with beneficiaries from over 20 African countries was selected as potential Lighthouse Demonstrators. These represent innovative, promising and important examples of how ICT can support African researchers and citizen empowerment.

African e-Infrastructure Foresight Study

A report identifying the significant interest in Africa towards the direct impact of e-Infrastructures on society and the growth and increased access to fundamental services for the population (i.e. Health services and education). Four main categories of benefits have been identified and major recommendations have been made. Early adopters of advanced ICT technologies have shown how e-Infrastructures can empower projects to better perform their activities and achieve and enlarge their potential.

Three ERINA4Africa events

Two well attended workshops and the final conference were run during the ERINA4Africa project: *Investigating Best Practices for e-Infrastructure Application Development*, Kigali, Rwanda, 21 April 2010, *Investigating African e-Infrastructure Applications of the Future*, Lilongwe, Malawi, 6/7 October 2010 and the *Final ERINA4Africa Conference* on 9/10 December 2010. Attended by over 300 participants these discussed the impact of e-Infrastructures in Africa and played a critical role in shaping the conclusions of this project. Importantly, two in-the-field demonstrations of e-Infrastructures were given. The EUFP7 Global ISABEL interactive video conferencing system assisted in uniting the Rwanda and European participants in the first workshop and during the second workshop, facilitated by a pioneering three-party high-definition video-conference session, medical experts at university hospitals in Malawi, Rwanda and Sweden discussed regional differences in treatment of portal hypertension and shared documents in real-time across continents. Both clearly demonstrated the potential of what advanced ICT can deliver to Africa.

1. Introduction

The ERINA4Africa project is a collaboration between the coordinating partner Brunel University (UK), the Royal Institute of Technology (Sweden), the UbuntuNet Alliance (Malawi) and Engineering Ingegneria Informatica S.p.A. (Italy)[3]. The initiative created cooperation between the EU and Africa with a win-win perspective so that Africa may benefit from the development of Research Infrastructure policies based on EU experiences and best practices and the EU will have the chance to demonstrate in-the-field benefits of exploiting Research Infrastructure in key ICT areas where public funding would be relevant, namely e-Government, e-Health and e-Learning. The aim of ERINA4Africa is therefore to:

> *foster knowledge-sharing between e-Infrastructures stakeholders in Africa and the EU in the key ICT areas of e-Health, e-Government, and e-Learning with the overall outcome of accelerating the contribution of e-Infrastructures to societal and economical development in Africa.*

The 'parents' of this study are the FEAST and ERINA studies. FEAST (www.feast-project.org) developed the basis of the high performancing networking AfricaConnect project and ERINA (www.erina-study.eu) studied the value of research infrastructures for e-Government, e-Health and e-Learning in Europe. Building on this, ERINA4Africa has attempted to provide African and EU policy makers with a detailed analysis of exploitable scenarios of e-Infrastructures in Africa, the so-called *Lighthouse Demonstrators*.

This final report details the results, recommendations and impact from ERINA4Africa. Section 2 presents the e-Infrastructure Ecosystem Mapping of Work package 1. Section 3 discusses the results from Work package 2 Quantitative and Qualitative Analysis. Section 4 presents the main events of the project in Work package 3 Dissemination and Networking. Section 5 discusses the major recommendations and impacts and Section 6 concludes the report.

Note that all deliverables can be freely downloaded from the ERINA4Africa website (www.erina4africa.eu).

The beneficiaries of the project are:

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country
1(coordinator)	Brunel University	UBRUN	United Kingdom
2	Engineering Ingegneria Informatica	ENG	Italy
3	UbuntuNet Alliance	UbuntuNet	Netherlands
4	Royal Institute of Technology	KTH	Sweden

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[3] Metaware (Italy) was part of the consortium until its departure in February 2010 due to unforeseen circumstances.

2.   e-Infrastructure Ecosystem Mapping

This task attempted to map the African 'e-Infrastructure Ecosystem' by investigating both the demand and supply sides of Africa e-Infrastructure applications and to create a Virtual Observatory, a central repository of contemporary on-going examples of relevant e-Infrastructure projects. The main outputs of this task are therefore:

- Data Collection and Analysis Report (D1.1)
- Virtual observatory (D1.2)

2.1.   *Data Collection and Analysis Results*

The Data Collection and Analysis Report highlighted key technologies and projects that illustrated the potential of e-Infrastructures in e-Health, e-Government and e-Learning in Africa.   To summarise the findings of the report, the rapid advance of ICTs, including mobile technologies, fibre optics and grid technologies, offers rich opportunities to enhance the quality of life and accelerate the socio-economic development in Africa through partnership initiatives between government, universities and private sector at national and international level. The accelerating diffusion of grid and cloud computing and high performance networks in the African context is facilitated by the boom of mobile phone networks and accelerating roll-out of optical fibre infrastructure enabling all sorts of networks. Cloud and mobile technologies can co-exist and offer interesting services combined with smart phones, PDAs and PCs, ranging from complete Management Information Systems to specific services. Clouds can be used to create cost-effective virtual desktops for all sorts of user groups by using one single computer to communicate with the rest of the world. At the moment the limited availability of production capacity and brain drain of highly educated and trained human resources as well as limited access to broadband networks are bottlenecks in the uptake of high performance e-Infrastructures. Some innovative advances have been made in mobile technology uptake but much remains to do. The situation is however changing rapidly with the emerging availability of fibre networks and should not be regarded as a limiting factor.

The Data Collection and Analysis Report included a historical review of projects in the area and showed that successful projects tended to be medium to large scale in terms of beneficiaries. This is the first time such a comprehensive review has been carried out. Based on a snowballing review, 44 e-Learning projects and 37 e-Health projects were identified as well as 119 e-Learning funding bodies and 83 e-Health funding bodies.   The following analyses were carried out: by African countries, by sponsoring country/multi-national body, by funding bodies, by project size, by sponsor/beneficiary, by funding body type, by ICT type and by historical trend. As examples of this, Figure 1 and 2 show the results of classification of e-Learning and e-Health projects by country and Tables 1 and 2 show the sponsor/benefit matrices for e-Learning and e-Health. Details of the full analysis are in the report.
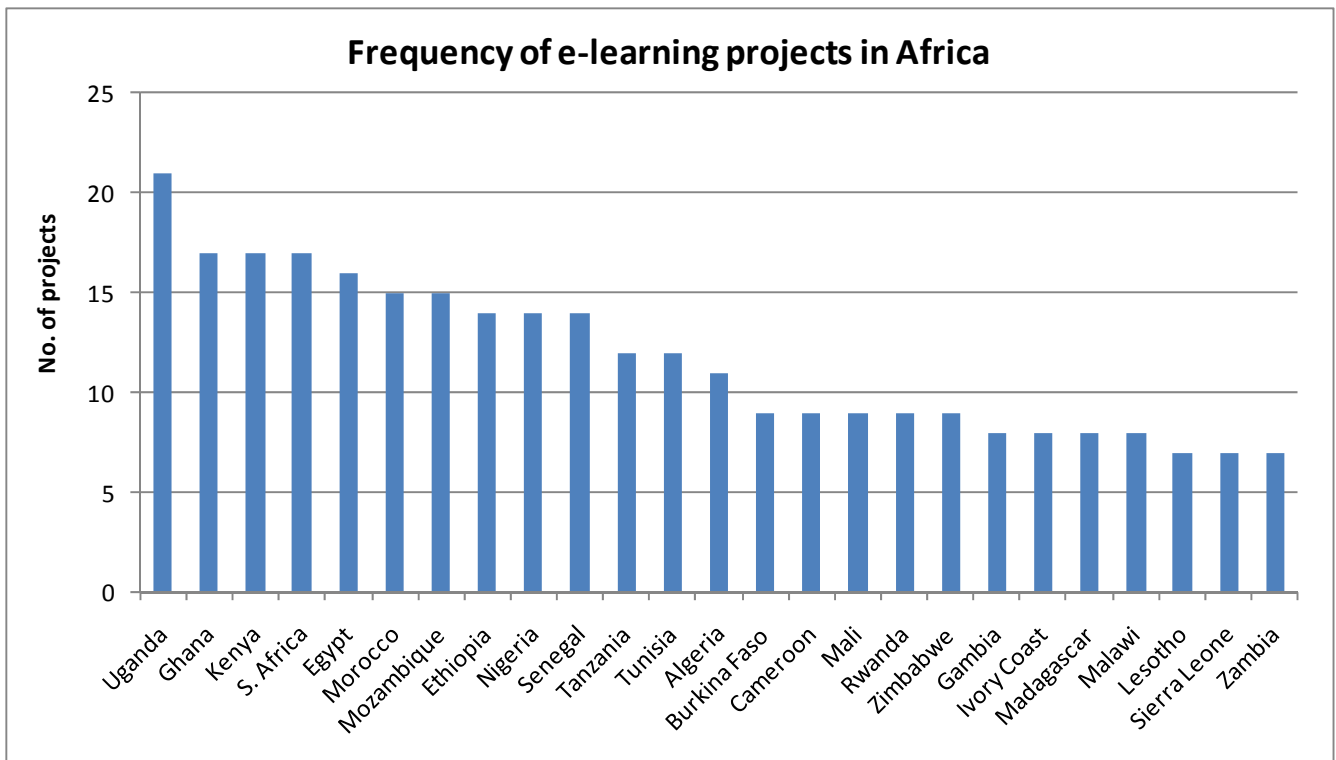
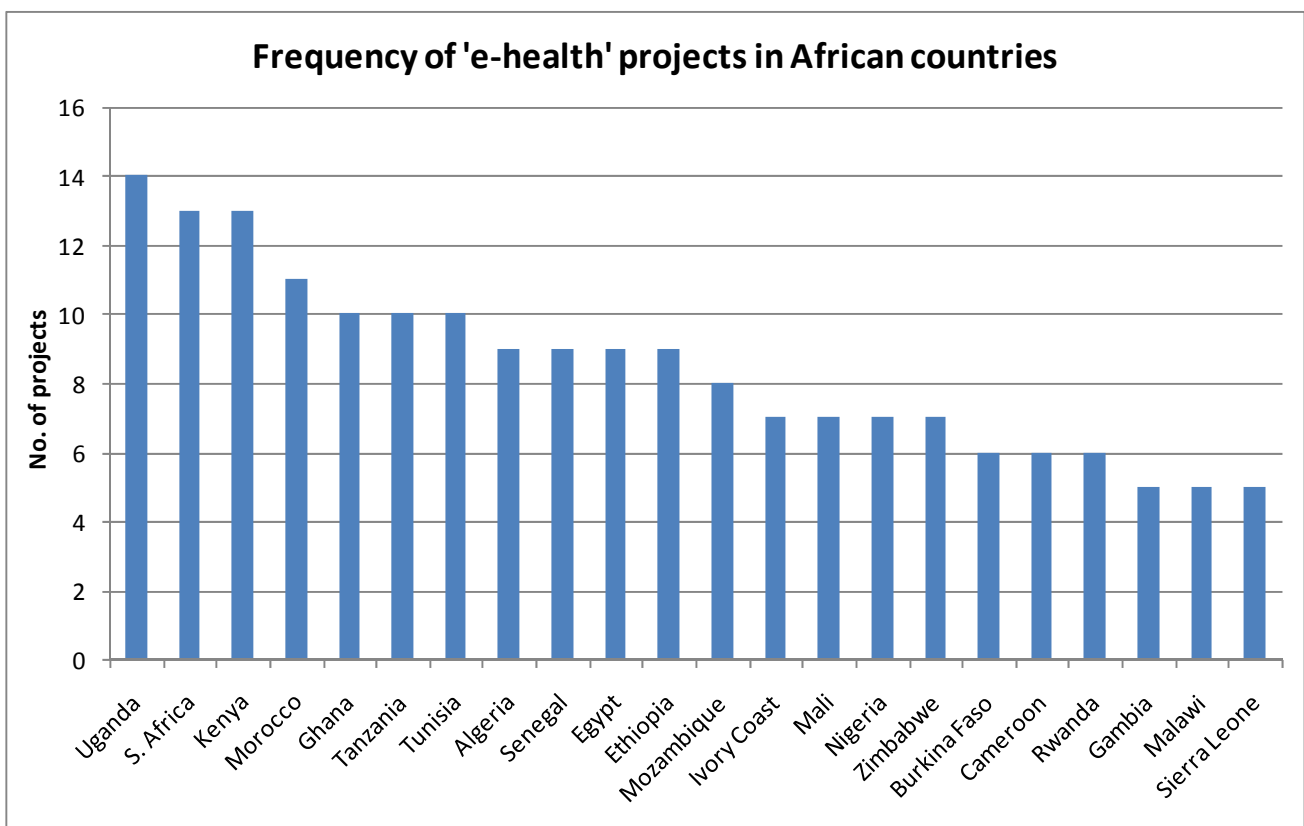**Figure 1: Frequency of e-Learning projects in African countries (top 25)**

Figure 2: Frequency of e-Health projects in African countries (top 25)

Table 1: e-Learning Sponsor - Beneficiary country matrix

	Major sponsoring countries or multi-national bodies						
Major beneficiary African countries	USA	EU	UK	Canada	S. Africa	UN	Switzerland
Uganda	Green	Red	Green	Yellow	Red	Red	Red
Ghana	Green	Red	Yellow	Yellow	Red	Red	Red
Kenya	Green	Red	Yellow	Yellow	Red	Yellow	Red
S. Africa	Green	Red	Yellow	Yellow	Yellow	Red	Red
Egypt	Yellow	Green	Red	Red	Red	Red	Red
Morocco	Yellow	Green	Red	Red	Red	Red	Yellow
Mozambique	Green	Red	Yellow	Red	Red	Red	Red
Ethiopia	Green	Red	Red	Red	Red	Red	Red
Nigeria	Green	Red	Yellow	Yellow	Red	Red	Red
Senegal	Yellow	Red	Green	Yellow	Red	Red	Yellow
Tanzania	Green	Red	Red	Red	Red	Red	Red
Tunisia	Green	Green	Red	Red	Red	Red	Red
Algeria	Yellow	Green	Red	Red	Red	Red	Red
Burkina Faso	Yellow	Red	Red	Red	Red	Red	Red
Cameroon	Yellow	Red	Red	Red	Red	Red	Red
Mali	Yellow	Red	Red	Red	Red	Red	Yellow
Rwanda	Yellow	Red	Yellow	Red	Red	Red	Red
Zimbabwe	Yellow	Red	Red	Red	Red	Red	Red
Ivory Coast	Yellow	Red	Red	Red	Red	Red	Red
Madagascar	Yellow	Red	Red	Red	Red	Red	Red
Malawi	Yellow	Red	Red	Red	Red	Red	Red
Lesotho	Yellow	Red	Red	Red	Red	Red	Red
Sierra Leone	Yellow	Red	Red	Red	Red	Red	Red
Zambia	Yellow	Red	Red	Red	Red	Red	Red

Key

Number of sponsored projects

Green 7+
Yellow 3-6
Red 0-2

Table 2: e-Health Sponsor - Beneficiary country matrix

		Major sponsoring countries or multi-national bodies					
		USA	EU	UK	Switzerland	France	S. Africa
Major beneficiary African countries	Morocco	Red	Green	Red	Red	Yellow	Red
	S. Africa	Yellow	Red	Red	Red	Red	Green
	Uganda	Green	Red	Red	Red	Red	Red
	Kenya	Green	Red	Red	Red	Red	Red
	Tunisia	Red	Green	Red	Red	Red	Red
	Algeria	Red	Green	Red	Red	Red	Red
	Egypt	Red	Green	Red	Red	Red	Red
	Ghana	Green	Red	Red	Red	Red	Red
	Senegal	Yellow	Red	Red	Yellow	Red	Red
	Tanzania	Green	Red	Yellow	Red	Red	Red
	Ethiopia	Green	Red	Red	Red	Red	Red
	Mozambique	Yellow	Red	Red	Red	Red	Red
	Ivory Coast	Yellow	Red	Red	Red	Red	Red
	Mali	Yellow	Red	Red	Yellow	Red	Red
	Nigeria	Yellow	Red	Red	Red	Red	Red
	Zimbabwe	Yellow	Red	Red	Red	Red	Red
	Burkina Faso	Yellow	Red	Red	Red	Red	Red
	Cameroon	Yellow	Red	Red	Red	Red	Red
	Rwanda	Yellow	Red	Red	Red	Red	Red

Key

Number of sponsored projects

Green   7+
Yellow   3-6
Red   0-2

Overall the report identified the following potential benefits of e-Infrastructures observed from the emerging African e-Infrastructure Ecosystem:

- Enable cooperation between the various African regions and institutions as well as between African and European institutions *(e.g. collaboration between African and European hospitals via network services as video/audio-conferencing, chat, email)*
- Development of learning in remote areas and reduce the gap due the huge distances *(e.g. the creation of virtual class rooms for students and teachers to interact online to educate more professionals in fields of low supply, such as medicine, science and technology, not least ICT).*
- Promote investment in the research and development domain *(e.g. through the partnership initiative between universities, government and private collaborations (national and international collaboration) and prevent brain drain of experts going to other countries to specialize).*

- Support local economy *(e.g. cloud services can help agriculture industry of tourism via SMS mobile services to inform population about weather or disaster).*
- Support institutional changes *(e.g. encourage the diffusion of health information as the prevention of HIV/Aids, Malaria, tuberculosis or encourage the diffusion of government initiative as searching documents, jobs proposal, pharmacies, nearest hospitals).*
- Environmental impact *(e.g. through grid/cloud services and relocation by using networks, the use of computing resources and power consumption can be reduced leading to reduced CO- emissions)*
- Collaboration with other countries to offer services to the citizens *(e.g. e-Infrastructure adoption can promote the sharing of data and instrumentation in e-Health, e-Government and e-Learning enhancing services to the citizens, i.e. sharing of clinical data among African and European clinical researchers and medical specialists and sharing of resources for detection, prevention and management of natural disaster such as fires or tsunami).*

2.2.   *Virtual Observatory*

The Virtual Observatory has been created as part of the ERINA4Africa website to give a single point, easy to access 'portal' to African and associated e-Infrastructure projects. At the end of the project, the Virtual Observatory has over 60 projects. These are:

- Access to e-Government services employing semantic technologies
- Advancing ICT for DRM in Africa
- Africa4All
- African Laboratory for Natural Products
- AgShare Project
- Baobab Health Trust
- Bringing Europe's eLectronic Infrastructures to Expanding Frontiers II
- Building Europe- Africa collaborative Network for applying IST in health care sector
- Centre of Excellence in ICT – Param Serengeti Supercomputer
- Connecting the EU and sub-Saharan Africa for ICT partnerships
- Coordination and advancement of sub-saharan Africa-EU science & technology cooperation network
- Co-ordination and Harmonisation of Advanced e-Infrastructures
- Database of African Theses and Dissertations
- Digital world forum on accessible and inclusive ICT
- Distance learning and telementoring in surgery
- eAgriculture Research Network for Africa (eARN): Effectiveness of electronic-based interventions in linking African farmers to markets
- e-Learning in Medical Education: Explore the Virtual Patient
- Establishing e-partnering programmes among various Mediterranean institutes to promote communication among young people with different languages and cultures, plus setting up a digital education fund
- Establishing the EU-Mediterranean ICT research network
- Establishment of a unit of high computing at the University of Ouagadougou (Burkina Faso)
- EXPReS: a production astronomy e-VLBI infrastructure
- Free/Libre and open source software: International cooperation development roadmap
- Global RFID interoperability forum for standards
- HealthOER
- Indicators of Information and Communications Technology
- Information System for risk management via remote detection
- Integrated risk management for Africa
- IPv6 Deployment Support

- Knowledge mapping on IT competencies in Mediterranean countries and dialogue fostering
- Logiciel libre et recherche scientifique : Système d'information géographique et environnemental de la Côte d'Ivoire
- Magnetic Resonance Imaging in Malaria Research at Malawi College of Medicine
- Malawi Agricultural Commodity Exchange Project
- Mediterranean Arabic Language and speech technology
- Mediterranean Information Society
- MLW Pathogen Genomics studies
- Natural Product Research Network for Eastern and Central Africa
- Network of the INCO-NCPs
- OERAfrica
- Open Philosophies for associative Autopoietic Digital Ecosystems
- Partnership between the EU and Africa in the ICT area
- Pedagogically sustained adaptive Learning through the exploitation of tacit and explicit knowledge
- Piloting Solutions for Reversing Brain Drain into Brain Gain for Africa: Use of grid and cloud computing applications as technical interventions to manage brain drain dynamics
- Quantifying weather and climate impacts on health in developing countries
- Regional Impact of Information Society Technologies in Africa
- Shrink-Path of ultra-low power super-conducting electronics
- Strengthening the European-South African Science and technology advancement programme
- Support for participants in ICT Priority by network for IST under the transition to the 7th Framework Programme
- Sustainable collaborative research between SLU, Uppsala and ILRI in the field of genomics, bioinformatics and immunoinformatics
- Sustaining the Research and Grid Computing Components of the University of Nigeria's UNESCO – HP BRAIN GAIN Project
- The European research taskforce creating human-machine interfaces SIMILAR to human-human communication
- Tools and expertise for 3D Collection Formation
- TRACnet: Fighting Pandemics through Information Technology
- Urban Rail Infrastructure

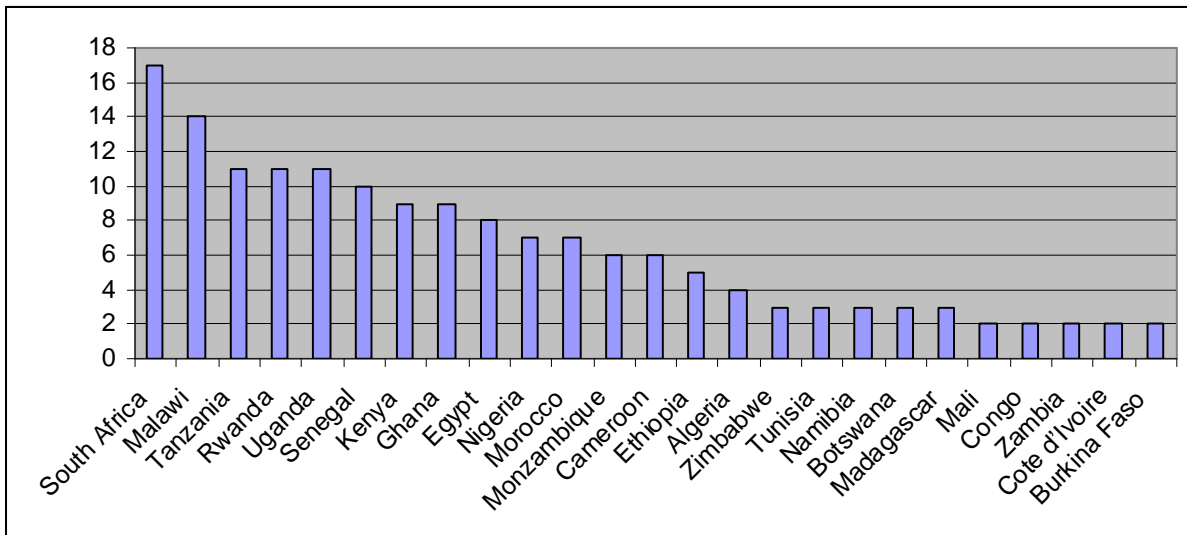The distribution of beneficiary over Africa as shown below.

Figure 1: Distribution of Virtual Observatory Projects by Beneficiary Country

Note overall 35 countries are represented. The above figure shows countries with a minimum of two projects. 10 other countries have one project: Libya, Mauritania, Burundi, Lesotho, Cape Verde, Somalia, Benin, Togo, Mauritius, Ivory coast, and Sudan.

2.3.   Conclusion

This task has attempted to map the African 'e-Infrastructure Ecosystem' by investigating both the demand and supply sides of Africa e-Infrastructure applications and to create a Virtual Observatory. Both these aspects have been done successfully and are available through the project website (www.erina4africa.eu).

3. Quantitative and Qualitative Analysis

The aim of this task was to analyse the data collected in the Data Collection and Analysis report from a qualitative and quantitative point of view, extract selected best practices for the EU and African community and perform, on a set of case studies, an impact analysis of the adoption of e-Infrastructures in the domains of e-Health, e-Government and e-Learning in Africa. The main outputs of this task are therefore:

- Patterns and best practices analysis report (D2.1)
- Foresight study report (D2.2)

The overall approach started from a context analysis moved to an impact analysis. The analysis activities consisted of the following steps:

- Context analysis
- Collection of projects
- Data gathering and case studies' selection
- Case study analysis
- Impact analysis

The ERINA4Africa team started its work by analysing and looking into the African context (step 1 of the process) identifying its peculiarities and also similarities with the European one. This activity drew mainly on the experiences of the partners, which have worked and still work in the African domain, in particular UbuntuNet and KTH. Research was also done by surveying the web and collecting feedback from already existing contacts. Results from other similar analysis as FEAST[4] and NICI[5] were also taken into consideration and represented an interesting starting point for our analysis.

Step 2, the "collection of projects" phase, followed the snowball data-gathering approach, that is normally used in social science when the area under analysis is not defined (i.e. the total number and list of all African projects in the area under analysis is not available). One of the conclusions made by the FEAST study was that the most efficient way to find ongoing and potential research projects in Africa, on the demand side, could not be done only via the research and education network communities. Taking into consideration the experience made by the FEAST study and the above conclusion, ERINA4Africa team used other routes to fact finding, such as contacting donors and financial institutions supporting development cooperation, using personal contacts and surveying the area via the web. All the current projects which were identified were added to the ERINA4Africa Virtual Observatory which is available by registering to the ERINA4Africa community on the project website (www.erina4africa.eu). Past projects were surveyed in the Data Collection and Analysis Report.

The ERINA4Africa data collection (step 3) was, then, performed in different stages. The first stage was the analysis of publically available documents (project fact sheet, websites, etc.). A preliminary questionnaire was then sent to all identified projects to collect general information helping the ERINA4Africa team to better understand project scope, objectives and potentials. All the information collected up to this point was used to perform the qualitative analysis and it became the

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[4]   http://www.feast-project.org/
[5]   Developing National Information and Communications Infrastructure

basis for the development of a second questionnaire, the selection of case studies and the quantitative-qualitative analysis.

Examining the information collected on the projects a set of case studies was selected. After the first questionnaire 10 cases were selected. Through the second questionnaire and a new request of information we reached the number of 15 cases. For this selection process the following elements were taken into consideration:

- *Transnationality:* we prioritised projects working in more than one African country (which means that the project has partners belonging to more than one country and/or that the project activities reach one or more African country). This choice is based on the hypothesis that transnational projects will generate more interest benefits from connecting to e-Infrastructures rather than projects with a more limited territorial dimension.
- *Working on more than one beneficiary/user typology.* The research hypothesis behind this criteria is that projects working with more than a user/beneficiary typology will have a greater impact at socio-economic level and, therefore, will deserve, more than other projects, to be connect with e-Infrastructures.
- *Availability of data and willingness to engage in ERINA4Africa analysis.* In the first questionnaire we asked the respondent their availability to be further contacted by the Erina4Africa project team. We then prioritised those projects when sending the second questionnaire.

The second ERINA4Africa questionnaire was sent to the 15 case studies for the final data gathering stage, which was used to collect data to perform the impact assessment following the ERINA methodology (adjusted to ERINA4Africa needs). One of the main aims of the ERINA4Africa impact analysis was to help decision makers and implementers to move beyond the technology level of analysis regarding networking/middleware/data of ICT related projects and frame initiatives forcing them to take into account social and economic benefits of existing and future ICT related projects, and think through why the projects are important for the beneficiaries and for society. In order to reach this goal, we considered the ERINA methodology and adapted it to the specific domain under analysis.

The macro indicators used in the ERINA methodology are:

- Economic efficiency
- Social impact.
- Environmental impact
- Technological dimension and Economic impact
- Benefits of being connected with e-Infrastructures

These variables guided the second questionnaire data gathering activity that was performed trough online and phone based interviews to projects' representatives. The data gathered was analysed and is presented in the Foresight Study. The difficulties in gathering financial data made it impossible to run a precise return of investment analysis. Furthermore, ERINA4Africa was analysing an ecosystem, the one of e-Infrastructure-based projects, which is at its early stages, for which term and historical series of data are not available. For this reason when adapting the methodology to the new context analysed stronger interest was given to social benefits and impacts and the consortium moved towards a more qualitative analysis of the data.

3.1. *Patterns and Best Practices Analysis Results*

This deliverable presents a selection of best practices which have been identified after the qualitative and quantitative analysis performed in WP1 and WP2. During the study activities a set of projects were analysed and among these a sub set of 15 case studies was selected as good practices and potential Lighthouse Demonstrators. These represent innovative, promising and important examples of how ICT can support African researchers and citizen empowerment. The best practices are presented below in alphabetical order:

Africa4all
> The project (started in 2010) will introduce and test an innovative e-Parliament framework leveraging Web 2.0 technologies in the participating countries (Kenya, Lesotho, Namibia, Tanzania and Uganda). Besides MPs, Parliamentary ICT staff and citizens will be educated to take advantage of ICT tools. The project final goal is that of supporting a wide uptake of e-Government instruments in order to actively engage the population in decision making processes.

AgShare Planning and Pilot
> The aim of the AgShare Planning and Pilot project is to create a scalable and sustainable collaboration among African organisations and support them in publishing, localizing, and sharing teaching and learning materials that fill critical resource gaps in African agriculture curriculum and that can be modified for other downstream uses. The project introduces and adapts the Open Educational Resources (OER) approach to African needs.

Baobab Health Trust
> Baobab Health Trust goal is to build, deploy and maintain innovative, robust and sustainable health care information systems suitable for the developing world in collaboration with government and health care workers. Patients' basic and relevant health information will be digitised for future follow-ups and treatments and the healthcare worker will be supported in the health decision making process, enabling her/him to spend more time with the patients and providing better care.

CARENET
> The CARENET project is developing and populating an open infrastructure facilitating cooperation on research, development and education in e-Health. It focuses on patient pathways rather than medical disciplines and, initiated by the Karolinska Living Lab in Stockholm, now includes international partners all over the globe. The infrastructure includes research and education facilities as well as dedicated extensions to reach rural health centres, out-patients and mobile users.

CSD4dev – Communication Systems Design for Development
> The programme is based on a technology transfer alliance supporting the establishment of sustainable communication networks and associated supply chains in areas with demand but short of supply due to high-perceived risks among commercial providers. It is focused on high-performance, low-effect, low-cost ICT systems based on open source software and selected standard off-the-shelf hardware components.

Magnetic Resonance Imaging (MRI) in Malaria Research at Malawi College of Medicine
> This project, started in 2008, is a public private partnership. The aim of the project is to use e-Learning approaches to build capacity for Health Care Professional Education in Malawi and to

identify, map and transfer the range of skills, resources and expertise available at international level to Malawi. This project plans to involve 500 students, 1500 health workers and the wider population.

(SIMART) Information System for risk management via remote detection
Started in January 2010, this project is a cooperation between Cameroon, France, Germany, USA and Canada. The goal of the project is to develop and test ICT infrastructures and services for the comprehensive management of risk (multi-risk) related to air pollution and flood. The project, thanks to the implementation of a collaborative alert e-infrastructure, will support networking among researchers and institution working in the field.

Vitual-Land Computer System (VCS)
Started on September 2006, the main objective of this project is the simulation of real processes in a virtual model, designing Methods for Information Systems. The project plans to improve the allocation of funding from the state and NGO, to be a more effective instrument of the state, scientific and business communities, and balancing the repartition of socio-economic resources. Forecast numbers of interested people are: 300 ministers, 300 doctors, 500 students.

WSN4WQM – WSN for Water Quality Monitoring
Started on 2008, the aim of this project is to develop a wireless sensor network based system for monitoring the quality of drinking water. Besides the design, implementation and field testing of the technical solution, the project also explores possible business models for installation and maintenance of equipment.

Param Serengeti Supercomputer
Started in 2009, the aim of the project is to improve the accessibility of the best health personnel to remote areas and the best education to people who are living in remote areas by the application of High Performance Computing. More than 100 people will be involved in this project that links Research institutions, Ministries, Manufacturing industries, Pharmaceutical Industries and farmers.

Malawi COM CPD
Started in 2007, the project is active in the e-Health sector and its main goal is to assure access to huge learning resources, primarily Virtual Patients. This Malawi-Scottish Partnership will support the networking in the region, facilitating sharing and content development. Clinical skills would be enhanced, innovations would be easily adopted, maternal child survival should improve as well as HIV management.

Piloting Solutions for Reversing Brain Drain into Brain Gain for Africa: Use of grid and cloud computing applications as technical interventions to manage brain drain dynamics
Started in June 2010, the consortium of Africa, Zimbabwe, connecting with Chinhoyi University of Technology is participating in the UNESCO/HP project on reversing brain drain into brain gain. The project is premised on the use of e-based education-oriented technologies running on the global cyber-infrastructure. The main technologies to be used are grid and cloud computing. One of the main objectives is developing a digital model to link up researchers as a way of supporting and developing research capacity in Africa.

NAPRECA
NAPRECA stands for Natural Products Research Network for East and Central Africa . It has the mandate to mobilize scientists in the relevant fields in the East and Central African sub-

region to contribute effectively to the development of the science of Natural Products. More specifically, in its current stage the network is looking for the identification of medicinal plants in the region, the digitalization of herbaria, the collection of information on infectious desease and on plants used in the traditional medicine for their treatment, collection of ethno-botanical and pharmacological, chemical information on medicinal plants and the creation of surveillance network on infectious diseases.

Sustaining the research and grid computing the research and grid computing components of the University of Nigeria's Unesco-HP brain gain project

Started in December 2010, this project consists in connecting with Africans in Diaspora in conducting plant tissue culture experiments that will entail the use of grid computing techniques. Final year undergraduate students, postgraduate students, lecturers from the participating universities and other affiliate agricultural institutions will compose the beneficiary community in South Eastern Nigeria. Other potential application areas/ actual spillovers are the development of biotechnology modules related to research techniques in mushroom, cassava and other local staples production.

Distance learning and tele-mentoring in surgery

Started in 2001, under the auspices of the UNESCO-HP Reversing Brain Drain to Brain Gain Initiative the project combine e-Learning and e-Health related activities. The main activities, in fact, are the development of distance learning in surgery, first between northern developed countries and Sénégal and second, between University hospital and rural hospitals. The two related activities are to train the residents who attend the programme of general surgery in video surgery, and to develop a project of e-Learning and tele-expertise in two rural hospitals in the middle west of Sénégal. The target of the project is composed by: surgeons, residents, students and nurses.

3.2.   *Foresight Study Report*

All projects under analysis share the goal of radically overcoming a serious lack of infrastructures and services in the macro-regions of Africa. However, as shown in Figure 3 progress is being rapidly made to connect African countries to each other and to the world. The projects, indeed, reflect the complexity of the relationship between new technologies, new skills needed and deployment of innovative services. With reference to the single application domains, one can observe the emphasis on e-Learning and in particular on the need for interoperability and scalability of systems and of technological upgrading. Of great relevance also is the attention to e-Government-related services, which are interpreted as instruments for participative democracy and self-reliance. All projects have a high degree of complexity and are in fact multi-tasking and multi-scope. This clearly increases the need for appropriate governance (and management) models and the acquisition of new capabilities and skills for the institutions working in those projects.

The analysis of the case studies clearly shows this above-mentioned multidimensional character of the projects. In the interviews the growing need for knowledge-related, economic and social resources emerged unquestionably. The main uncertainty arises in particular when taking into consideration mid and long term financial sustainability and the need for networking actions and support. Beside the financial sustainability, in fact, the social dimension of connecting researchers across African countries and with research communities at world level becomes a paramount factor for the success and uptake of innovation projects in Africa.
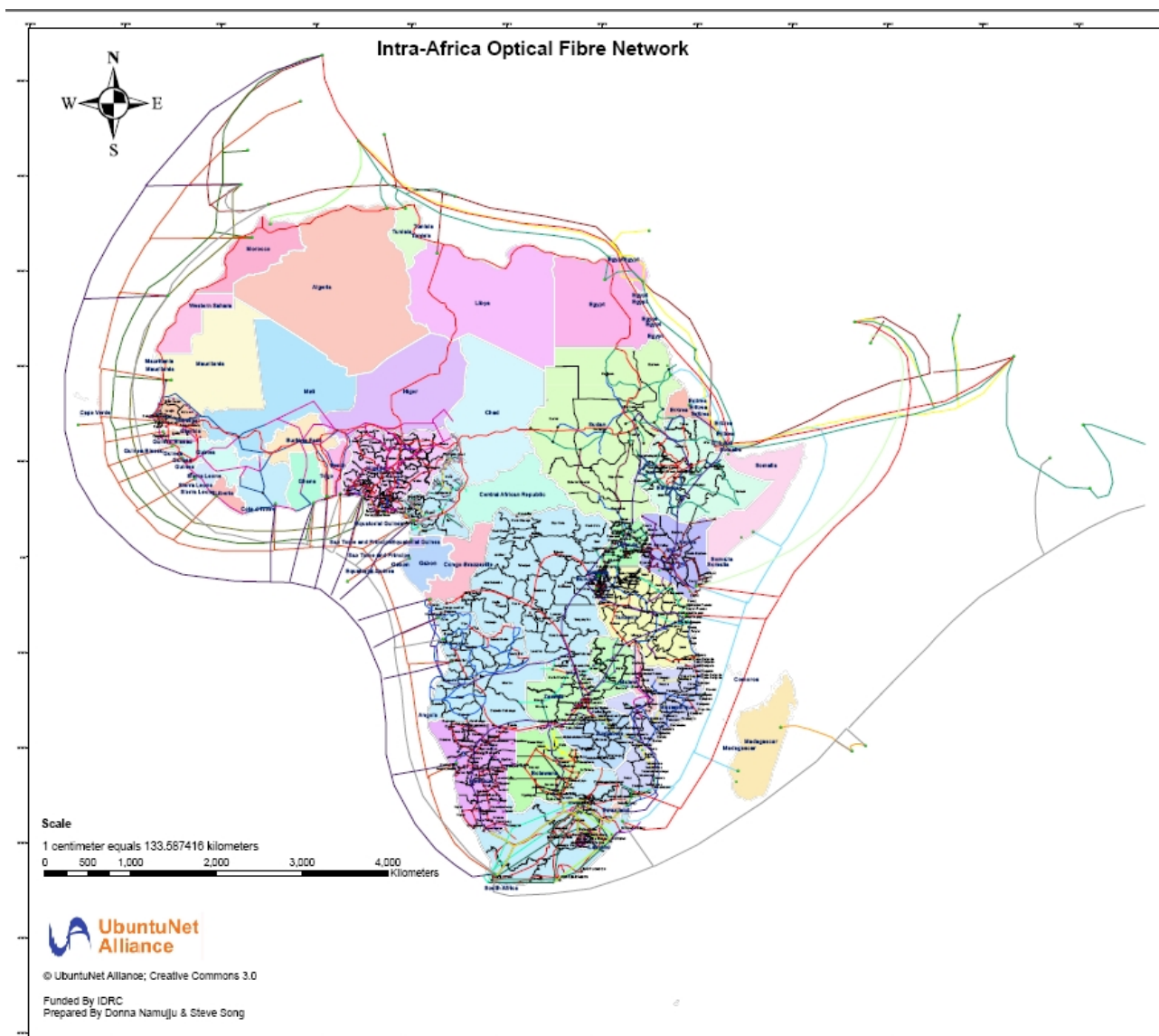
Figure 3 Infra-Africa Optical Fibre Network[6]

The Foresight Study Report discusses in detail the results from the analyses: the domain and geographical coverage, funding arrangements, benefits and beneficiaries, social impact, environmental impact, technological impact, economic impact, and benefits with connecting to e-Infrastructures. Figure 4 shows the coverage of our identified projects in 23 Africa countries and confirms that there is significant interest in e-Infrastructures across Africa. The results clearly indicate the potential of developing e-Infrastructure applications in the areas of our study, i.e. why should European and African countries invest in developing e-Infrastructures in Africa and connecting the already-existing research centres with European and world e-Infrastructures?

We know that e-Infrastructures radically change the way research is conducted, overcoming distance to support a growing multitude of virtual research communities across the globe and most of the researchers would see their research or work programmes impaired if the e-Infrastructures did not exist.

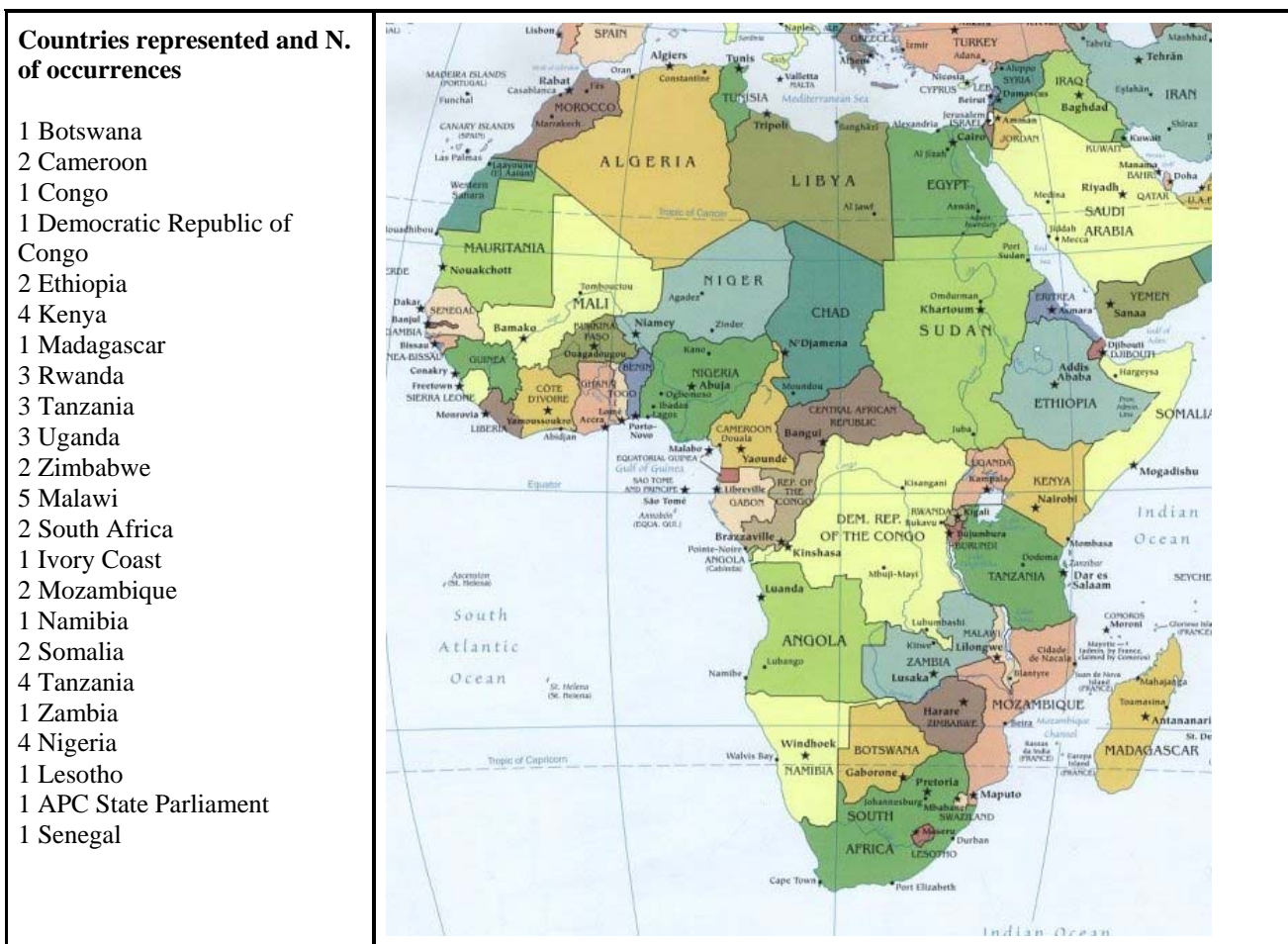[6] For a better view of the map a pdf version can be downloaded from www.ubuntunet.net/fibre-map

Countries represented and N. of occurrences	
1 Botswana	
2 Cameroon	
1 Congo	
1 Democratic Republic of Congo	
2 Ethiopia	
4 Kenya	
1 Madagascar	
3 Rwanda	
3 Tanzania	
3 Uganda	
2 Zimbabwe	
5 Malawi	
2 South Africa	
1 Ivory Coast	
2 Mozambique	
1 Namibia	
2 Somalia	
4 Tanzania	
1 Zambia	
4 Nigeria	
1 Lesotho	
1 APC State Parliament	
1 Senegal	

Figure 4 - Countries represented in the analysed projects

While the investment in Europe in e-Infrastructures has been mainly technology-driven and advanced by scientists involved in Grid computing and the funding bodies behind them, in Africa there is more interest towards the direct impact on society and the growth and increased access to fundamental services for the population (i.e. Health services and education). e-Infrastructures in Africa have to aim at identifying applications that create impact in the country's economic value, this will make policy makers at national level support and sustain the investment and advance use of e-Infrastructures. We have identified four main categories of benefits: sharing of information and access to research-related resources, skills and capacity building, connectivity and ICT technologies and extended cooperation. The foresight study concluded with the overall recommendations of ERINA4Africa. ERINA4Africa has identified the vast potential for future developments in the three domains under study. The analyses of the case studies, early adopters of advanced ICT technologies, have shown how e-Infrastructures can empower projects to better perform their activities and achieve and enlarge their objectives. To fully release the potential, ERINA4Africa addresses to the EC and Member States the following recommendations:

Build a Human Infrastructure as well as a Technological one
Identify and support targeted communication activities involving multidisciplinary audiences, focusing on the establishment of specific e-Infrastructures. It was noted that those approached were not fully aware of the opportunities offered by e-Infrastructures not only in term of funding, but also and especially in term of best practices, technology availability and expertise. Linking and reaching out to user communities, funding agencies, universities, decision makers, government, hospitals,

scientific communities etc. can bring an early engagement of communities and help build knowledge and solutions with a focus on supporting social and economically sustainable growth.

Sustain a programme for promoting and implementing Lighthouse Demonstrators.
The planning of e-Infrastructures for new virtual research communities should start immediately to become available as AfricaConnect improves connectivity. The case studies analysed by ERINA4Africa can all be turned into Lighthouse demonstrators. These are early adopters of e-Infrastructures or e-Infrastructure-related technologies in Africa which create a showcase to fully demonstrate the impact and benefits of the adoption of advanced technologies in the three information society key areas (e-Health, e-Government, e-Learning).

Euro-Africa twinning and partnerships
Encourage established European and emerging African e-Infrastructures communities to organise co-operation, e.g. by exchange of researchers, experiences and plans, peer review of proposals, etc, similar to the twinning between established and emerging NRENs organised by TERENA[7].

3.3.   Conclusion

This task analysed the data collected in the Data Collection and Analysis report from a qualitative and quantitative point of view. It extracted selected best practices for the EU and African community and performed, on a set of case studies, an impact analysis of the adoption of e-Infrastructures in the domains of e-Health, e-Government and e-Learning in Africa. The deliverables from this task are available from the project website (www.erina4africa.eu).

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[7] http://www.terena.org/

4.   Dissemination and Networking

The objective of this task was to provide and support a sound communication platform for the dissemination, exchange of knowledge and cross-fertilization among projects, initiatives and organizations. This task also involved liaising and synergizing with related projects and initiatives to build a community of key actors in the innovation process and to promote the results of the ERINA4Africa study, as well as involving as much actors as possible in the study definition. The main outcomes of this task were:

- ERINA4Africa Workshops (D3.1)
- ERINA4Africa Community Database (D3.2.1/.2)
- Dissemination Plan (D3.3)
- Final ERINA4Africa Conference (D3.4)

The results of the main activities of this are detailed below. The details of the ERINA4Africa Community Database and Dissemination Plan can be found on the project website (www.erina4africa.eu).

4.1.   The ERINA4Africa Workshops

Two well attended workshops were run during the ERINA4Africa project.

- *Investigating Best Practices for e-Infrastructure Application Development*, Kigali, Rwanda, 21 April 2010
- *Investigating African e-Infrastructure Applications of the Future*, Lilongwe, Malawi, 6/7 October 2010.

Overview of First Workshop, Kigali, Rwanda, 21 April 2010

The aim of the first workshop was:

> The use of advanced distributed computing techniques and technologies are revolutionising many different fields such as e-Health, e-Learning and e-Government. The e-Infrastructures are enabling the realisation of truly global virtual research communities and have led to significant advances across the world. The Exploiting Research Infrastructures Potential for Boosting Research and Innovation in Africa (ERINA4Africa) initiative aims to identify existing and planned exemplars of such advances in an Africa context. Building on results of the ERINA and FEAST studies, ERINA4Africa is investigating key best practices and barriers to realisation of contemporary and future e-Infrastructure-based applications. This workshop gives attendees the opportunity to brainstorm interim results and observations from the project.

The workshop was held in at the Aberdeen House Hotel held in Kigali, Rwanda on 21 April 2010 and had an exciting programme of events. The day was officially opened by the Honourable Minister of Education Dr Charles Murigande. The Minister, who came with his Principal Secretary, took a lively interest in the event. After a succinct introduction on the purpose of the workshop by ERINA4Africa coordinator, Dr Simon Taylor via ISABEL, presentations were made around the three broad areas of ERINA4Africa: e-Health, e-Governance and e-Learning. The Workshop

concluded with in depth discussion in three groups and concluded with a roundup brainstorming session .

Unfortunately the European consortium members were prevented from attending by the Icelandic volcanic ash cloud that sporadically interrupted air travel across Europe at that time. However, the use of the EUFP7 Global ISABEL interactive video conferencing system assisted in uniting the Rwanda and European participants until the submarine cable was severed around midday in mid ocean. This took several weeks to be reconnected, bringing much of east and southern Africa connectivity to a grinding halt. Despite this ISABEL did however give an excellent illustration of how e-Infrastructures could support global virtual communities between Europe and Africa in practice.

Use of the ISABEL system permitted an interactive start to the meeting and Dr Taylor's introduction and the first two presentations were videostreamed and accessible at www.globalproject.org. All presentations are available at www.erina4africa.eu and at http://globalplaza.org/spaces/_global/events/kigali-meeting. There were approximately 37 local participants from 12 African countries and 6 European participants were virtually present during the period that the GLOBAL link was functioning. While functioning the ISABEL system demonstrated how a global virtual research community between Europe and Africa could work in practice.

Overview of Second Workshop, Lilongwe, Malawi, 6/7 October 2010

The workshop was introduced as follows:

> e-Infrastructures enable research environments in which researchers globally collaborate and have shared access to scientific facilities (data, communications, computing and instruments). The coming of the first fibre cables to East Africa in 2009 presented enhanced opportunities for enhanced harnessing of e-Infrastructures in sub-Saharan African region in a way that was not possible when VSAT was the main means of connectivity. The AfricaConnect initiative will enhance the development of these e-Infrastructures in the countries where it is implemented and also more broadly through their interconnection to the Global REN community. Once AfricaConnect is fully realised, what will be the major scientific applications that will use the network? The "Exploiting Research Infrastructures potential for boosting research and iNnovation in Africa" (ERINA4Africa) project is investigating these applications. This workshop presents the opportunity to discuss this question and to outline the high priority applications of the future that urgently need to be developed.

The 2nd ERINA4Africa Workshop 'Investigating African e-Infrastructure Applications of the Future' was held in Lilongwe, Malawi on the 6th and 7th October 2010 and was attended by over 70 participants. Day one was held at Kumbali Lodge and Day two at Kamuzu Nursing College, University of Malawi. *Facilitated by a pioneering three-party high-definition video-conference session, medical experts at university hospitals in Malawi, Rwanda and Sweden discussed regional differences in treatment of portal hypertension and shared documents in real-time across continents* (Figure 5). This clearly demonstrated the potential of what advanced ICT support called e-Infrastructures can deliver to Africa. The future of these technologies was also discussed in the workshop and addressed issues including digitization of research data, malaria research, secure drug distribution, e-Health, e-Learning, e-Government and other advanced e-Applications.

Figure 5: Pioneering three-party high-definition video-conference session, medical experts at university hospitals in Malawi, Rwanda and Sweden discuss regional differences in treatment of portal hypertension and shared documents in real-time across continents

The connectivity during the workshop in Malawi to support the e-Infrastructure video-conference was provided by courtesy of the incumbent Malawi telecom operator (MTL) via a temporary terrestrial microwave link to Dar es Salaam and a not yet commissioned link in the EASSy cable. The connectivity in Rwanda was provided by the Rwanda REN, Rwednet, connected via the SEACOM cable. The connectivity in Europe was provided by CARENET, a research network for e-Health applications connected to the European REN backbone, GÉANT that is also connected to the emerging regional REN backbone in Southern and Eastern Africa, UbuntuNet.

The workshop was an opportunity to discover e-Infrastructures and their applications, to network with those interested in application development and to outline the high priority e-applications of the future that urgently need to be effectively designed and developed. The theme of the first day centred around brainstorming these issues and took place at Kumbali Lodge with the guest of honour James Kalilangwe, Principal Secretary in the Ministry of Information and Civic Education. A second day gave attendees the opportunity to see demonstrations and presentations of potential e-Infrastructure applications. This was held at the University of Malawi, Kamuzu College of Nursing and was kindly opened by the Principal of KCN, Dr. Address Malata.

In conclusion, discussions during the brainstorming were extremely lively and positive evaluation was received from participants. It must be recognised that the sheer constraints that have been experienced in the region because of the very limited bandwidth access have greatly limited opportunities for application development. The timing of the meeting is crucial as the fibre is being laid and people can begin to conceptualise a bright new future where ICT applications are not

defined by bandwidth constraints. Figures 6 and 7 summarise the findings of the brainstorming sessions. Figure 6 shows the results of the applications and opportunities discussion and figure 7 shows the outcomes of the challenges discussion.

Figure 6: Applications and Opportunities

Figure 7: Challenges

The results of both workshops can be found in D3.1 Workshops Evaluation Report.

4.2.   The Final ERINA4Africa Conference

The ERINA4Africa Final Conference took place on the 9th & 10th December 2011 at the Scandic Marina Congress Centre, Helsinki, Finland within the framework of the 2010 Euro-Africa Week on ICT Research & e-Infrastructures. The ERINA4Africa consortium decided to co-locate the final conference with this event in order to synergise resources and at the same time to maximise the final conference impact and results.

Attended by over 190 participants, the conference opened with a networking event followed by a session of key presentations and a panel of experts. It aimed at presenting and promoting the results of the project's study and focussed on the questions on how existing EU and Sub-Saharan Africa e-Infrastructure links should evolve in a way that will bring benefits to African development and to the e-Infrastructure cooperation between both regions.

Reports on key presentations and outcomes from the Roundtable Discussion can be found in *D3.4 Final Conference Proceedings*. The conference agenda and full presentations from the conference can be found on the ERINA4Africa Website (www.erina4africa.eu/events/conference-1/programme). The organisers wish to thank the eI-Africa consortium for their kind and enthusiastic support.

4.3.   Conclusions

The objective of this task was to provide and support a sound communication platform for the dissemination, exchange of knowledge and cross-fertilization among projects, initiatives and organizations. Three events were successfully delivered and a new community established. Details of these initiatives can be found on the project website ((www.erina4africa.eu).

5.   Recommendations and Impact

5.1.   Recommendations

The key recommendations of this project are the need for a Euro-African 'human infrastructure' and the identification of the 15 candidate lighthouse demonstrator projects. These reflect the currently most important 'ambassadors' or 'islands of innovation' to facilitate the development of effective e-Infrastructures supporting European-African collaboration. ERINA4Africa has identified the vast potential for future developments in the three domains under study. The analyses of the case studies, early adopters of advanced ICT technologies, have shown how e-Infrastructures can empower projects to better perform their activities and achieve and enlarge their objectives. We also recognise that e-Infrastructure development is 'socially constructed' and not just the result of technological collaboration. It is vital that developers understand the subtleties of the African scene and to incorporate these for effective application deployment. It is also clear that high performance networking is making advances in Africa. However, developers should not adopt a 'wait and see' attitude. There is much work to be done. Prototypes can be conceptualised and designed for a changing bandwidth environment (using local computing resources, making available data/literature/research sources locally, etc). Further, the e-Infrastructures 'message' needs to be spread effectively and in a coordinated manner.

There are important lessons to be learnt from other regions. In Latin America, for example, with European support, ALICE and RedCLARA have successfully developed a Latin American NREN infrastructure connected to Europe. Building on this, EELA[8] has linked the e-Infrastructure initiatives in Europe with Latin America NRENs by creating a collaborative network and interoperable Grid infrastructure capable of supporting biochemical research. EELA has either made it possible for Latin American scientists to participate in global science. Importantly EELA has created strategies for scientists from low bandwidth environments to adapt ICT for local Grid support or to alternative strategies to connect to the global Grid. The Wide In-Silico Docking of Malaria (WISDOM) programme is an excellent example of this. In Europe, the Enterprise Desktop Grid Initiative (EDGI)[9] have developed low maintenance desktop grid middleware based on BOINC that can further these goals by exploiting local desktop PC resources in a scalable, EGI-compatible, manner.

RedCLARA has also made possible an ambitious e-Health project in Brazil. The Brazilian Telehealth initiative operates video- and web- conferencing, diagnosis and consultation, and education links university and teaching hospitals via the RNP (Rede Nacional de Ensino e Pesquisa), Brazil's NREN. It supports two significant national e-Health projects: The Telemedicine University Network (RUTE[10]) (Science and Technology Ministry) and the National Telehealth Primary Care Program (Brazil Telehealth[11]) (Health Ministry). Coordination and collaboration is across municipal, state, national and international health institutions with projects in research, innovation, development, management, education and assistance. In places Brazilian communication networks are reaching a very sophisticated state, although countrywide bandwidth is mixed. Even so, the programme includes all Brazilian University Hospitals and is rolling out across all public certified teaching Hospitals, federal health institutions and the federal indigenous

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[8]   www.eu-eela.org
[9]   www.edgi-project.eu
[10]   www.rute.rnp.br
[11]   www.telessaudebrasil.org.br

health departments. The management of this is world class and has important lessons not only for Africa but to the rest of the world.

Although the above examples are mainly e-Health, the implications for e-Learning and e-Government are clear. The development of African e-Infrastructures has much to learn from experiences in Latin America and India (ERNET[12] and GARUDA[13]).   The leadership role of NRENs and NREN associations is critical in liaising between communication network development and Grid infrastructure development as well as between stakeholders and government policy. These have clear implications for UbuntuNet and WACREN. A further point is that worldwide it appears that 'traditionally' network infrastructure is the province of NREN bodies and Grid infrastructure is the province of different but collaborating organisation bodies (GEANT and EGI for example). As e-Infrastructures come to Africa, it might be suggested that the same administrative bodies address both areas given limited organisation (human) resources.

ERINA4Africa therefore addresses to the EC and Member States the following main recommendations:

Build a Human Infrastructure as well as a Technological one
Identify and support targeted communication activities involving multidisciplinary audiences, focusing on the establishment of specific e-Infrastructures and applications. It was noted that those approached were not fully aware of the opportunities offered by e-Infrastructures not only in term of funding, but also and especially in term of best practices, technology availability and expertise. Linking and reaching out to user communities, funding agencies, universities, decision makers, government, hospitals, scientific communities etc. can bring an early engagement of communities and help build knowledge and solutions with a focus on supporting social and economically sustainable growth. In many cases , the data repositories created in a specific e-infrastructure would be of public interest and provide important contributions to the general soft infrastructure of the societies in which they are created.

Sustain a programme for promoting and implementing Lighthouse Demonstrators.
The planning of e-Infrastructures for new virtual research communities should start immediately to become available as AfricaConnect improves connectivity. The case studies analysed by ERINA4Africa can all be turned into Lighthouse Demonstrators. These are early adopters of e-Infrastructures or e-Infrastructure-related technologies in Africa which create a showcase to fully demonstrate the impact and benefits of the adoption of advanced technologies in the three information society key areas (e-Health, e-Government, e-Learning) and will act as a draw to e-Science. Unless support is provided to formulate project proposals in response to coming EU Calls, there is a risk that the groups behind several of the identified cases will not be submitted due to lack of know-how to formulate competitive proposals.

Euro-Africa twinning and partnerships
Encourage established European and emerging African e-Infrastructures communities to organise co-operation, e.g. by exchange of researchers, experiences and plans, peer review of proposals, etc, similar to the 'twinning' between established and emerging NRENs organised by TERENA[14]. It is suggested that medium-to-large collaborations of beneficiaries be organized on the basis of peer-to-peer twinned partnerships to develop and sustain collaborations.

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[12]   www.eis.ernet.in
[13]   www.garudaindia.in
[14]   www.terena.org/

It is strongly suggested that these recommendations be implemented through a targeted Coordination/Support Action that builds on the experiences of this project, BELIEF[15] (Bringing Europe's eLectronic Infrastructures to Expanding Frontiers), eI-Africa[16] and the EURO-AFRICA ICT[17] Cooperation Forums.

5.2. *Impact*

The impact of ERINA4Africa has been to strengthen the development of the European and African policy for research infrastructures and has contributed to the specific needs for international cooperation in this field by a combination of the foresight study, the virtual observatory and a series of well attended events. Specifically ERINA4Africa's impact has been to provide African and EU policy makers with a detailed analysis of exploitability scenarios of existing (and proposed) e-Infrastructures in Africa with the identification of a series of potential technological innovation targets, the so-called **lighthouse demonstrators**. To encourage the coordination between National and pan-European e-Infrastructure initiatives such as Africa Connect, this project has provided measures and evidence that will influence the future picture of global multidisciplinary ICT infrastructures with respect to the implementation of the European vision and has reported to relevant policy groups in the area. ERINA4Africa has successfully supported this by fostering cooperation between the **EU and Africa with a win-win perspective:** Africa will benefit from developing Research Infrastructure policies based on EU experiences and best practices, whilst the EU will benefit by disseminating and demonstrating on-the-field benefits and experiences in e-Infrastructure development in key IST areas where public funding is relevant: **e-Government, e-Health and e-Learning.** This project has promoted international interoperation between similar infrastructures with the aim of reinforcing the global relevance and impact of European e-Infrastructures by sharing development experience in international workshops. ERINA4Africa has also for the first time created an **international community of EU and African stakeholders** enabled through the virtual observatory and website. The project has already made a concrete impact by demonstrating how low-cost video conferencing can be set up in Africa (during the second ERINA4Africa workshop in Lilongwe, Malawi that created a video conference for clinicians between Malawi, Rwanda and Sweden).

Overall, the ERINA4Africa results are essentially in two directions: i) identifying concrete opportunities for adoption of e-Infrastructures in other fields complementary to e-Science, and ii) proposing a set of recommendations for realization. It has been clearly shown that the exploitation of existing and planned ICT infrastructures can benefit African citizens and that collaboration between Europe and Africa to develop these will have a reciprocal benefit to European citizens and member states by considering innovative uses of ICT (in particular mobile technology).

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[15] www.beliefproject.org
[16] www.eI-Africa.eu
[17] www.euroafrica-ict.org

6. Final Report Summary

This final report has summarised the main results, recommendations and impact from ERINA4Africa and its activities (e-Infrastructure Ecosystem Mapping, Quantitative and Qualitative Analysis and Dissemination and Networking).

Note that all deliverables can be freely downloaded from the ERINA4Africa website (www.erina4africa.eu).

7. Use and Dissemination of Foreground

Section A (public)

The planned dissemination activities are:

- Continued updates on website to reflect follow on activities
- Dissemination of ERINA4Africa Flyers to key people/organisations as described in D3.3 Dissemination Report
- Press releases on project results to key people/organisations as described in D3.3 Dissemination Report as well as newsletters such as iGSTW, NUANCE, and ICT4D
- Presentation of project results at IST-Africa 2011
- Future EURO-AFRICA ICT Meetings
- Flyer on Malawi Videoconference 'story' for the European Commission

One scientific publication has been submitted to IEEE Transactions on Information Technology in Biomedicine. Others are planned and in preparation. The first of these will be targeted at IEEE Computer.

	TEMPLATE A: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES									
NO.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers[18] (if available)	Is/Will open access[19] provided to this publication?
1	*e-Health in Africa: Can African NRENs Make a Difference?*	*SJE Taylor*	*IEEE T-ITB*	*Submitted*	*IEEE*	*NA*	*NA*	*NA*	NA	TBA
2										

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[18] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

[19] Open Access is defined as free of charge access for anyone via the internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

Section B (confidential)

The applications for patents, trademarks, registered designs, etc. shall be listed according to the template B1 provided hereafter.

The list should, specify at least one unique identifier e.g. European Patent application reference. For patent applications, only if applicable, contributions to standards should be specified.

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.			
Type of IP Rights: Patents, Trademarks, Registered designs, Utility models, etc.	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)
NA			

Please complete the table hereafter:

TEMPLATE B2: OVERVIEW TABLE WITH EXPLOITABLE FOREGROUND					
Exploitable Foreground (description)	**Exploitable product(s) or measure(s)**	**Sector(s) of application**	**Timetable, commercial use**	**Patents or other IPR exploitation (licences)**	**Owner & Other Beneficiary(s) involved**
NA					

8. Report on Societal Implications

Replies to the following questions will assist the European Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

Grant Agreement number: 246663

Project acronym: ERINA4AFRICA

Project title: EXPLOITING RESEARCH INFRASTRUCTURES POTENTIAL FOR BOOSTING RESEARCH AND INNOVATION IN AFRICA

Funding Scheme: FP7-INFRASTRUCTURES-2009-3.3

A General Information *(completed automatically when **Grant Agreement number** is entered.*

Grant Agreement Number:	246663
Title of Project:	Exploiting Research Infrastructures Potential for Boosting Research and Innovation in Africa
Name and Title of Coordinator:	Dr Simon J E Taylor

B Ethics

		O	**Yes**
1.	**Did you have ethicists or others with specific experience of ethical issues involved in the project?**	X	**No**
2. Please indicate whether your project involved any of the following issues (tick box) :			*YES*
INFORMED CONSENT			
• Did the project involve children?			
• Did the project involve patients or persons not able to give consent?			
• Did the project involve adult healthy volunteers?			
• Did the project involve Human Genetic Material?			
• Did the project involve Human biological samples?			
• Did the project involve Human data collection?			
RESEARCH ON HUMAN EMBRYO/FOETUS			
• Did the project involve Human Embryos?			
• Did the project involve Human Foetal Tissue / Cells?			
• Did the project involve Human Embryonic Stem Cells?			
PRIVACY			
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)			
• Did the project involve tracking the location or observation of people?			
RESEARCH ON ANIMALS			
• Did the project involve research on animals?			
• Were those animals transgenic small laboratory animals?			

• Were those animals transgenic farm animals?	
• Were those animals cloning farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Use of local resources (genetic, animal, plant etc)	
• Benefit to local community (capacity building ie access to healthcare, education etc)	**YES**
DUAL USE	
• Research having potential military / terrorist application	

C Workforce Statistics

3 Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator		1
Work package leader	2	2
Experienced researcher (i.e. PhD holders)	3	5
PhD Students		1
Other	2	1

4 How many additional researchers (in companies and universities) were recruited specifically for this project?	
Of which, indicate the number of men:	0
Of which, indicate the number of women:	0

D   Gender Aspects

5	**Did you carry out specific Gender Equality Actions under the project** ?	O X	Yes No

6   Which of the following actions did you carry out and how effective were they?

		Not at all effective				Very effective
❏	Design and implement an equal opportunity policy	O	O	O	O	O
❏	Set targets to achieve a gender balance in the workforce	O	O	O	O	O
❏	Organise conferences and workshops on gender	O	O	O	O	O
❏	Actions to improve work-life balance	O	O	O	O	O
O	Other:					

7   Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

O   Yes- please specify

X   No

E   Synergies with Science Education

8   Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

O   Yes- please specify

X   No

9   Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

O   Yes- please specify

X   No

F   Interdisciplinarity

10   Which disciplines (see list below) are involved in your project?

1.1   Main discipline[20]:

3.3   Associated discipline[20]:   5.3   Associated discipline[20]:

G   Engaging with Civil society and policy makers

11a	**Did your project engage with societal actors beyond the research community?** *(if 'No', go to Question 14)*	X O	Yes No

11b   If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

O   No

X   Yes- in determining what research should be performed

X   Yes - in implementing the research

X   Yes, in communicating /disseminating / using the results of the project

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[20] Insert number from list below (Frascati Manual)

11c	**In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?**	O O	Yes No

12	**Did you engage with government / public bodies or policy makers (including international organisations)**

	O	No
	X	Yes- in framing the research agenda
	X	Yes - in implementing the research agenda
	X	Yes, in communicating /disseminating / using the results of the project

13a   Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

	X	Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
	O	Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
	O	No

13b If Yes, in which fields?

Field		Field		Field	
Agriculture		Energy	X	Human rights	
Audiovisual and Media		Enlargement		Information Society	X
Budget		Enterprise	X	Institutional affairs	
Competition		Environment	X	Internal Market	
Consumers		External Relations		Justice, freedom and security	
Culture		External Trade		Public Health	X
Customs		Fisheries and Maritime Affairs		Regional Policy	X
Development Economic and Monetary Affairs		Food Safety		Research and Innovation	X
Education, Training, Youth	X	Foreign and Security Policy		Space	
Employment and Social Affairs		Fraud		Taxation	
		Humanitarian aid		Transport	

13c   If Yes, at which level?

	X	Local / regional levels
	X	National level
	X	European level
	X	International level

H   Use and dissemination

14	How many Articles were published/accepted for publication in peer-reviewed journals?	0
To how many of these is open access[21] provided?		
How many of these are published in open access journals?		
How many of these are published in open repositories?		
To how many of these is open access not provided?		
Please check all applicable reasons for not providing open access:		
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other: ……………		

15	How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		0
16	Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	0
		Registered design	0
		Other	0

17	How many spin-off companies were created / are planned as a direct result of the project?	0
	Indicate the approximate number of additional jobs in these companies:	

18   Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑	Increase in employment, or	❑	In small & medium-sized enterprises	
❑	Safeguard employment, or	❑	In large companies	
❑	Decrease in employment,	❑	None of the above / not relevant to the project	
X	Difficult to estimate / not possible to quantify	❑		

19 For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:*
Difficult to estimate / not possible to quantify	X

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[21] Open Access is defined as free of charge access for anyone via the internet.

I   Media and Communication to the general public

20   **As part of the project, were any of the beneficiaries professionals in communication or media relations?**

    ○ Yes   X No

21   **As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?**

    ○ Yes   X No

22   **Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?**

X	Press Release	X	Coverage in specialist press
X	Media briefing	❑	Coverage in general (non-specialist) press
❑	TV coverage / report	❑	Coverage in national press
X	Radio coverage / report	❑	Coverage in international press
X	Brochures /posters / flyers	X	Website for the general public / internet
❑	DVD /Film /Multimedia	X	Event targeting general public (festival, conference, exhibition, science café)

23   **In which languages are the information products for the general public produced?**

❑	Language of the coordinator	X	English
❑	Other language(s)		

Question F-10: Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1.   NATURAL SCIENCES
1.1   Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]
1.2   Physical sciences (astronomy and space sciences, physics and other allied subjects)
1.3   Chemical sciences (chemistry, other allied subjects)
1.4   Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)
1.5   Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2   ENGINEERING AND TECHNOLOGY
2.1   Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)
2.2   Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]
2.3.   Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3.   MEDICAL SCIENCES

3.1   Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2   Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3   Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4.   AGRICULTURAL SCIENCES

4.1   Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2   Veterinary medicine

5.   SOCIAL SCIENCES

5.1   Psychology

5.2   Economics

5.3   Educational sciences (education and training and other allied subjects)

5.4   Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6.   HUMANITIES

6.1   History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2   Languages and literature (ancient and modern)

6.3   Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group] .