PIDA

The Programme for Infrastructure Development in Africa:
Transforming Africa through Modern Infrastructure

Programme for Infrastructure Development in Africa

Interconnecting, integrating and transforming a continent

AFRICAN UNION
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Africa Information and Communications Technology Sector
Phase III Report

ICT Sector Report

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

AEO	Africa Economic Outlook
AfDB	African Development Bank
AICD	African Infrastructure Country Diagnostic
ATU	African Telecommunication Union
AU	African Union
AUC	African Union Commission
AWF	African Water Facility
BPO	Business Process Outsourcing
CAB	Central African Backbone
CEN-SAD	Community of Sahel-Saharan States
COMESA	Common Market for Eastern and Southern Africa
CR	Criticality Ratio
DSP	Public Service Delegation (Délégation de Service Public)
EAC	East African Community
EASSy	Eastern African Submarine Cable System
ECA	Economic Commission for Africa
ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EU	European Union
GDP	Gross Domestic Product
GIS:	Geographic Information System
HIPPSA	Harmonization of ICT Policies in Sub-Saharan Africa
IAIDA	Institutional Architecture for Infrastructure Development in Africa
ICT	Information and Communication Technology
IGAD	Intergovernmental Authority on Development
INX	Internet Node Exchange
IP	Internet Protocol
IPTV	Internet Protocol Television
ISP	Internet Service Provider
ITU	International Telecommunications Union
IXPs	Internet Exchange Points
MDG	Millennium Development Goals
MLTSF	Medium and Long Term Strategic Framework
MM	Man Months
NEPAD	New Partnership for Africa's Development
NPCA	NEPAD Planning and Coordinating Agency
NRA	National Regulatory Authorities
OF	Optical Fibre
OCPT	Office Congolais des Postes et Télécommunications (Congolese Postal and Telecommunications Office)
OPGW	Optical Power Ground Wire
PAP	Priority Action Plan
PAPU	Pan African Postal Union
PIDA	Programme for Infrastructure Development in Africa
PPP	Public Private Partnership
REC	Regional Economic Community
RIO	Reference Interconnection Offer
SADC	Southern Africa Development Community
SANE	South Africa, Algeria, Nigeria and Egypt

SATA	Sub-Saharan Africa Basic Network-Terrestrial Link
SLA	Service Level Agreement
SMP	Significant Market Power
TEAMS	The East African Marine System
UMA	Arab Maghreb Union
UN	United Nations
UNECA	United Nations Economic Commission for Africa
WACS	West African Cable System
WAEMU	West African Economic and Monetary Union
WAPP	West African Power Pool
WB	World Bank
WSIS	World Summit on Information Society

INTRODUCTION

The Program for Infrastructure Development in Africa (PIDA) was conceived out of the merger between continental sector policy studies and master plans of the African Union Commission (AUC) and those of the NEPAD Medium and Long Term Strategic Framework (MLTSF) under the execution of the African Development Bank.

It covers transport, energy, telecommunications and information technology and communication (ICT) and Trans-boundary water sectors addressing their regional and continental dimensions.

The importance of regional integration for supporting Africa's economic development has long been recognized by African leaders, who have consistently expressed their desire to build a common market for goods and services. PIDA's overall strategic objective aims at accelerating the regional integration of the continent and facilitating the creation of an African Regional Economic Community as planned by the Abuja Treaty. By improving access to integrated regional and continental infrastructure networks, PIDA will allow countries to meet forecast demand for infrastructure services and boost their competitiveness by:

- Increasing efficiencies
- Accelerating growth
- Facilitating integration in the world economy
- Improving living standards
- Unleashing intra-African trade.

The essential benefits of a regionally integrated approach to infrastructure development are to make possible the formation of large competitive markets instead of small, isolated and inefficient ones—and to lower costs across production sectors. Despite robust GDP gains by many countries in recent years, Africa's staggering infrastructure inefficiencies have been choking integration efforts, stunting growth and sapping public and private national resources.

This is the final PIDA ICT Report. It was drafted based on a consultative process, taking into account the conclusions of the Africa ICT Outlook 2030 (Phase I of the project) as well as the conclusions of the following workshops and meetings:

- The workshop on the ICT Sector Brief, held in Tunis on July 78, 2011
- The AUC/RECs Meeting held in Addis Ababa on September 12, 2011
- The regional workshops (Tripartite and IGAD) in Nairobi on September 30 and October 1st 2011, ECCAS in Libreville on October 3-4, 2011, ECOWAS in Yamoussoukro on October 13, 2011 and UMA in Rabat on October 27-28, 2011.

The overall goal of the report is to provide the context and explain the rationale for the proposed activities and identified projects. It provides also details of the following three key outputs:

- A strategic framework
- An infrastructure development program with a Priority Action Plan 2012-2020
- An implementation strategy and process

1. KEY FINDINGS – AFRICA ICT OUTLOOK 2030

Key Messages

• High speed broadband for everybody has become a top priority for all countries worldwide, not just Africa. National broadband plans are being implemented all over the world to help ensure that everyone has access to fast and affordable internet services.

• Africa has an opportunity to advance quickly to high-speed broadband because it has not made massive investments in old technologies, thereby giving itself the possibility to leapfrog to the latest technologies.

• Exploding bandwidth demand and requirements for 24/7 uptime requires that multiple international fibre links be available to every country across the continent.

• Much of the needed international fibre infrastructure is now in place in Africa but most of it is not competitively priced due to the continued dominance of incumbent operators along with the lack of access to fibre infrastructure on energy grids or that could be deployed on rail and road networks.

• Improving the policy and regulatory environment to encourage competition and open-access to existing international and national backbones, and to encourage the use of alternative infrastructure, is the main requirement for increasing broadband access.

• Funding will rely on strong and committed national leadership. According to study estimates, financing expected from domestic sources (public or private) may represent over 50% of total PIDA funding as soon as 2020. Official development assistance (ODA) will continue to play an important role, but these ODA resources will not be enough, and they should not be relied on solely for a coherent financing strategy. Countries will have to mobilize their own public and private domestic resources and attract foreign private investment. To attract private investment, there is a need for countries to ensure a competitive market based on clear legislation with enforcement of commercial law and transparency in procurement. Also needed are an enabling and regulatory environment along with more competitive markets and banking systems

• Due to the limited development of national and regional traffic exchange points, much domestic and regional broadband traffic is exchanged overseas, leading to poor network performance and millions of dollars in transit fees annually paid to foreign operator

1.1 Introduction

High-speed broadband has become the lifeblood of the knowledge economy, or as some have observed, the electricity of the 21st Century. In any case, access to high-speed broadband is fast becoming a human right as well as a significant contributor to economic growth[1].

The focus of this report is therefore to identify, at the regional level, any gaps in the requirements necessary to give every country in Africa sufficient access to this vital resource at the national and international levels, between countries within Africa and between African countries and the rest of the world.

The identification, definition and prioritization of the projects needed to ensure access to regional telecommunication infrastructure are the key output of this report, supported by a strategic infrastructure development framework and implementation strategy. These outputs are encompassed in a proposed Priority Action Plan (PAP).

Cross-border ICT backbone infrastructure project costs are relatively low[2], and in contrast to the other PIDA sectors, relatively profitable. Once enabling policy environments are more uniformly in place, much of the cost will be met by the private sector, or through Public-Private Partnerships.

Being less than 20 years old, the ICT sector is the 'new kid on the block' and its dynamics are less familiar, especially when combined with the general immaturity of bandwidth markets worldwide, rapidly evolving technical and business models, and the 'invisible' nature of ICT services and inputs. As a result, the PIDA ICT sector strategy must necessarily place greater emphasis on 'soft' capacity building projects to ensure enabling environments which provide efficient access to existing infrastructure and to attract more private and

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[1] The World Bank estimates an increase in GDP of 1-2% for a 10% increase in broadband penetration – see:
http://siteresources.worldbank.org/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/Resources/282822-1208273252769/Building_broadband.pdf
[2] The much larger capital costs lie in the rolling out of the national network and last mile to serve the customer

> ***The Worldwide Broadband Challenge:***
>
> ***Today's need is not just for "broadband", but for "high speed broadband"***
>
> Ensuring sufficient broadband development is a growing issue everywhere. Technology development in transmission networks and applications continues to result in an exploding demand for higher speed for Internet access. The broadband target moves ever forward and providers in some countries are already offering 1Gbps connections to the end-user in order to support applications such as multiple streams of High Definition TV over IP, cloud computing and real time simulation. As a result even the more advanced economies have established regional or national broadband development programs based on public and private sector funding, these initiatives include:
>
> • European union (27 Countries): Digital Agenda for Europe 2020 Strategy"
> • South Korea: National 1Gbps network for end-users by 2012
> • Japan: "e-Japan Priority Policy"
> • Singapore:"Next Generation National Broadband Network"
> • Australia: "National Broadband Network"
> • New Zealand: "Ultra Fast Broadband Initiative"
> • USA: "National Broadband Plan"
> • Canada: - CRTC National Broadband Policy
> • Brazil : Plano National de Banda Larga
> • Argentina: Argentina Conectada
> • Nigeria: Vision 2020

Figure 1: High speed internet: the 21st century challenge
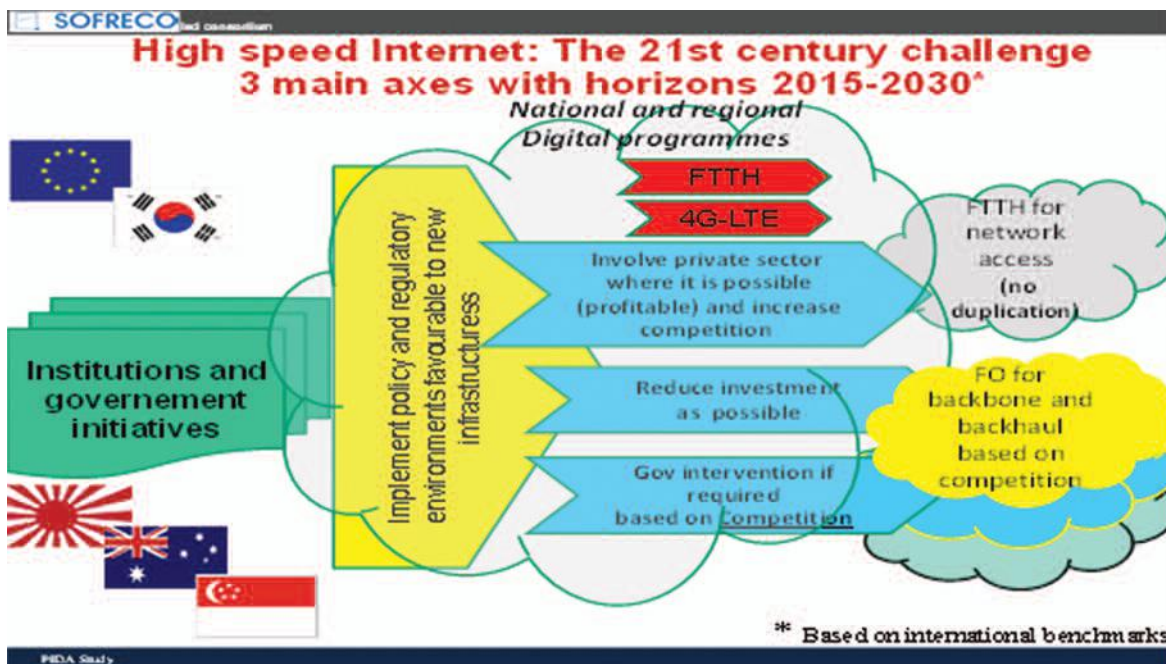
public investment in new infrastructure.

As highlighted in Figure 1 above, addressing infrastructure requirements to meet exploding broadband bandwidth demand is not a problem in Africa or in other developing country only. Worldwide, nations and providers are grappling with these issues. Network operators are still in the process of migrating from a voice-centric model to a broadband capacity model, and this affects the provision of infrastructure at every level - continental, regional, national and local. In this respect, it can be seen that the one key investment that will stand the test of time and is technology neutral, is the deployment of ducts and optical fibre.

As has been shown in the more advanced competitive markets in Europe, North America and Asia, each of the major national operators needs its own fibre pairs to manage its own network and compete effectively. Given that markets in Africa are only just really opening up, an open access or 'duct-centric' or rights-of-way policy approach to infrastructure deployment will allow new operators to have access to deploy their own fibre.

1.1.1 ICT infrastructure within the PIDA context

It is important to note that within the context of PIDA, ICT infrastructure development focuses on regional *physical infrastructure* involving co-operation from two countries or more. Domestic infrastructure and related national projects are of course a vital part of overall ICT strategies, but are not considered to be directly part of the PIDA infrastructure unless they are part of the regional infrastructure to build or to renovate (see ToRs). In addition, for PIDA purposes, continental or regional infrastructure is mainly comprised of optic fibre, and ducts or conduit which can support the transport of high volumes of traffic.

Definition of PIDA regional ICT infrastructure

Regional infrastructure consists of passive optical fibre links and ducts providing connectivity (*) between nations to enable improved broadband connectivity for African governments, businesses and consumers. This infrastructure currently consists of:

• Infrastructure of the incumbent or public (state-owned) operators
• Infrastructure of the private sector operators
• Other state-owned infrastructure companies
• Fibre or conduit infrastructure of other sectors such as transport and energy, often called 'alternative infrastructure' or complementary infrastructure

Regional infrastructure can be:

• A link from a point of interconnection at a submarine cable landing station.
• A national backbone, which provides inter-connectivity with the infrastructure of other countries.
• A "missing" element within existing national infrastructure which, when complete, can provide access to international, regional or intercontinental infrastructure.

In order to ensure low costs on regional infrastructure, the latter is usually accompanied by:

• A passive interconnection point where operators can physically interconnect the components of their infrastructure to each other or to regional infrastructure.
• Collocation rooms located along the cable for use by operators to house their optical amplifiers or other active elements required for transmission.
• A reference interconnect document providing the technical details and tariffs for the use of the infrastructure.

(*) Active components are not being considered

1.2 Overview of the Existing ICT Environment in Africa

1.2.1 Policy and institutional frameworks

ICT Policy and regulatory harmonization
The pattern of land-based infrastructure distribution in Africa is largely a reflection of the policy and regulatory environment in place in the various countries. The key features of the existing policy and institutional frameworks in Africa are:

● At the continental level, a set of broad ICT goals, strategies, policies and regulations proposed by the African Union (AU) for adoption by RECs and Member States. While there are broad similarities in the types and status of the different REC's Information and Communication Technologies (ICT) policies and regulations, there are some significant variations in priorities and institutional decision-making processes, which are usually the result of the specific political and socio-economic conditions of the Member States in each REC.

● At the regional level, a set of regional ICT policy and regulatory guidelines adopted by RECs and their Member States. The national transposition of REC-wide policies and regulations is supported in each REC by regional associations of national regulators. The level of national transposition and enforcement of REC policies varies considerably between RECs because some have stronger legal instruments for enforcing national transposition of regional decisions. In addition, many countries in Africa are members of more than one REC, so this can present some conflicting issues and overlaps. Landlocked countries are especially vulnerable to

this lack of harmonization – the critical need for low-cost international access is dependent on their neighbouring country policy environment and if the latter is restrictive, the landlocked country will be unable to achieve its connectivity goals.

● At the national level, a set of national ICT policies and regulations within each country, supported by a Ministry of Telecommunication or ICTs, and a National Regulatory Authority (NRA), sometimes constituted as a utility regulator and occasionally supported by a general competition law, and a competition authority[3].

There are wide ranges in the levels of transposition of REC policies and regulations referred to above, variation in the capacity of national regulators to enforce policy and also different levels of national commitment to the use of ICTs for supporting development goals. It should be noted that one of the other reasons for the variation in policies and regulations between countries is that the harmonization process is still very much an ongoing process. However, the AUC and RECs could be powerful drivers to run the various national harmonization programs.

The main ICT policies and regulations that have been adopted at the REC level fall into the following categories:

● National Policy Priority for ICTs
● Market Liberalization
● Policy & Regulatory Harmonization
● Spectrum Policy Development
● Cyber Security
● Statistics/ Data Collection
● Infrastructure Development- Regional Backbone, Missing Links, Alternative Infrastructure
● e-Applications development support
● Universal Service Projects
● Education, research and health connectivity
● Duties & taxes on ICTs
● Training/ HRD

ICT Market Environment

In most countries, mobile voice markets have high levels of private sector participation and rapidly increasing levels of competition, especially where number portability has been introduced. However, when backbone and broadband access networks are included, formal or de facto monopolies still exist in many countries, and as a result market prices remain high and service levels remain poor.

In some cases, even where there has been opening of the markets to new entrants, discrimination often continues between the incumbent and the new private sector operators. Because a large portion of the existing optical fibre backbone infrastructure in Africa is still under these formal or former monopolies, there

is a lack of competition and poor tariff control. Thus, high prices for fibre capacity leasing persist. This environment has also put a brake on new private or PPP backbone infrastructure investment. As a result, the overall picture is that land-based optical fibre infrastructure in the majority of countries in Africa is both inefficiently used and insufficient.

On the demand side, although most mobile/wireless markets in Africa are competitive, there is still suppressed demand for international capacity because costs remain high (compared to Asia for example) through exogenous factors. The most notable of these factors are high input costs (such as expensive diesel-powered base stations, high spectrum and license fees), small markets, and high perceived levels of business risk leading to short time horizons for achieving a return on investment. In addition, interconnection between mobile operators is not yet universally cost-efficient because traffic still needs to be routed through incumbent or duopoly gateways in many countries.

The mobile infrastructure that is in place today was initially dimensioned for voice services and therefore, will not be able to fully handle the demands for broadband services without substantial and costly upgrades, mainly involving interconnecting base stations with fibre backhaul links. The lack of competitively priced or open access to national backbones means that resources may be wasted because each operator builds its own backbone and backhaul links, resulting in duplication or triplication of infrastructure.

The alternative infrastructure is not yet exploited to the extent possible. Up to 90% cost-savings can be made by using the existing cabling, ducts and rights of way of energy and transport networks. Currently, the awareness of the extent of these cost benefits is low, and much of the available alternative infrastructure is not yet authorized for third party usage, or is already owned by incumbent operators. Where available, prices charged by the infrastructure operators are often high, and not market related. Land-use planning rules have also not yet been widely adopted to enforce the deployment of fibres or ducts on new transport or energy infrastructure.

Another important factor is that limited levels of civil works co-ordination and information sharing mean that fibre infrastructure may be unreliable because of frequent accidental cuts. Low penalties for theft or vandalism of this strategic national asset also contribute to this problem.

Finally, given the vital importance of up-to-date and accurate information for decision-making in this rapidly

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[3] General competition law and competition authorities are an important component to fully support the national ICT regulators

evolving sector, there is a distinct lack of publicly available ICT information at the national, regional and continental levels.

In conclusion, many regional and national policy makers and regulatory authorities require support for more effective policy and regulation in some key areas:

- Support for introduction of open access backbones and competitive markets at all levels in the value chain
- Control of dominant operators and other regulated operators through Significant Market Power (SMP) determinations and wholesale and retail tariff controls
- Ensuring that new alternative infrastructure include appropriate fibre or ducts for telecommunication purposes.
- Ensuring reasonable access to existing alternative infrastructure and rights of way
- Adopting detailed planning guidelines for identifying and implementing new regional and cross-border links
- Gathering and publishing periodically of up-to-date ICT market and infrastructure data

1.2.2 Conclusions of the existing ICT infrastructure and programs review

Taking into account the infrastructure in place today, along with that already under construction (or fully funded with tenders launched), it can be observed that there has been a tremendous improvement over the past few years in optical fibre capacity in many countries. In particular, there has been a dramatic increase in the availability of international bandwidth for coastal countries where submarine cables have landed, and substantial price reductions where different submarine cables are competing. For example, Kenya had no international fibre links three years ago, and is now connected to three submarine cables (TEAMS, SEACOM and EASSy). As a result, capacity pricing on international links in Kenya has dropped by a factor of more than 20, and there is very little danger of service interruption.

Kenya is not unique in this respect, and submarine cable capacity is already available in quantities that are sufficient to meet continent-wide demand. Two large cable systems on the West Coast – WACS and ACE - came into service in 2012.

However, the lack of nationally competitive infrastructure compared to the extent of supply and competition in submarine cables, is demonstrated by the fact that capacity from an African submarine landing station to Europe, North America or Asia is usually cheaper than the in- house country national backbone capacity. This is the case currently in most countries which have competing submarine cables, such as Nigeria, South Africa and Kenya, where it may only cost \$100-\$300/Mbps/month to link the coast to London, while it costs \$500- \$2000/Mbps/month to link the inland to the coast. This trend is accentuated considerably for landlocked countries, which have to pay land-based transit across their neighbors to get to the coast.

Africa Fiber Infrastructure (July 2010)

<p align="center">**Figure 2:** **Terrestrial Fiber infrastructure**</p>

Figure 3a: Submarine cables

Figure 3b: Submarine cable landing stations in Africa, per country, 2010
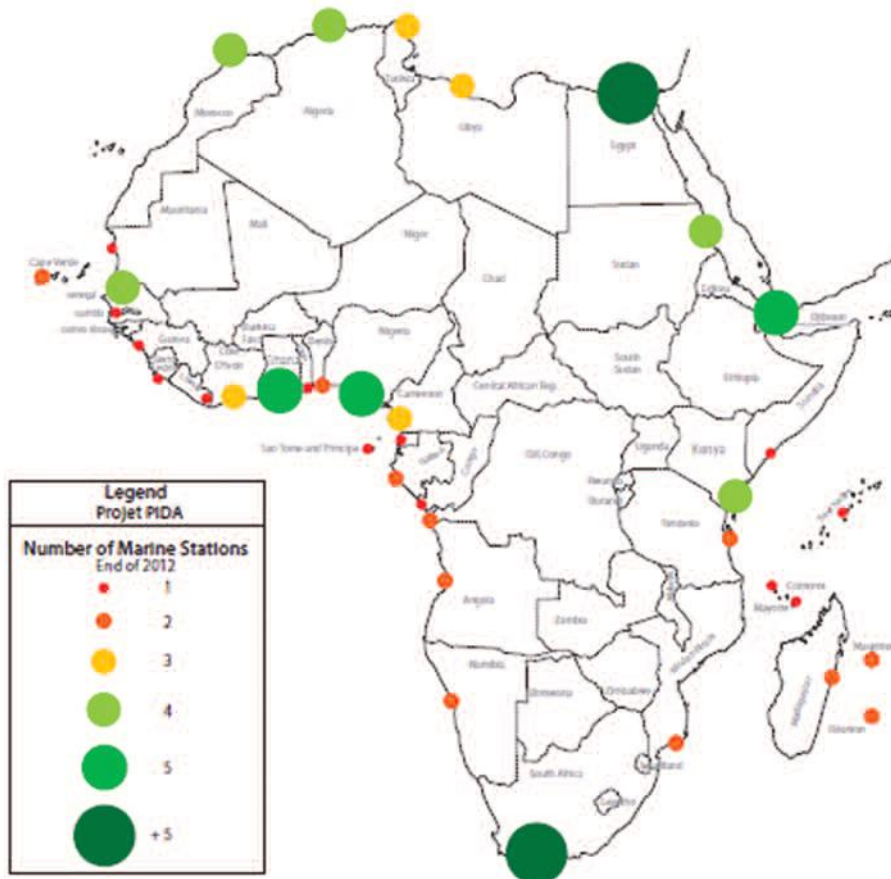
While the overall availability of international and cross-continental capacity via submarine cables is encouraging *(Figure 4)*, the much lower levels of national uptake show that national and regional infrastructure is insufficient to take advantage of the submarine capacity, as shown in the Figures below. These highlight the current gap between supply and demand by showing the total international capacity available on the submarine cables (excluding UMA) and the trend in actual international capacity in use in Africa *(Figure 5)*. As can be seen, only about 0.5Tbps (2.7%) of the 18Tbps of the available submarine capacity is available on the continent since 2012.

Figure 4: ICT International bandwidth available
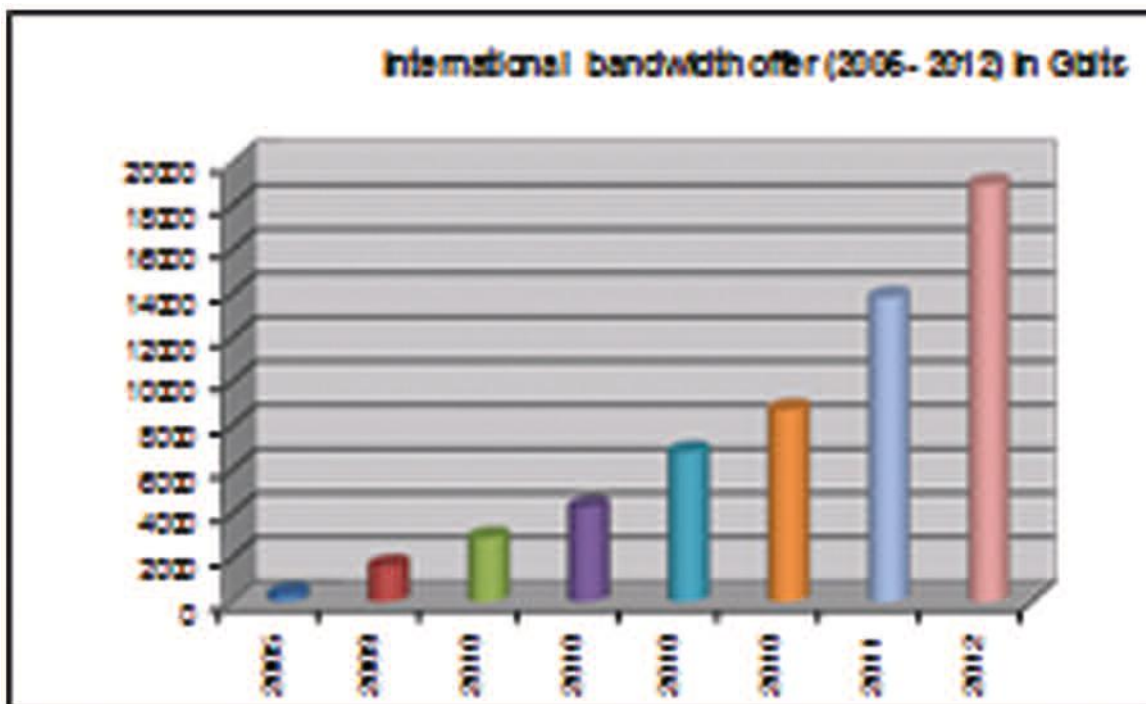
Figure 5: International bandwidth in use
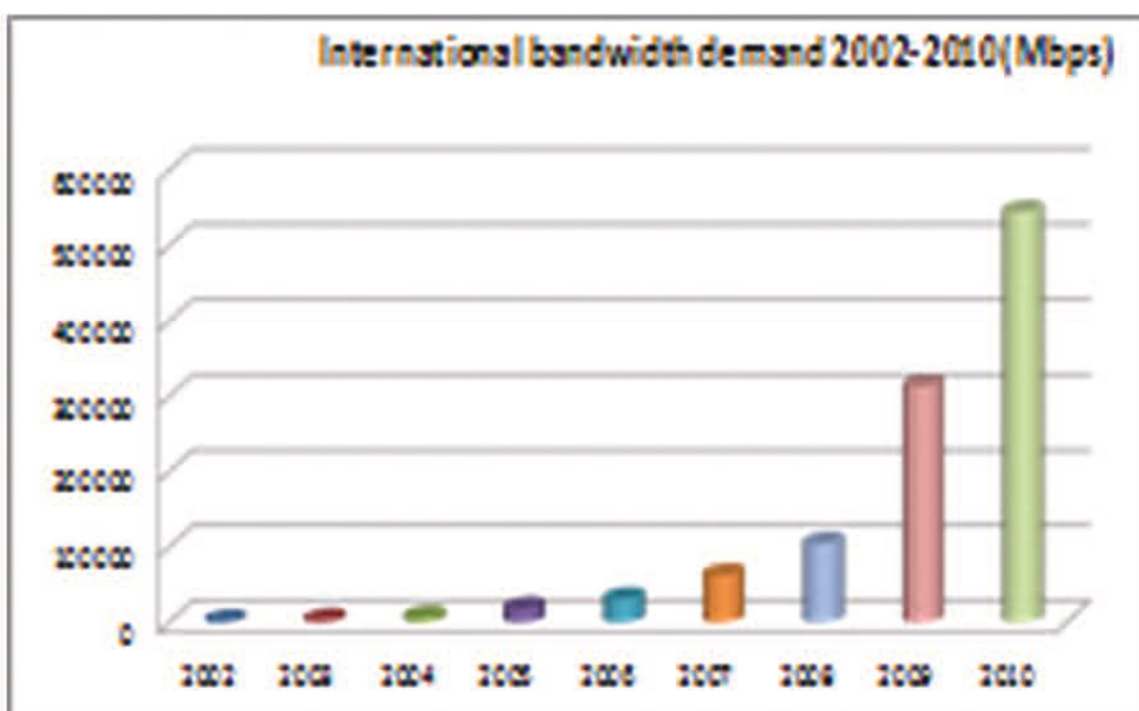
There is a large gap between Sub-Saharan Africa and North Africa which has patterns of broadband diffusion similar to Europe, as illustrated in the *Figure 6* below.

Figure 6: North-South digital divide in international bandwidth use (2010)
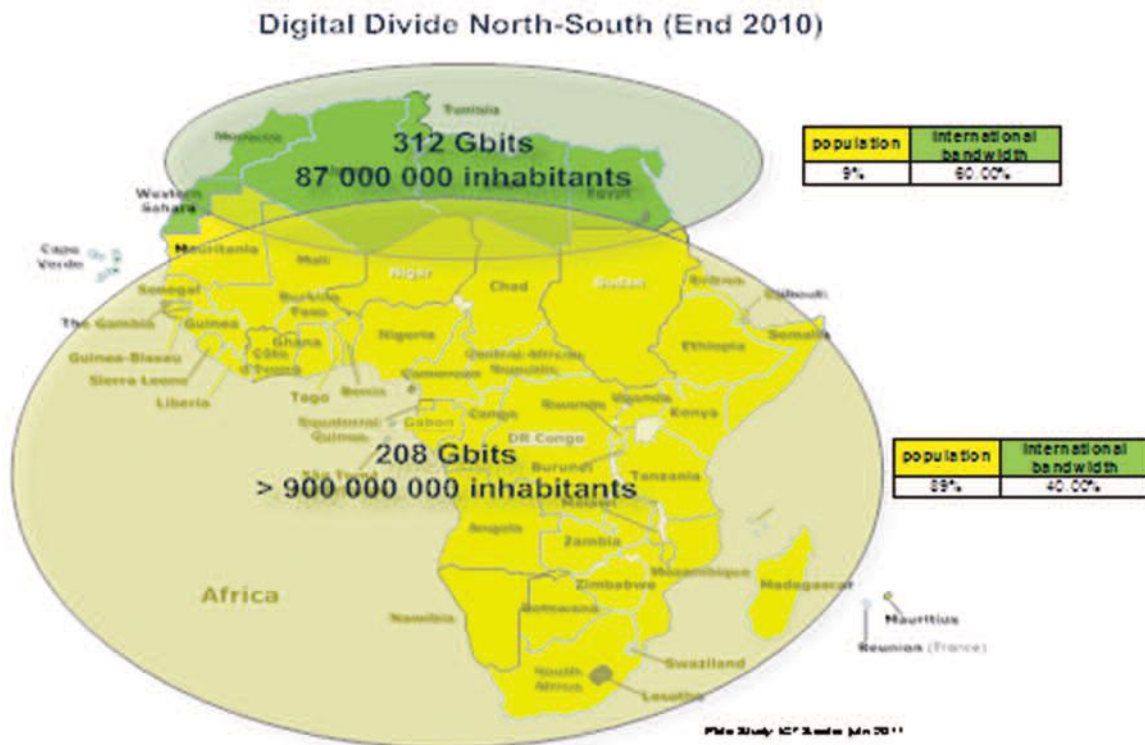
1.2.3 Main challenges stemming from the Africa ICT Outlook 2030 analysis

In summary, the main challenges in the ICT sector in Africa that have been identified are:

- Ensuring that each country has reliable and multiple fibre connections, internationally, regionally and to its neighbours, which are competitively priced or based on open-access principles.
- Ensuring that national markets are fully competitive so that the benefits of reliable low-cost international capacity filter down to the end-user, and by the same coin, the investment in international infrastructure is justified by the level of demand.
- Ensuring that electric energy is widely available, both to reduce the cost of ICT infrastructure operations and to maintain demand from the end-user.
- Ensuring that the many opportunities presented by roads, electricity grids and other energy and transport infrastructure are accessible for optical fibre cable deployment, thereby massively reducing the cost of establishing international and national ICT broadband backbone infrastructure.
- Ensuring sufficient ownership, commitment and co-ordination from RECs and Member States to encourage quick deployment of needed regional infrastructure through the development of the required enabling environment to promote competition and open-access backbones.
- Ensuring that the most effective governance and ownership models are adopted to maximize the financing opportunities from the private sector while taking into account the needs of the public sector to minimize costs to the end-user and ensure universal access.

1.3 Results of the Outlook Analysis

1.3.1 PIDA ICT network

Figure 7 below describes the context for ICT infrastructure development in Africa. The PIDA scope is described on the left of the diagram. The access networks on the right are clearly dependent on the supporting underlying infrastructure shown on the left.

Figure 7: value-chain components for broadband development in Africa
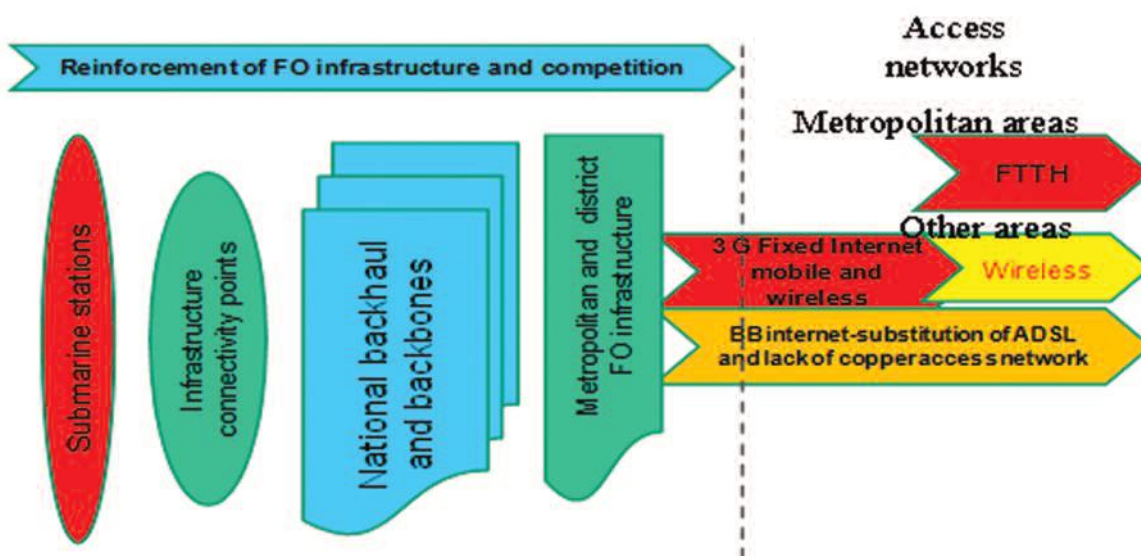
When viewed from a different perspective, as shown in Figure 8, the infrastructure is the vehicle for African governments, businesses and consumers to obtain access to relevant content and applications, at the national, regional, continental and intercontinental levels. Today, most of this content is hosted off-shore, mainly as a result of the deficiencies in backbone and access infrastructure. In this respect, it is expected that addressing the infrastructure issue will result in much increased local content, especially if boosted by pro-active initiatives to develop relevant local content and to host international content locally, in particular by supporting the development of local Internet Exchange Points (IXPs), content distribution networks and data centers.

Figure 8: the content value chain for broadband provision
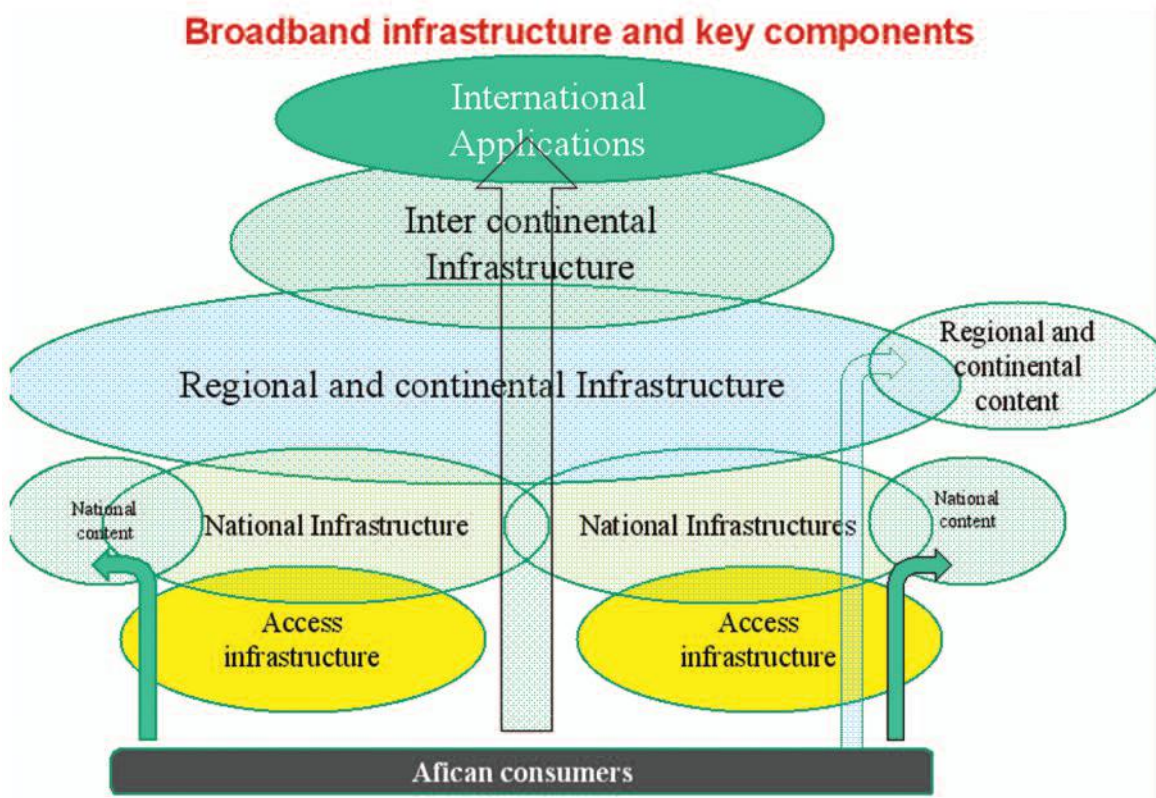
1.3.2 Projections of future demand at the continental and regional levels

Based on extensive international benchmarking and operator data, which draws on detailed analysis of experiences in Europe and North Africa, a predictive model to forecast future capacity requirements was developed to determine:

- National and international bandwidth (traffic) requirements
- The impact of broadband penetration (density) on overall bandwidth demand
- The impact of growth in end-user bandwidth demand – the increased use of new e-applications that increase bandwidth consumption (often called the 'YouTube effect').

Based on these trends, the most likely scenario for short term uptake in Africa is estimated to be an average penetration of 20% of the population with high-speed broadband and 60kbps per subscriber of required international capacity.

It should be noted that 20% penetration may seem low given the expected uptake in wireless smart phones over the coming years, but as observed by operators in North Africa and Europe, smart phone bandwidth-use is virtually insignificant compared to high-speed broadband usage of desktops, laptops and triple/double-play boxes connected to either the fixed networks or mobile networks using wireless modems. Thus, the 20% population penetration figure may be more closely equated to a 60-80% household penetration level.

Similarly, the 60kbps/user of international capacity requirement may seem low, but is verified by operator field data, and explained as follows: a) as markets mature a more significant amount of traffic is local rather than international, b) high bandwidth international traffic is cached locally (such as YouTube), c) 60kbps is the multiplexed capacity permanently allocated per subscriber, and since the user is not online 24hrs a day, this is the actual utilization averaged over an entire day.

Figure 9a: Internet traffic "Europe"
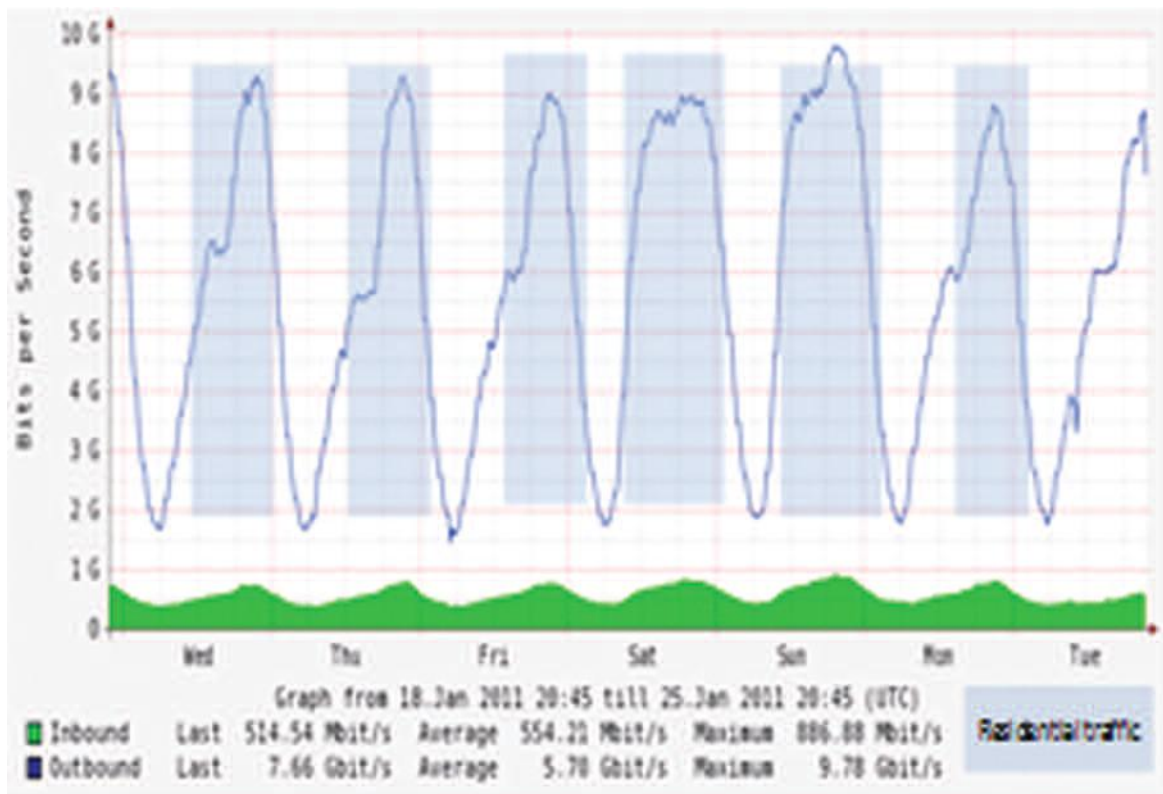
Figure 9b: Internet traffic 3G+Fixed "Africa"
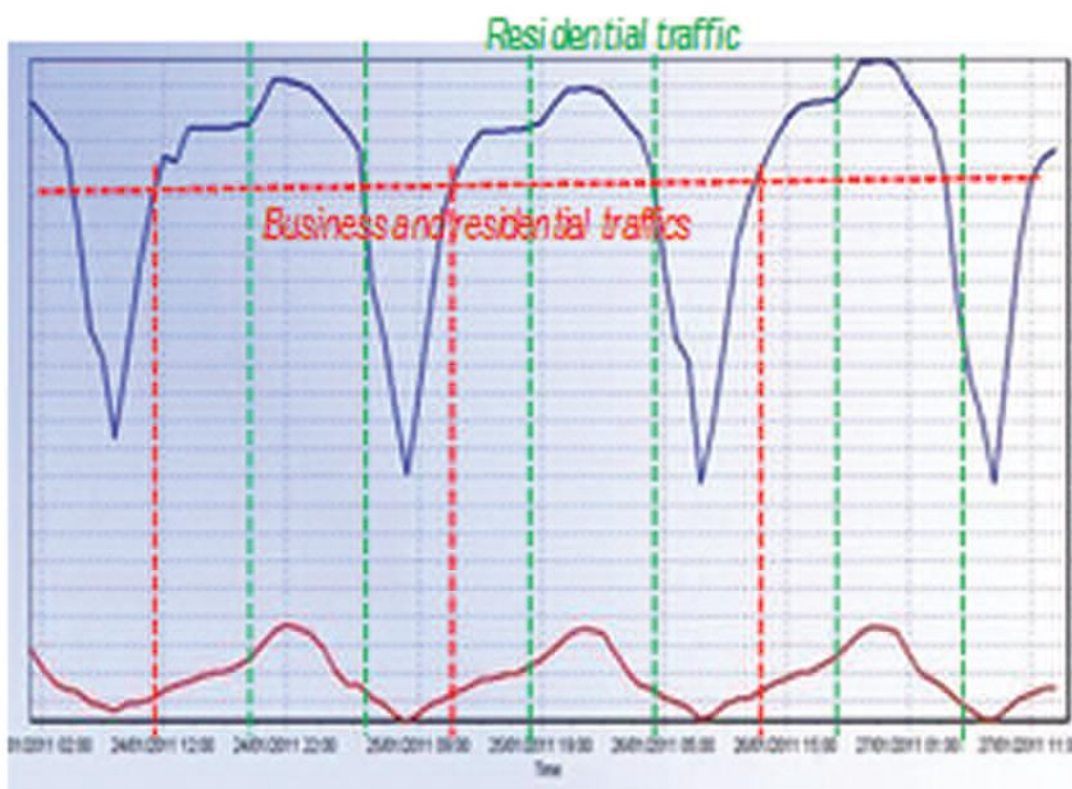
The figures above show the predominance of residential traffic (end of the day and week end) which shows that bandwidth sizing needs to be based on the residential traffic.

Continental level
The PIDA traffic forecast model indicates that international capacity demand will grow from the 2010 level of about 500 Gigabits per second to a total of 6 000 Gigabits per second by 2018.

Figure 10 illustrates this expected explosion of capacity required to service Africa's broadband demand before the end of the present decade.

Figure 10: Africa's international bandwidth requirements[4]
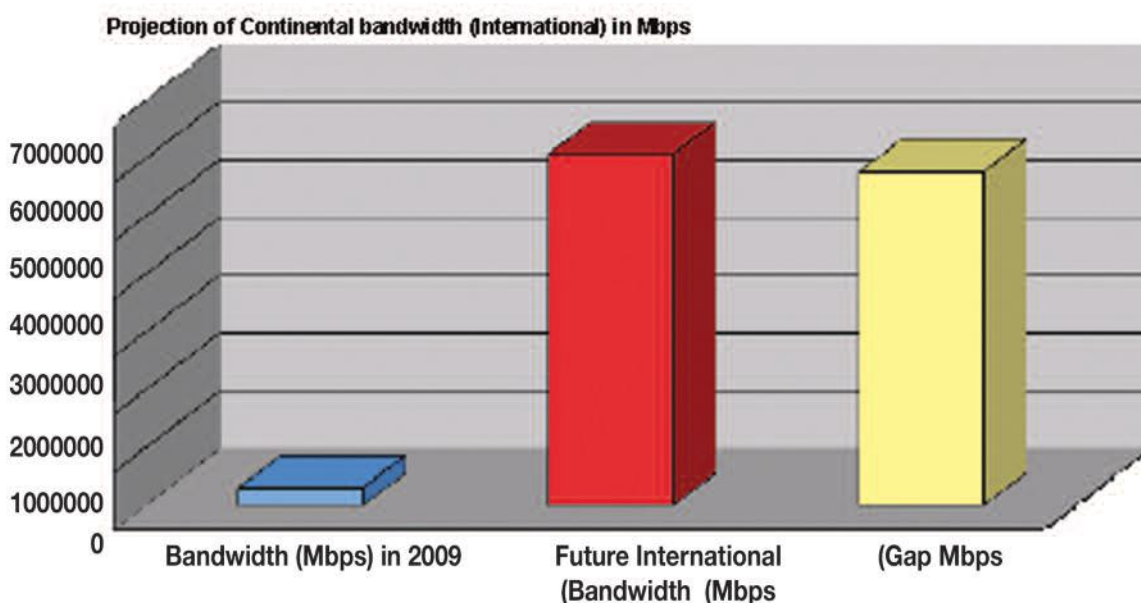
[4] More explanation is provided in the Africa ICT Outlook 2030; the figure is for 20% broadband penetration and 60 kbps of international bandwidth per subscriber (Data from of EU and African operators (June 2011)

Regional level

Figure 11 provides the same data as above for international bandwidth forecast, but per REC.

Figure 11: International Bandwidth forecast per REC
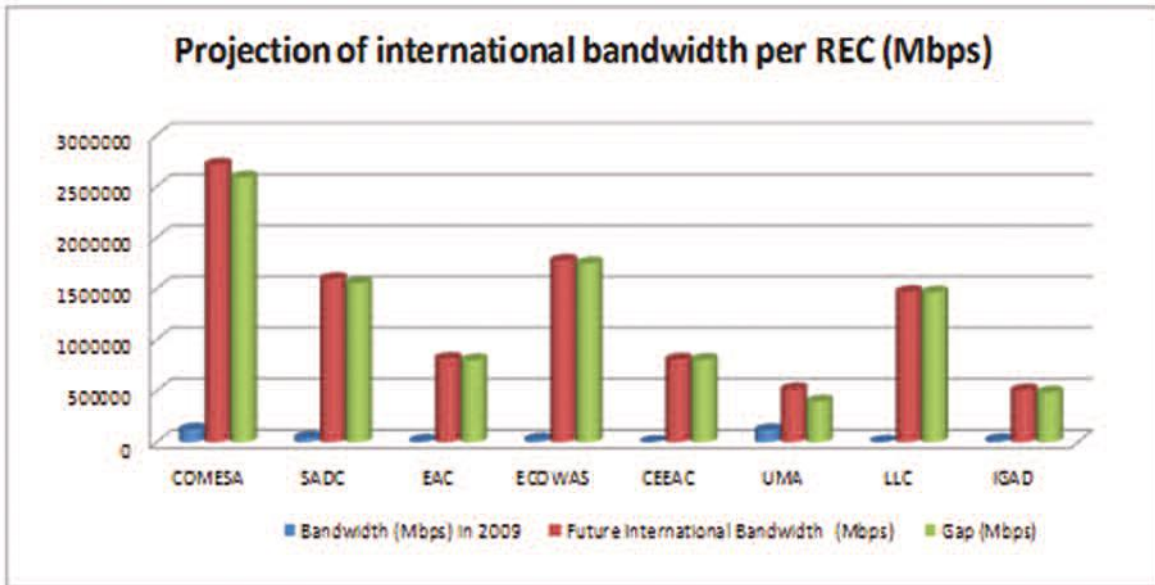
The key conclusion from the sensitivity analysis carried out on the traffic model is that bandwidth requirements are largely dependent on exogenous factors, rather than organic market development, and completely unrelated to voice traffic, which is now insignificant compared to broadband requirements and not even considered by operators in European traffic models. In addition, capacity requirements can change dramatically over a very short time, as shown by the experience in Tunisia with the opening of access to YouTube and social networking sites after the Jasmine revolution, and in Kenya when fixed and mobile broadband services exploded following the arrival of plentiful and cheap international bandwidth. To highlight this, Figure 12 below shows the use of international capacity in Kenya between 2002 and mid-2011, showing the massive growth when the submarine cables began to arrive in Kenya in mid 2009.

Figure 12: Trends in international capacity used in Kenya[5]
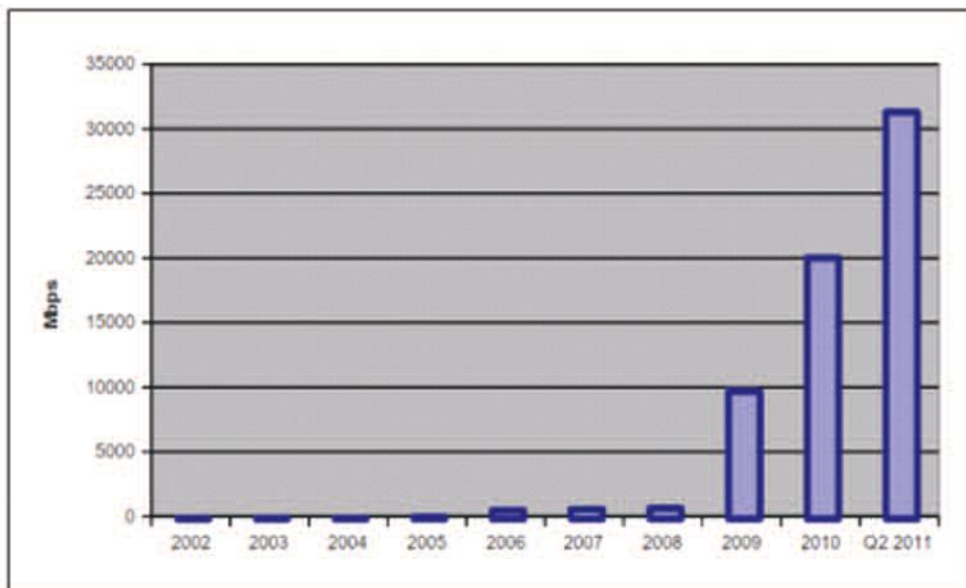
[5] More detailed analysis is provided in Annexes to Africa ICT Outlook 2030; the curve is similar to most advanced EU countries

As underlined by the above, there are three key factors that can change international capacity demands virtually overnight – i) content censorship, ii) arrival of multiple submarine cables to provide low cost international capacity and iii) an enabling environment for competing domestic operators looking to take advantage of cheap international capacity to build local demand for broadband services.

The imminent arrival of even more competing submarine cables is already galvanizing the acceleration of backbone fibre deployment by local operators. It can be seen that, by next year, when every coastal country will have at least one submarine landing station, the main drivers for broadband uptake will be:

- National ICT market dynamics – cost and coverage (mainly influenced by policies on competition, access to alternative infrastructure, and availability/cost of radio spectrum, carrier & 3/4G license costs)

- Penetration/cost of access devices (computers, handhelds – affected by technology trends, taxes and lines of consumer credit, including bundling of laptops as part of the broadband service)

- Availability of reliable low-cost energy to power networks and access devices, especially in rural areas (affected by national energy policies)

Levels of wealth and literacy are also variable factors that can affect broadband uptake. But in Africa, they have had very little impact on broadband penetration because of the other constraints outlined above that have created very high levels of suppressed demand.

Figure 13 below illustrates the outcomes of the international capacity requirement analysis per country.

Figure 13: IAIDA
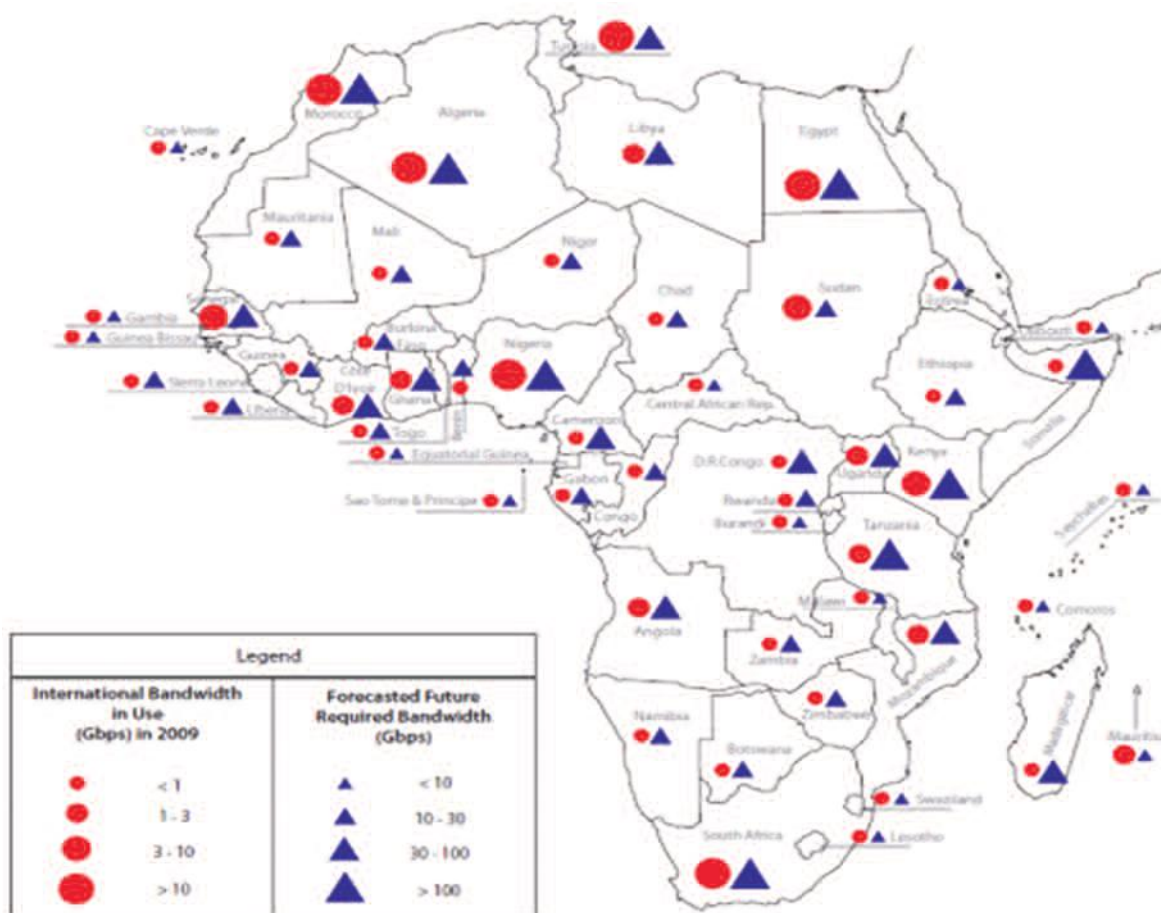
1.3.3   Key conclusions on capacity needs

As discussed above, there is now, relatively good submarine cable presence and competition with all coastal countries having at least one landing station. Most countries will have more than one landing station, and cross-border land-based links in place or under construction will allow many others to access one of the nearby countries with submarine cable hubs where three or more different cables land. On the terrestrial side, the picture has also improved dramatically, and while it can be misleading to generalize from the wide range of conditions in Africa, the specific gaps and constraints, which have been identified, are:

- Existing optical fibre infrastructure is not equally accessible to all operators. Constraints include: the limited extent of the cross-border and national routes, lack of metro networks, unsuitable types of optical fibre for modern protocols (DWDM), old fibre with many repaired cuts leading to signal attenuation, or a limited number of fibre pairs for exploitation by different operators.
- High capacity costs and unreliability of fibre networks, mainly because of de-facto monopolies by incumbent operators in many countries, and even formal monopolies in some countries.
- Low levels of regional or national co-operation and policy harmonization, which create difficulties in implementing cross-border or regional infrastructure on a competitive basis.
- Lack of national and regional traffic exchange points (IXPs) resulting in domestic traffic between local operators that travels outside the country, and intra-African traffic that is exchanged in Europe, North America or Asia, increasing the cost of capacity and reducing performance.
- Lack of up-to-date and publicly available ICT information (market data, and fibre infrastructure information and technical specification)

In summary, and as shown in the diagram below, aside from the missing backbone and access infrastructure purely at the national level, which is outside the PIDA scope, the key short term needs in Africa that have been identified consist of:

- Some relatively short cross-border links to connect with the national infrastructure of some neighbouring countries
- A few key unimplemented national backbone links that would play an important role in connecting the country to its neighbours or to connect regions or neighbours to each other
- Sufficient regional backbones to ensure reliability and competitive pricing
- Open access to existing fibre on transport and energy infrastructure and a mechanism to ensure that all such new infrastructure includes fibre and ducts
- Sufficient links to allow all landlocked countries to competitively reach multiple submarine landing stations
- Sufficient national or regional traffic exchange points to ensure local traffic is kept local and to maximize performance
- A strategy for maximizing the use of land-based and cross-border infrastructure for maritime and lake communications
- A strategy for deploying satellite links where needed, including for regional remote sensing applications

Therefore, as a key priority, a variety of 'soft' capacity building projects are first required to help address these missing links and maximize the use of existing infrastructure.

Required Regional ICT Infrastructure
Figure 14 below shows the major land-based infrastructure in use by African operators (or under construction).

Figure 14: Key cross-border, regional and national ICT infrastructure in use by operators or under construction)
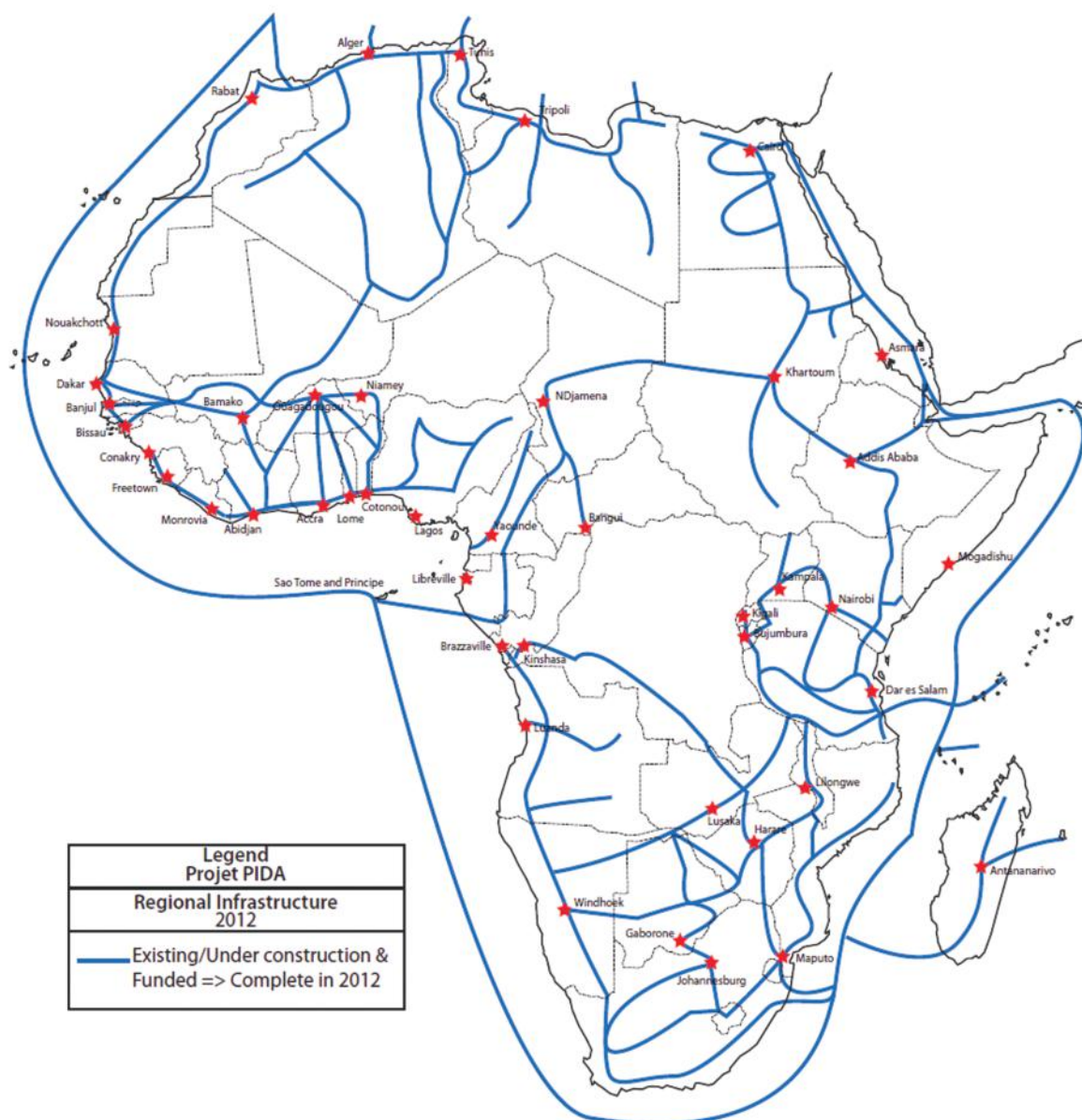
While Figure 14 above shows that most of the cross-border infrastructure needed is in place, this by itself does not guarantee that the required capacity is available at the regional level and that the use by all actors is ensured. This lack of "open to all connectivity" is one of the main reasons why a large part of the intra African traffic transits through non African operators. This is due to:

- Most of the links being owned by incumbent operators and therefore not open to all players or with usage tariffs that make economically infeasible the efficient use of these links

- Interconnectivity between this infrastructure not being guaranteed and being difficult to analyze given that the legal and regulatory environment does not allow access to this information from operators.

Nevertheless, these are promising indications that this capacity is potentially available and could be opened up with the appropriate enabling environment (see below).

Trans-boundary corridors - a new strategy to deploy ICT infrastructure

Most efforts made to identify and deal with the necessary fiber infrastructure in Africa have been addressed by the necessity to complete "the missing links" and facilitate interconnection of the incumbent operators' national infrastructure.

This approach has contributed to minimizing the need for external finances (as the cost is usually borne by the operators themselves). In fact, because they are not based on "open access" or a high regulation of interconnection, encouraging discrimination of new operators, this approach has reduced network development and therefore the required capacity to meet demand.

The strategy to develop the missing links and implement trans-boundary infrastructure can be taken into consideration thanks to the "Trans-boundary ICT Intelligent Network". This approach aims at meeting the incumbent operators' needs as well as those of the new operators to set up the necessary infrastructure on a cost-oriented basis. These corridors, whose length can vary, will be made up of:

• Optical cables for trans-boundary and national traffic

• Empty pipes for the future development of cables and others

• Shared equipments" to host intermediate access points along the road

In synergy with other sectors, a large number of smart ICT corridors can be set up in combination with the electricity transmission cables or roads

2. STRATEGIC FRAMEWORK

Key Messages

The e-Africa is a vision for the ICT sector by which the continent participates in the information society and is granted with an integrated e-economy in which every government, business and citizen has access to reliable and affordable ICT networks. It is estimated that a 10% increase in broadband penetration results in a 1-2% increase in GDP, and the PIDA ICT strategy will have a pivotal role to play in helping ensure that Africa has a chance to accelerate its economic and social development.

The objectives to reach the vision are:

• Satisfy African broadband demand at the least cost, while increasing accessibility and security of access from all African countries to the rest of the world, with specific attention to landlocked and isolated countries
• Develop social and regional integration by providing uniformly accessible services without discrimination
• Increase accessibility for all Africans to local, regional, continental and international content and applications

Based on the Connect Africa Summit goals (Kigali 2007), the three conditions to reach these objectives are:
• All countries connected to the rest of the world – sufficient submarine cables
• All countries and capital cities connected to each other – neighbouring country links and regional hubs
• All countries interconnected domestically – national traffic exchange points linking domestic operators

The strategic requirements to reach this vision are for each country to have:

• Fibre access to at least two different submarine cables by two alternate routes and for landlocked countries to have guaranteed access to the coast
• Interconnection via fibre infrastructure to its neighbour(s)
• A national traffic exchange point (IXP) to ensure local interconnection between national operators to reduce the level of external interconnection, improve performance
• A competitive market in broadband services based on a combination of private and public infrastructure provided on an open access non-discriminatory basis
• New fibre infrastructure with sufficient capacity (fibres) to support the medium term vision (more than 10 years)
• A set of regional traffic exchange hubs which facilitate interconnection between countries within a region and between regions

2.1 The Vision for the ICT Sector: e-Africa

The PIDA vision for the ICT sector in Africa is that of a continent that participates in the information society and is granted with integrated e-economy in which every government, business and citizen has access to reliable and affordable ICT networks (i.e. permanent low-cost connectivity) for the following key applications:
- e-Government, e-Health, e-Agriculture, e-Education
- e-Commerce/e-Trade/e-Finance
- Social Networking & Email
- Telephony and video calls
- IPTV

Low cost convenient and reliable access to these applications will support:

- Accelerated economic development, GDP and job growth, both within the ICT sector, such as in Business Process Outsourcing (BPO), and within other sectors (due to the cross cutting nature of ICT)
- Improved social inclusion, especially for isolated or rural communities which will become connected to high speed broadband
- Regional Integration, on a continent-wide basis, within and between RECs and between individual countries (improved trade, communications and coordinated decision-making)
- Equal participation on the global stage
- Improved peace and security through, amongst others, better governance and participation by civil society
- Accelerated achievement of the Millennium Development Goals (MDG)

To achieve the vision of an e-Africa, joint efforts from all stakeholders are required, along with support from the highest political levels. The key stakeholders are:

- AUC, NPCA, RECs, and regional ICT regulatory bodies
- National governments and ICT sector Ministries responsible for e-development policies
- National ICT regulators responsible for the implementation of competition rules and coordination/information exchange with other sector agencies in government, such as transport and power.
- The private sector as the largest potential investor, supported by the DFIs and national governments
- Civil society and business, which are the main beneficiaries of the e-Africa vision
- International and continental specialized organisations/agencies ATU, PAPU, UNECA, ITU,

2.2   Objectives

As outlined in the e-Africa Vision above, the continent requires access to high-speed broadband for economic and social development. This has been well recognized ever since the UN Economic Commission for Africa (UNECA) launched the African Information Society Initiative (AISI) in 1997. Today, the imperatives and required strategies are even clearer and better understood, reinforced by the two World Summits on the Information Society (WSIS) and the Connect Africa Summit.

ICT is a cross-cutting technology affecting every other sector, and in this respect, it can be seen that the PIDA ICT strategy will have a pivotal role to play in helping to ensure that Africa has a chance to reduce the digital divide and accelerate its economic and social development (the World Bank has determined that a 10% increase in broadband penetration results in a 1-2% increase in GDP).

Africa can take advantage of its delay, by leapfrogging a generation of old technology and by learning from the best practices and mistakes of other regions. Similarly, forward thinking infrastructure strategies and policies will need to be adopted in order to ensure that the digital divide does not increase, and to make ICT universally accessible in order to move smoothly from commodity- based to knowledge economies.

Building on the goals developed at the Kigali Connect Africa Summit, the African Information Society Initiative, and the World Summits on the Information Society and in line with AUC strategic framework, the PIDA ICT sector objectives are identified below. In the short term, the aim is to ensure rapid optimization of available resources leading to immediate reductions in the digital divide and the opening up of new wealth creation opportunities within the ICT sector. In the longer term, this will lay the groundwork to maximize the cross-cutting benefits of ICT in all sectors, which will ultimately create demand for additional backbone infrastructure.

PIDA objectives in the ICT sector

Objective 1: Double the contribution of the ICT sector to the GDP whose current level (about 5%), must reach about 10% by 2025

Objective 2: Satisfy African broadband demand at the lowest cost, while increasing accessibility and security of access from all African countries to the rest of the world, with specific attention to landlocked or isolated countries;

Objective 3: Promote intra-African e-commerce

Objective 4: Develop regional and continental physical integration

In specific terms, this will involve, amongst other matters:

- Reducing by 2/3 at least by 2020, the volume of intra-African traffic transiting outside of the continent;
- Lifting all the institutional and regulatory constraints which hinder infrastructure deployment and broadband networks as well as open access to these infrastructure and networks.

2.3   Strategies to Meet the Objectives

PIDA ICT strategic activities focus on:
- Facilitating the development of physical ICT infrastructure
- Creating an enabling environment to increase the efficient use of existing infrastructure
- Maximizing the value of investments by both the private and public sector.

A set of key strategies that underlie the activities have been developed in consultation with the stakeholders, as outlined below.

> **Key Strategies**
>
> **Guarantee of international access:** Each country has fibre access to at least two different submarine cables
> **Guarantee of secure terrestrial routes:** Each country has access to submarine landing stations its choice through different land-based infrastructure. to ensure reliability and security
> **Landlocked countries charter:** Ensure to landlocked countries access to submarine cable landing stations in coastal countries at a similar cost enjoyed by coastal countries
> **Continental inter-connectivity:** Each country is interconnected with land fibre infrastructure to its neighbor based on the most economic criteria
> **International and national bandwidth optimal use:** Each country has a national IXP and access to regional exchange points to ensure local interconnection between national operators, reduce the level of external interconnection, improve performance, encourage local applications development and build economies of scale to attract international operators to create access points locally, thereby reducing the need for African operators to pay transit fees to foreign operators
> **Competitive open markets:** Each country has a competitive broadband services market based on a combination of private and public infrastructure provided on an open access non-discriminatory basis
> **Sustainable new infrastructure:** all new infrastructure needs to have sufficient capacity (fibres) to support the medium term vision (over 10 years)

In addition to the key strategies highlighted above, future infrastructure should promote the implementation of high quality and resilient optical fibre infrastructure, with the required quality, quantity and a geostrategic location. Hence, the following challenges:

> **Specific challenges of the future regional infrastructure**
>
> The real challenge is not the identification of active equipments which remain the prerogative of operators and are in continuous progression (transmission capacity) but rather to enable the development of passive and/or active infrastructure meeting a number of constraints:
> • Qualitative: be able to support active equipments and be sustainable.
> • Quantitative: be sufficiently well calibrated in order to meet needs.
> • Tariffs: be in compliance with a community cost model.
> • Geostrategic:
>   - **Meet the expectations of governments** in terms of digital development of the territory.
>   - **Meet the operators' expectations** in terms of destination
>   - **Meet reliability criteria** required to develop a digital economy and society

2.4 Actions Required to Meet the Objectives

In consultation with the stakeholders, the actions required to meet the objectives of the e-Africa Vision have been identified as follows:

2.4.1 Short term actions: 2012-2015 (in parallel)

1. More efficient use of existing infrastructure – in the short term, there are massive benefits to be gained simply by improving access to what is existing – i.e. the efficiency of the current fibre infrastructure. The major part of the e-Africa vision can be achieved by ensuring that the extensive fibre infrastructure that is currently in place is made available at competitive or cost-oriented prices. This will require the development of an enabling policy and regulatory environment (especially through price regulation and non-discriminatory access requirements on Significant Power Market (SMPs) for:

- Optimizing the use of existing telecommunications fibre (reducing costs and providing access to all operators)
- Ensuring access to existing alternative infrastructure (transport & energy) to provide additional routes and competitive choice
- Gathering and analysing regularly ICT market and infrastructure data to support more informed decision making, monitoring and evaluation
- Raising awareness and developing a peer-review process to ensure commitment from all countries to the strategy and encourage countries that are lagging behind to catch up.

2.. Connecting the few remaining missing links – both between countries, and to submarine cable landing stations where needed

3. Increasing international demand – opening markets to new access providers, establishing national traffic exchange points (IXPs), lowering ICT taxes and license/spectrum fees, supporting extension of national/international backbones to remote and rural areas (PPP/reverse auction), deploying fibre on alternative infrastructure.

4. Establishing a more conducive environment for future fiber deployments – Domestic markets need to be opened to increased competition to encourage private sector investment in cross-border and national backbone infrastructure in order to optimize the very large potential cost savings for new fibre deployments. Planning regulations need to be developed to ensure that all new transport and energy infrastructure includes ducts and fibre for telecommunications purposes. To further support this activity, specialized 'smart ICT corridors' need to be established in which necessary investment should take into account optical fibre component or upgraded trans-border road links to ensure they include the required fibre facilities.

5. Developing domestic satellite infrastructure to improve backbone reliability where there is only one fibre link, for broadcasting, and to fill the gaps in rural broadband coverage, especially in the remote areas where it may take many years before land-based infrastructure becomes available. Satellite infrastructure would also be necessary for regional remote sensing applications.

6. Supporting local and international content hosting and applications development – in particular e-government and e-education applications

Actions 5 and 6 above are strictly national and therefore outside the PIDA scope. However, it is worth mentioning them here as part of the priority interlocking actions that need to be undertaken in concert with the other actions.

2.4.2 Medium term actions (2015-2020)

1. Once the national enabling policy environment and institutional frameworks are fully in place, new projects for regional and international fibre along major routes can be more sustainably developed, especially where there is currently only one link.

2. Improve availability of electricity for use in ICT, especially in rural areas

Similarly, while the latter action above is outside the PIDA scope, it needs to be mentioned here as part of the priority interlocking actions that need to be undertaken.

The key strategies proposed in chapter 2.3 above should be in majority or fully implemented on the medium term.

2.4.3 Long term actions (2020-2030)

More national routes and more competition on existing routes, especially from access to ducts of new trans-border road and energy projects, with locations/routes mainly driven by market demand for capacity and resiliency

2.5 Expected Outcomes of Investment in ICT Infrastructure

The expected outcomes of the above initiatives are enshrined in the PIDA e-Africa Vision which is expected to lead to a wide range of outcomes, including:

- Acceleration of economic growth, creation of wealth and employment
- Improvement of health and well being of the African population
- Increase of regional integration, improvement of local and international trade, as well as financial services
- Reduction of levels of isolation and increased participation of the public in global, continental, regional and national decision-making
- Faster decision making

2.6 Supporting Institutional Frameworks

The ICT and other sectors (transport, energy, water) strategic frameworks are aligned with the Institutional Architecture for Infrastructure Development in Africa (IAIDA) developed by AUC and its development partners.

PIDA implementation will rely on all actors at all levels of the African development process taking coordinated action—AUC and NPCA at the continental level, the RECs at the regional level and, at the national level, the individual countries on whose territory the projects will be constructed and whose population should benefit from them. The implementation process is grounded in the Institutional Architecture for Infrastructure Development in Africa (IAIDA) (Figure 15) whose general aim is to reinforce institutional capacities and to create conducive environment for resource mobilization. The architecture consists of structures for decision-making

and implementation. Its decision-making component involves several existing actors or bodies with a new innovation in the form of a Council for Infrastructure Development (CID), a non-permanent body, composed of members of the bureau of the Specialized Technical Committees of the four sectors. Based on IAIDA, the continental bodies (AUC, NPCA) will be focused on the monitoring and advocacy of the implementation process at the continental level.

At the project level, the implementation progress will be monitored by the RECs according to individual sector arrangements. The RECs have a key responsibility in assuring the harmonization and implementation of «soft» policy measures across countries. They will also inform the continental bodies responsible for keeping policymakers and Heads of State and Governments informed of overall progress.

Figure 15: IAIDA

DECISION MAKING STRUCTURE	IMPLEMENTATION STRUCTURE
i) The decision making mechanism defines organs and institutional arrangements that provide the framework for formulating and implementing policies and ensuring credibility, transparency and predictability of the operations of those organs. ii) It comprises the AU Assembly, the Council for Infrastructure Development (CID), the AU Commission and NPCA. iii) In the area of infrastructure development, the AU Assembly takes decision on projects/programmes	a) The implementation mechanism allocates rights and responsibilities to each intervening organ and ensures that all decisions taken on PIDA are timely implemented. b) Once the priority projects in the framework of PIDA are endorsed by the AU Assembly, NPCA takes all necessary actions for implementing the decisions of the Assembly and produces ad-hoc and annual report on the state of implementation of AU decisions. AUC and other organs of AU ensure that they address any bottleneck hampering the implementation of AU decision and provide the necessary support and facilitation to NPCA.
proposals submitted iv) The CID's main functions are to review selected projects and ensure coherence and harmonization across sectors, arbitrate and approve priority projects and provide strategic guidance for resource mobilization and technical cooperation. In addition the CID reviews projects/programme implementation report	c) The NPCA is in charge of: (i) Facilitating and coordinating the implementation of the continental and regional priority programmes and projects; (ii) Organizing donors coordination meeting with RECs, AfDB, Development Partners and prospective Private Sector investors for the funding/financing of the PIDA PAPs; (iii) Signing MoU with RECs, for each PIDA project under implementation; (iv) Producing consolidated ad-hoc and annual reports on status of implementation of PIDA and its priority projects.
v) AUC ensures alignment of selected priority projects and programme with regional and continental strategies and policies framework and reviews strategic plans, studies and reports prepared by NPCA and makes appropriate recommendations to CID. vi) AUC elaborates all policies necessary for creating enabling and conducive environment for PIDA implementation as well as advocacy for resources mobilization. In fulfilling its mandate, the AUC shall be supported by an Infrastructure Advisory Committee (IAC). Its mission is to provide the AUC, advice on technical economic and financial relevance on sectoral infrastructure projects and programmes. This committee is composed of high level experts and directors in charge of infrastructure of RECs and IS. Development banks, private sector and regulators may participate. vii) The NPCA is responsible for the pre-selection of projects. In this regard, NPCA sets appropriate process to coordinate with all existing organs such as RECs, Countries, Development Partners and Specialized Institutions and Agencies, Private Sector to receive their support in the compilation of projects.	d) The Regional Economic Communities and Countries are responsible for direct implementation of PIDA priority projects with the facilitation of NPCA and technical support of Specialized Agencies. RECs will coordinate their actions with regional specialized bodies e) The Specialized Institutions will support the implementation of priority project by providing support to NPCA, RECs and Countries, on project development activities. f) As a key partner in the infrastructure development, the Private Sector will be fully involved in the process of implementation in particular in financing, construction, operation and maintenance of infrastructure. g) The contribution of AfDB and Development Partners is essential in all phases of the project preparation and implementation as well as capacity building and technical assistance to implementing Institutions and Countries.
IAIDA key functions include: Creation of an enabling environment for infrastructure development, Resource mobilization and Management and Networking.	

For ICT sector in particular, it is proposed to consider the following in making the IAIDA effective:

Key roles of the regional institutions

- Develop continental/regional frameworks and policies - support and enforce their regional/national transposition.
- Establish the legal and regulatory conditions for regional ICT infrastructure (avoid reinventing the wheel and draw on best practices developed in other RECs[6]).
- Involve all the actors in regional infrastructure projects through public consultation or other appropriate forums
- Promote optimization of investments in regional infrastructure by sharing costs between sectors (ICT, transport, energy) and actors (operators)
- Establish Continental/Regional Master Plans for Digital Infrastructure Development (CMPDID, RMPDID) and associated guidelines for each of the different ICT infrastructure environment (Metropolitan, low density/rural areas, infrastructure corridors (Transport, Energy, Sanitation)
- Publish regionally consolidated ICT market and infrastructure data
- Publish annual continental and regional ICT market progress reports and ICT strategy reviews

National Government and regulator roles

In the ICT context, the role of sovereign governments is to:

- Support the e-transformation of their countries and implement appropriate policies for this transformation facilitated by the development of 'National Master Plans for Digital Development (NMPDD), and the use of an appropriate agency to implement the solutions that are best suited to the particular local context.
- Be responsible for the implementation of regional institutional directives into their national legal and regulatory frameworks.
- Provide coordinated support for land use planning involving ICT aspects – i.e. the ICT Ministry but also the Ministries in charge of other infrastructure (transport and energy), as well as metropolitan and rural district authorities
- Facilitate trans-boundary infrastructure development and cost-based access to rights of way
- Facilitate access to alternative infrastructure

Within this context, the role of the national regulatory authorities (NRAs) and RECs is to ensure that an enabling environment is in place as well as appropriate enforcement mechanisms in order for all actors to comply with them. This requires that NRAs have sufficient financial resources and legal tools to enforce adherence to the regulations. The capacity of the NRAs

to collect market and infrastructure data also needs to be reinforced by the legal environment to compel licensed operators to submit their data on a quarterly basis.

In addition, NRA support to the optimization of the use of radio frequencies is essential for the development of cost-efficient wireless broadband access. Of particular current importance is to ensure that the spectrum freed up from Analog to Digital TV migration[7] is made available for broadband.

Operator roles

Network operators are the main actors in broadband development, offering connectivity services and investment in infrastructure (private sector ICT infrastructure investment probably accounts for more than 90% of the total investment in Africa).

Although not directly part of regional institutional frameworks, national and regional operators will be able to identify the bottlenecks that hinder the development of infrastructure and can be involved at both national and regional levels in land-based infrastructure projects, sharing the costs with the public sector where needed. As a result, policy makers and regulators will need to ensure there are adequate mechanisms to establish formal multi-stakeholder consultation procedures with the industry, which would include the alternative infrastructure providers with facilities for operators.

Civil society roles

The role of civil society in infrastructure projects is usually relatively weak, and perhaps even more so in the ICT sector, where there is less apparent social and environmental impact (compared to building a road or a hydro dam). However, ICT infrastructure projects can indeed have a measurable impact on the environment, such as trenches through agricultural farmland and in their energy requirements[8]. Perhaps, even more importantly, consumers are the ultimate beneficiaries of the e-Africa Vision and the role of civil society organizations therefore needs to be boosted in this respect. Aside from highlighting inequalities in access to services, civil society organizations can help represent the concerns of under-resourced individual citizens regarding proposed new projects in their locality, and raise awareness on the benefits of the ICT infrastructure being put in place, thereby helping to secure it against accidents, pilferage and vandalism. In addition, civil society can even support the implementation, such as the local villagers who organize trenching teams for fibre cable deployment and other ancillary support.

Civil society therefore has a strong role to play in helping to identify needed infrastructure and policy changes. Civil society consultations and public

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[6] Ecowas has developed guidelines on open access to submarine cables. EAC has developed guidelines on cross border interconnexion

[7] Africa has committed to move to digital broadcasting by June 2015 although very few countries have begun the migration.
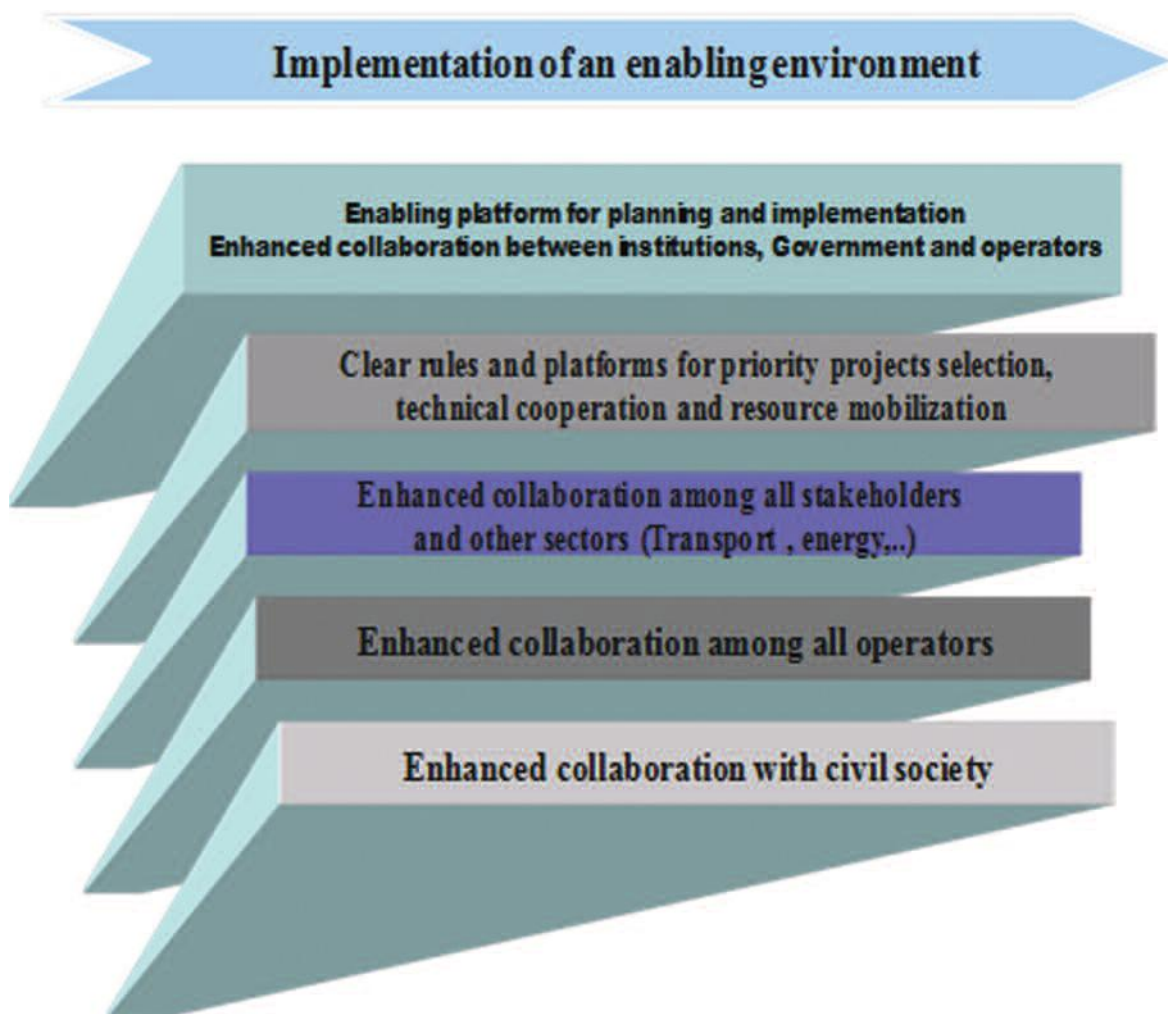
[8] In the USA, ICTs are now responsible for almost 10% of total energy consumption

hearings are normally an inherent part of a national regulator's work in ICT policy and regulatory development, but in many cases limited financial and human resources can result in limited effectiveness of this process.

Capacity building of NRAs and civil society organizations will be an important aspect of any soft or hard project implementation. Reinforcing this, ensuring civil society's role in infrastructure project preparation and implementation has been identified as a PIDA principle. All proposed projects in the PAP would need to be prepared in accordance with standards for environmental and social assessment, of which stakeholder participation is a mandatory component. Costs for the stakeholder participation activities during project preparation will need to be factored into the financing plans for every project.

Figure 16: The strata of a national ICT strategic institutional framework

Implementation of an enabling environment

Enabling platform for planning and implementation
Enhanced collaboration between institutions, Government and operators

Clear rules and platforms for priority projects selection, technical cooperation and resource mobilization

Enhanced collaboration among all stakeholders and other sectors (Transport , energy,...)

Enhanced collaboration among all operators

Enhanced collaboration with civil society

2.7 From the Strategic Framework to the PIDA ICT Project Portfolio: Selection of Projects

2.7.1 Introduction

The PIDA ICT program is based on existing approved regional projects and new projects identified from the findings of the Africa ICT Outlook 2030 which include:

- Capacity building and regulatory guideline development to create the enabling environment that reinforces performance of regional and national institutions to manage the broadband infrastructure challenge

- Missing links to serve required demand generally, and accommodate the needs of the landlocked countries in particular
- Regional infrastructure which improves competition and connectivity within Africa and to different submarine landing stations

Considering the market dynamics of the ICT sector and rapid evolution of ICT infrastructure, it is suggested that institutions can add new projects to the Priority Action Plan (PAP) on emergency requirements to optimize broadband development. This also helps address the difficulty of establishing the long-term needs beyond 2025.

Figure 17: **PAP project environment**
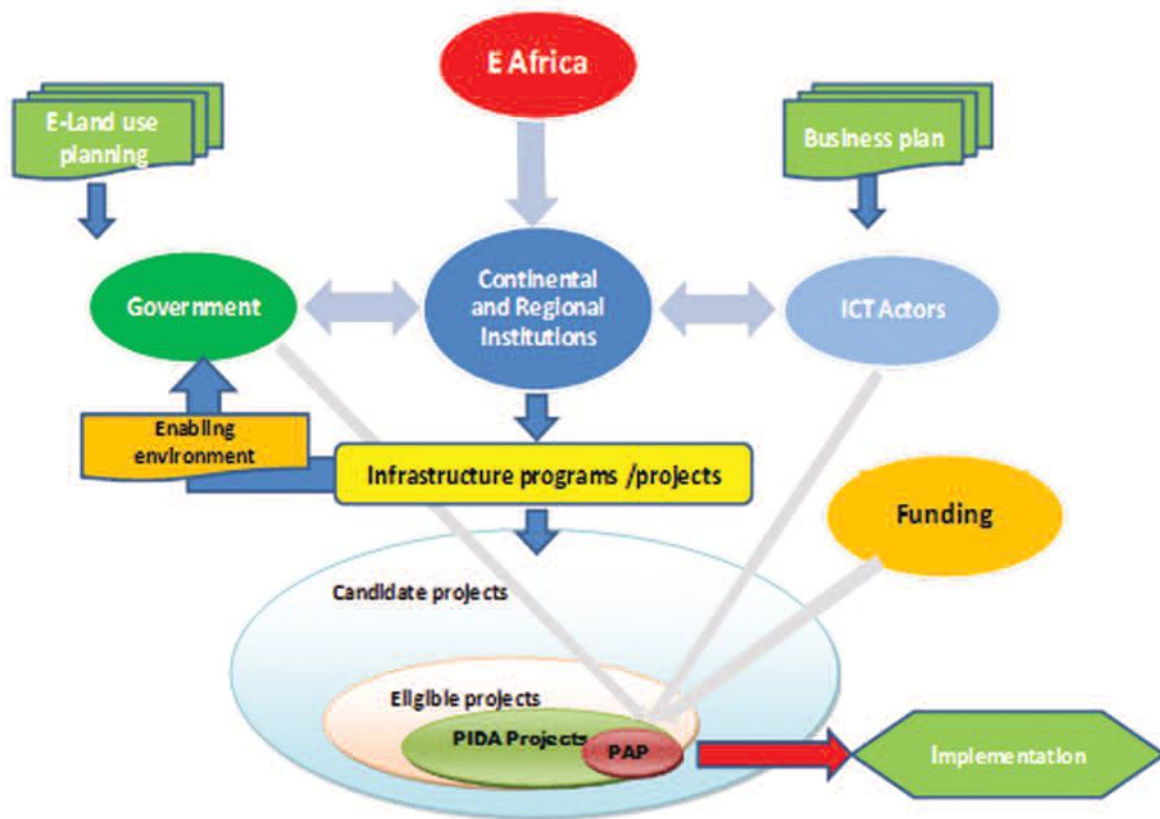
Guiding principles

The screening process applied to ICT projects for their integration in the PIDA program was carried out as described below.

Projects were first selected at the REC level and secondly at the inter-RECs and continental levels in accordance with the strategic framework.
Pre-qualification of projects was based on existing data relating to identified projects or projects under study, using action plans, master plans and investment programs, feasibility studies, project studies, and other potential projects obtained from a variety of institutions such as national agencies, regional organizations and also the private sector.

2.7.2   Types of programs and projects considered

For the PIDA ICT sector, in line with the other three PIDA sectors, four categories of programs and projects were considered:

- *Facilitation projects:* Establishing policy, regulatory and institutional frameworks to create an enabling environment for broadband development, associated investment and efficient operations to implement.
- *Capacity building projects:* Launching initiatives to empower the implementing institutions to perform their mandates.
- *Studies:* Preparing future projects
- *Investment projects[9]:* Investing in physical and capital projects

The agreed nomenclature for the projects described in subsequent sections of this Report as well as in the project files were categorized from N1-N4 as illustrated in the below table.

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[9] All the investments should reinforce competition or be based on open access to encourage competition in the service

<div align="center">**Table 1: Categorization of projects**</div>

Facilitation projects	N1: Institutional projects: initiatives establishing policy, regulatory and institutional frameworks to create an enabling environment for investment and efficient operations.
Capacity Building projects	N2: Capacity building projects: initiatives to empower the implementing institutions to perform their mandates with regards to infrastructure development and management.
Studies	N3: Pre-investment studies aiming at identifying investment opportunities and preparation of investment projects and programs.
Investment projects	N4: Investments in regional infrastructure for which the detailed studies are available.

To select and prioritize the potential PIDA projects falling into these categories, the methodology that is described below has been used. This process was discussed and agreed on by all PIDA stakeholders at various stages of the Study.

STEP 1: Eligibility of Projects
As agreed during the workshop held in Tunis on July 7 and 8, 2011, the eligibility criteria used are as follows:

<div align="center">**Table 2: PIDA ICT eligibility**</div>

Criteria	Definition
Country involvement	The program/project is regional/continental and involves 2 or more countries, with shared activities and undertaken in a spirit of cooperation
Africa's participation in the e-World market	Contribution to increased regional/continental integration and Africa's participation in the e-World market ■ Increasing connectivity in Africa and/or increasing connectivity with the rest of the world ■ Increasing security of access and usage
Consistency with PIDA ICT strategic framework	This covers both hard and soft programs: ■ create an enabling[10] environment for African broadband development ■ ensure access to submarine cable through different infrastructure (International connectivity) ■ connection to the neighbouring capital city or country through fibre infrastructure (regional connectivity) ■ Implementation of the appropriate national and regional IXPs to facilitate intra-African IP traffic

STEP 2: Multi-Criteria Analysis

Based on the examples of various multi-criteria analyses in Europe, in Latin America and in Africa, and the results of the stakeholder workshop in Tunis (July 7-8, 2011), the PIDA ICT analysis was structured around the five basic criteria listed below in ***Table 3.*** Through the ranking process, each project would be given a score between 1 and 100. Each criterion was given a relative weight based on the consensus reached during the July 2011 stakeholder workshop as follows:

[10] Added after ADDIS ICT RECs expert meeting (September 2011)

Table 3: PIDA ICT prioritization

Criteria	ICT sector	Score
		100
Economic and financing	▪ Financial/economic viability ▪ Attract public and/or private investment ▪ Involvement of multiple actors to share investment	35
Social rating	▪ Reduction of wholesale prices ▪ Increase in broadband quality and affordability to consumers ▪ Environmental impact ▪ Rural universal services enhancement	15
Institutional and policy	▪ Increase of connectivity and competition to landing stations and/or secure connectivity to coast for landlocked countries ▪ Increase connectivity, competition and security on regional infrastructure ▪ Open access ▪ Technologically neutral ▪ Wholesale prices are cost oriented	20
Technical criteria	▪ Sustainability of project ▪ Enough capacity to handle multi-operator networks ▪ Interconnection points and collocation facilities ▪ Sound operational and maintenance plan	20
Synergies among PIDA sectors	▪ Link to other sectors (transport, energy) reducing cost investment	10

At the subsequent Tripartite and IGAD workshop in Nairobi[11], the stakeholders observed that all the projects should be completed within the PAP time-horizon. In the future, the RECs, countries and DFIs would be able to use the ranking methodology to improve the ongoing development of their regional and national master plans.

[11] Sept 30 – October 1 2011

3. INFRASTRUCTURE DEVELOPMENT PROGRAMME

Key messages

The PIDA ICT infrastructure development program includes the following 3 elements:

1. Improvement of the policy and regulatory environment in order to ensure better access to existing fibre infrastructure and accelerate development of new fibre infrastructure.
2. Implementation of new land trans-boundary fibre infrastructure in order to (i) complete country interconnection at REC level, (ii) secure the countries' access to submarine cable landing stations, (iii) complete continental connection between RECs as well as develop new infrastructure and create private or private/public carrier to carrier operators using the opportunities offered by alternative infrastructure in synergy with the energy sector or independent infrastructure.
3. Implementation of national and regional Internet Exchange Points (IXPs) where needed

3.1 Elements of the PIDA ICT Infrastructure Development Program

The PIDA ICT Infrastructure Development Program includes 3 implementation axes as follows:

- Improvement of the political and regulatory environment in order to ensure better access to existing fibre infrastructure and to accelerate deployment of new fibre infrastructure.
- Implementation of new trans-boundary fibre infrastructure in order to (i) complete country interconnection at REC level, (ii) secure countries' access to submarine landing stations, (iii) complete continental connectivity between the RECs as well as develop new infrastructure and create private or private/public carrier to carrier using the opportunities offered by alternative infrastructure in synergy with the energy sector or independent infrastructure.
- Implementation of national and regional Internet Exchange Points (IXPs) where needed.

In this context, the methodology including the Priority Action Plan is as follows:

Figure 18: ICT Infrastructure development organigram
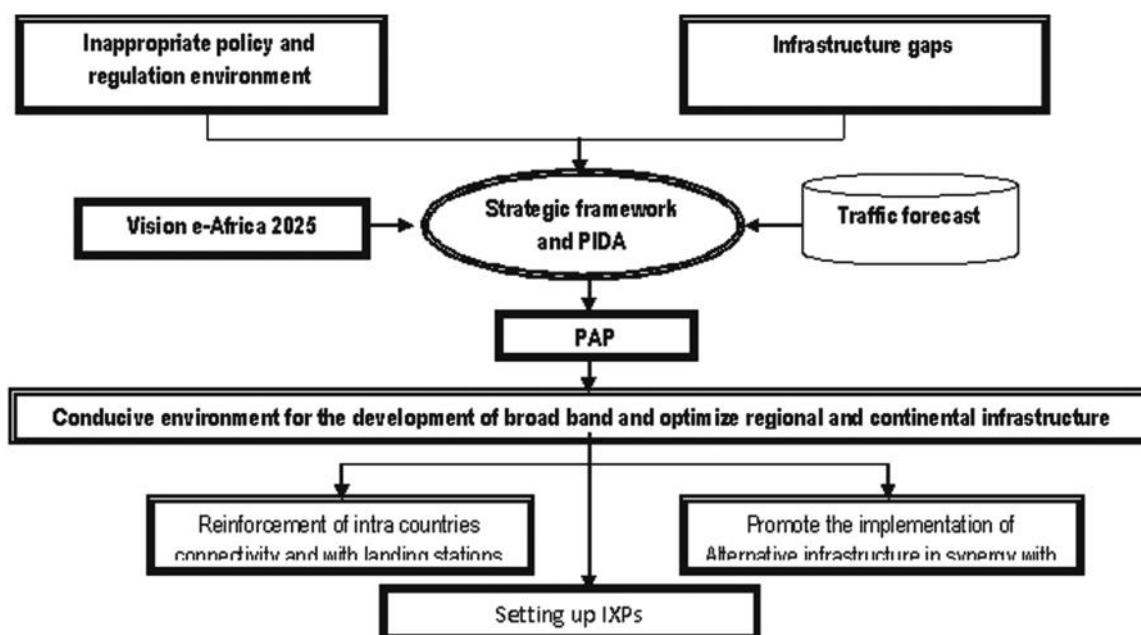
3.2 PIDA ICT Projects, the Regional Master Plan for the Development of Broadband

The process described in Section 2.7 has been taken into consideration when preparing the PIDA ICT Infrastructure Development Program and the PAP which cover (i) soft programs to improve the enabling environment, (ii) development of land infrastructure and (iii) implementation of Internet Exchange Points (IXPs).

3.2.1 The top priority – Enhancing the enabling environment for the development of broadband

The most important program identified is that of capacity building to support the key actions that policy-makers need to take in order to improve the national policy and regulatory environment so to make them as conducive as possible for the development of infrastructure aimed at high-speed broadband connectivity. Although some of these actions seem purely domestic rather than transborder issues, they have a direct impact on international/transborder capacity demand.

The outcomes of the various components of the capacity building program should be:

- Strengthening of a competitive environment for access to existing infrastructure notably, the regulation of SMPs and wholesale/retail price fixing to ensure a level playing field for new operators
- A charter to ensure that landlocked countries have access to submarine cable landing stations at prices similar to those of the coastal countries
- Facilitation of trans-boundary ICT 'smart' corridors implementation and use
- Development of land use planning rules to require the incorporation of ducts and/or fibre in transport, sanitation and energy infrastructure, including ensuring rights of way for operators
- Ensuring access to existing and planned alternative infrastructure, on a non-discriminatory basis and based on cost
- Sustainable and efficient planning and implementation of trans-boundary ICT infrastructure project
- Implementation of open access regimes for publicly funded infrastructure, including pricing methodologies
- ICT infrastructure market data collection and reporting
- Spectrum management in order to maximize international connectivity demand by releasing inefficiently used spectrum and reducing spectrum utilization fees

These elements are described in much more detail in the Annex "Guidelines for improving enabling policy and regulatory environments for ICT infrastructure investment" of the Report I. The elements would need to be localized to suit REC-specific environment (in particular where some RECs have already begun the process of implementing some of the guidelines. The HIPSSA program has done extensive work in this area, and provides a detailed analysis of the progress made towards implementing some of the required enabling policies and regulations in Sub-Saharan Africa as described in the Phase I report). The elements of the project could be divided into: (a) autonomous activities – independent from hard programs, and (b) programs linked as part of the enabling environment to implement hard infrastructure investment activities.

Some elements can be linked to ongoing HIPSSA activities to optimize their implementation; others may be the responsibility of the AUC, NPCA and the UNECA for continental programs, or under REC responsibility for regional programs.

Apart from the general environment conducive to broadband infrastructure, two of the more specific outcomes of the program are expected to lead to medium term projects in order to implement 'Trans-boundary Smart Corridor' projects for the establishment of passive infrastructure on trans-boundary transport routes, and for the identification of the additional needs of continental and regional infrastructure. These issues are further described in the Annexes.

3.2.2 Land fibre infrastructure program

Developing the land fibre infrastructure program is the result of key principles described in section 2.3.1.
The identified priority elements of the land fibre project have been discussed with the AUC, NPCA and the RECs in order to reach consensus in Addis Ababa in September 2011 and during the following meetings:

- Tripartite and IGAD meeting in Nairobi on October 1st, 2011
- ECCAS meeting in Libreville on October 4th, 2011
- ECOWAS meeting in Yamoussoukro on October 14, 2011
- UMA meeting in Rabat on October 27, 2011

a) Continental Master Plan: major infrastructure axes dubbed « regional »

The program should take into consideration how "regional infrastructure known as strategic" will be reinforced. Figure 19 shows the major ICT veins" to ensure for all the players' accessibility in both quality and quantity by 2020 (PAP).

**Figure 19:** Strategic Regional Infrastructure Map by 2020
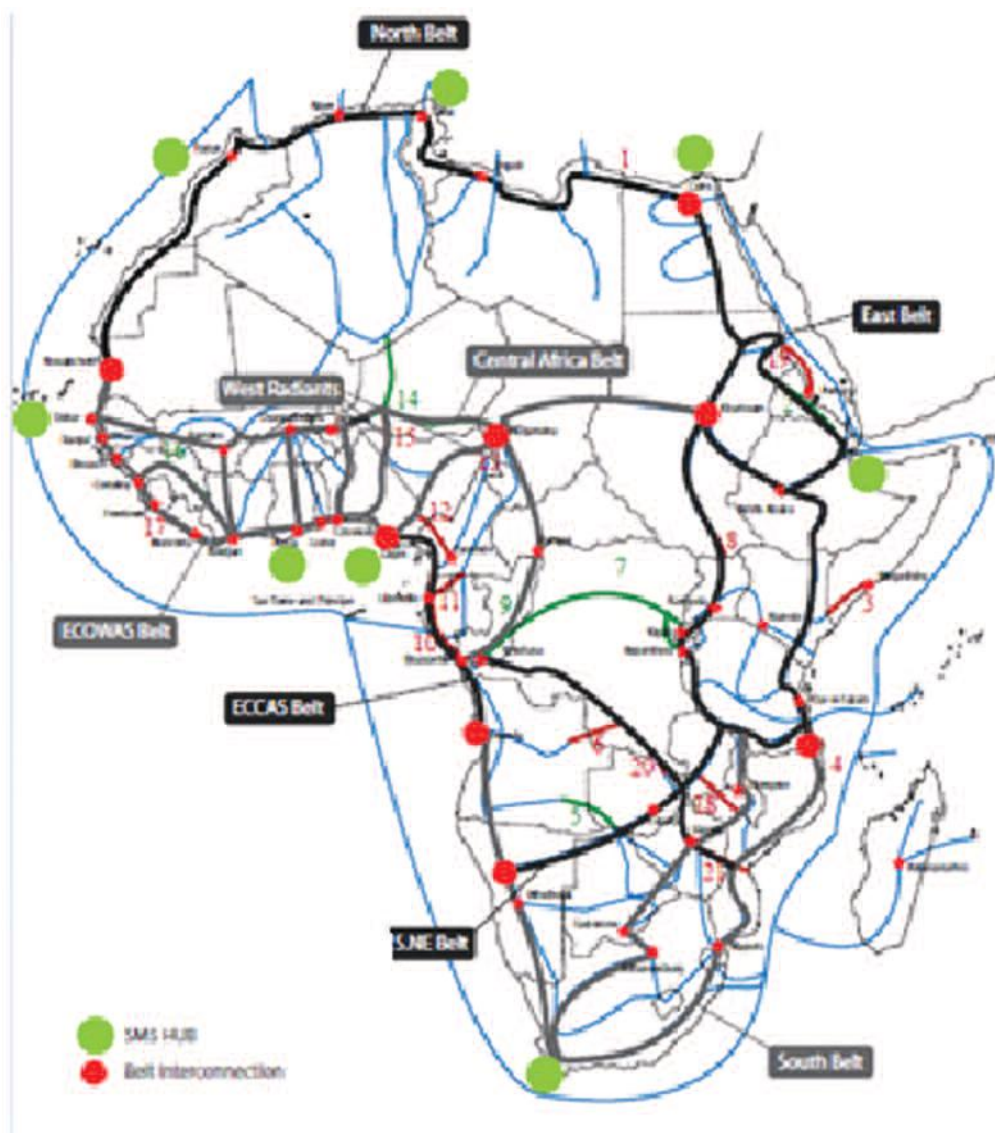
It can be broken down into sub-strategies as follows:

● Strengthening country interconnectivity and ensuring access to submarine cable landing stations can be carried out in various ways by:

● Strengthening infrastructure interconnection of the existing operators (the Missing Link approach)

● Optimizing existing alternative infrastructure and implementing new alternative infrastructure in synergy with other sectors

● Implementing carrier to carrier operators

● Existing programs or initiated by institutions.

● Implementing Internet Exchange Points (IXPs)

b) Strengthening of infrastructure interconnection of the existing operators (Missing link Approach) or implementation of regional infrastructure

These projects, identified below in ***Figure 20***, are made up of some relatively short trans-boundary links to interconnect national infrastructure of some neighbouring countries and some national backbone links which have not been carried out yet and which would play an important role in interconnecting countries to their neighbours or to connect neighbouring regions or countries to one another.

Figure 20: **Regional infrastructure and « Missing Trans-boundary ICT Corridors» Short Term 2015**
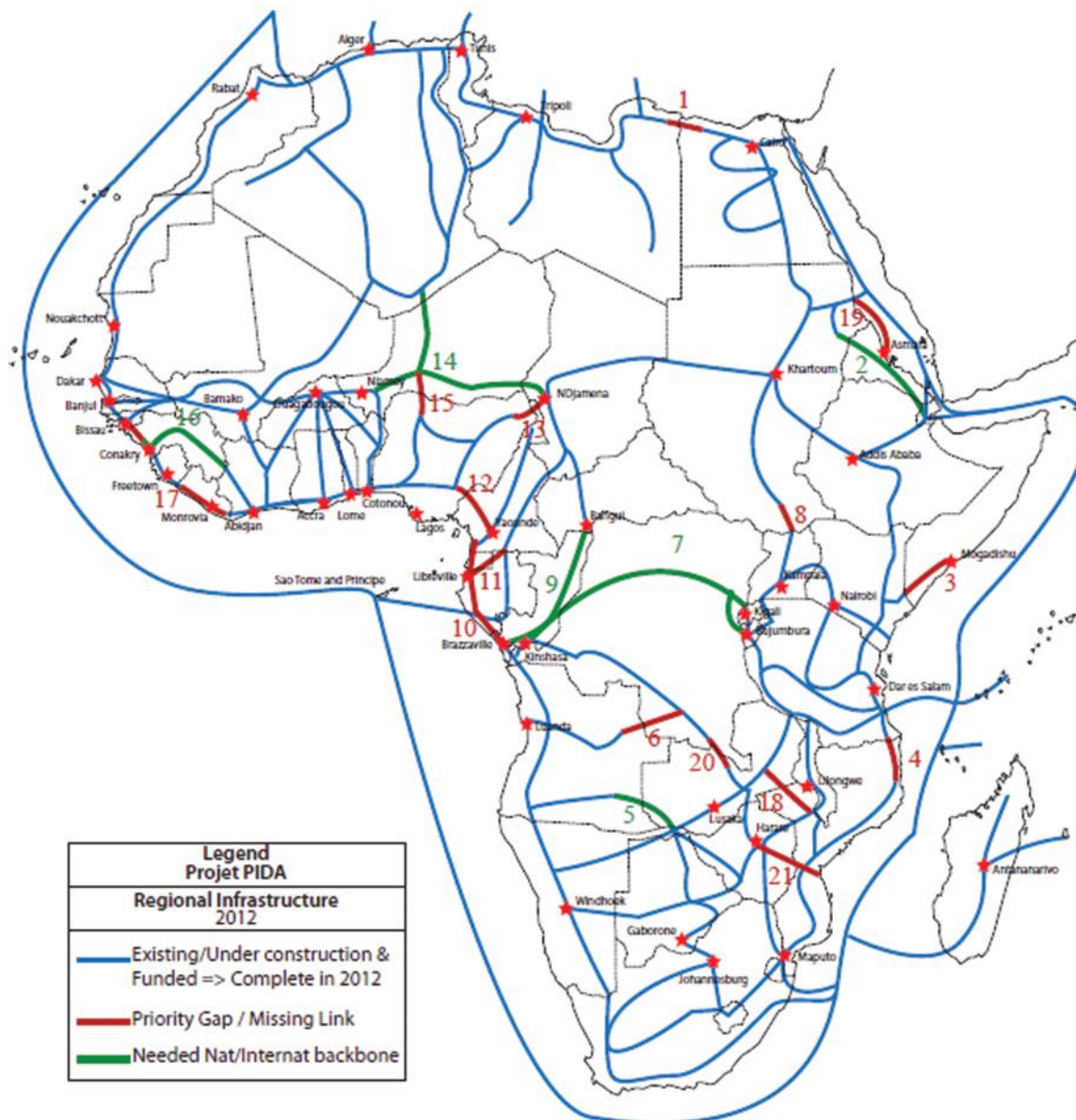
It is defined as a short term program which has as objective the realization of the Kigali objectives to end the isolation of landlocked countries and ensure connectivity. It is not very structuring but must be realized urgently in order to monitor broadband growth. The implementation of these projects will require the development of an enabling environment whose key elements will be:

• Facilitation by governments of the feasibility of trans-boundary links open to all the operators.
• Landlocked countries Charter or transparent accessibility to landing stations
• Regulation of wholesale offers of the dominant operators connected at both ends in order to guarantee connectivity to other operators that is broader than that of the "Trans-boundary ICT Corridors" and the publication of an reference offer catalogue.

Their implementation is also related to operation and maintenance structures which should ensure to players, financial transparency cost and a non-discriminatory approach, amongst others.

In the context of the PIDA Study, the master plans and the REC projects were taken into consideration and the various small projects were put together in order to develop homogenous, coherent and synchronized projects. They are synthesized per REC.

Their implementation is also closely related to deployment and operation facilities such as ICT alternative infrastructure provided by the road corridors or power transmission infrastructure and also private initiatives for the implementation of carrier to carrier operators as described in the examples in Annex 5.

c) Financial considerations

The global required financing for the PIDA fibre land-based infrastructure is related to initiatives underway or planned by some countries. A large quantity of proposed national infrastructure in particular can be part of regional infrastructure.

The sector's changes make it difficult to provide a comprehensive evaluation of the required financing as a portion could be included in the national infrastructure project. The last call for bids or projects put forward for a financing outside PIDA show the difficulty of a "fixed" PAP proposal for the ICT sector such as:
- Chad : STICOM call for bids July 2011
- Côte d'Ivoire : Call for interest for the DSP which will ensure implementation of national infrastructure (July 2011)
- Gabon : State infrastructure project (2011)
- Guinea : State infrastructure project (2011)

d) Setting up regional carrier to carrier operator: consolidation of competition with new independent infrastructure

Based on the same approach as that developed for the

RECs with their projects such as Nepad e BB, EAC Bin, UMA BB which were analyzed in Phase I, there emerge opportunities targeting private operators or Public-Private Partnership in Western Africa.

As this exists in East Africa (COMESA, EAC) with projects such as Liquid, KDN, WIOCC, strengthening regional infrastructure can be realized through the creation of two identified projects which complete in an advantageous way the WAPP project financed by the World Bank.

Figure 21 below shows the areas covered by three carrier to carrier projects:

- WAPP : Financed by the World Bank
- Phase 3: operational in Nigeria and seeking regulation and financial support for the sections in Togo, Benin, and Ghana. (60 millions $) (2011-2013)
- Finetis: Covering the UMA and ECOWAS and seeking financial support to invest in a whole independent optical fibre infrastructure offering carrier to carrier services. (Phase 1 : 50 millions $, total : 300 millions $ (2012-2015)

Figure 21: Carrier to carrier influence zone
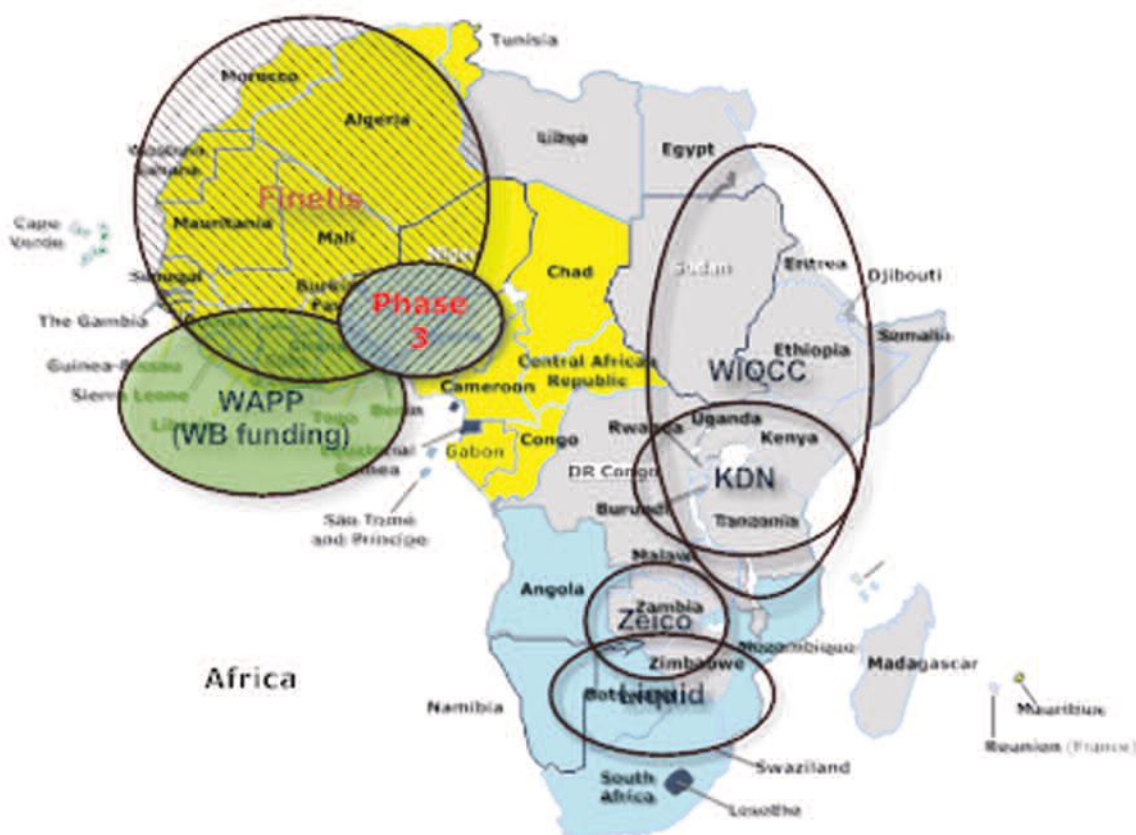
Phase III projects (extension) and Finetis complete in a very advantageous way the WAPP project financed by the World Bank. Besides, the Finetis project is partially based on purchasing IRU using the Nigeria-Niger-Algeria infrastructure.

Figures **22a, 22b, 22c**, below show the coverage by the 3 carrier to carrier operators identified in the PIDA Study.
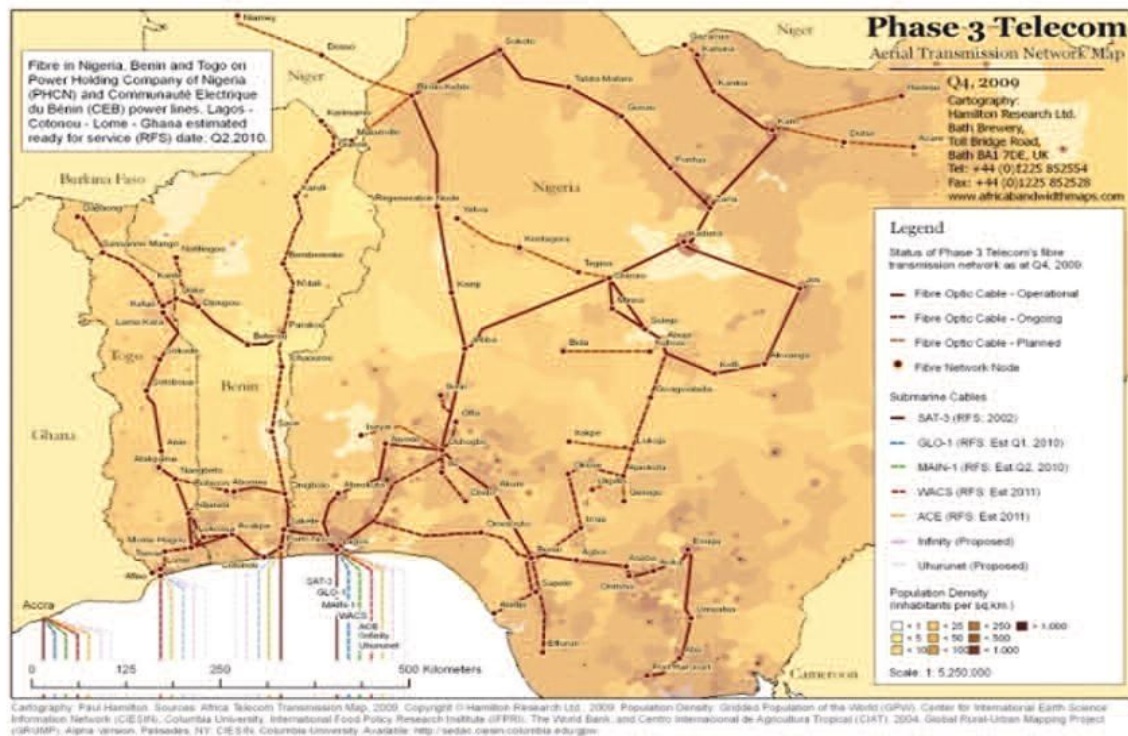
Figure 22a: WAPP financed by the World Bank
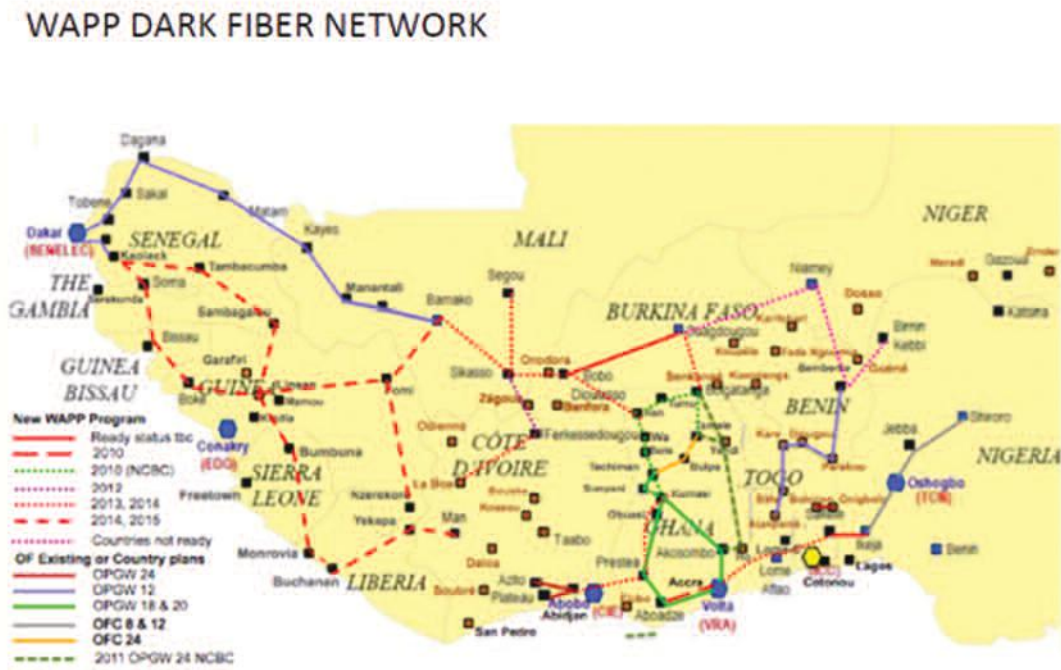
Figure 22b: Finetis proposed as part of PIDA ICT

Figure 22c: Phase3 Extension (Ghana, Benin, Togo...) proposed by PIDA

Details of the Phase 3 Project and Finetis are provided in Part 4 of the Report.

It is important to note that the Phase 3 Project is in synergy with the sector "Energy Transport" thanks to the implementation of the OPGW cables on CEB which Finetis purchases on certain IRU sections on existing infrastructure (Algeria-Niger…)

It would be equally important to further the approach to analyze potential synergies with road corridors.

3.2.3   Traffic exchange point Program (IXPs)

Strategic axes for the creation of IXPs

a) Deploying IXPs on the African continent is important as it allows the following:

• The reduction of the traffic exchanged between African ISPs subject to the following conditions:

    ✔ That African IXPs be virtually interconnected among themselves at the regional level (but not in the institutional REC sense). Interconnection between IXPs using the same language, and where strong economic and cultural exchanges would improve regional integration economically and culturally. This need can be amplified with the emergence of data centres which will converge the flow of traffic coming from "linguistically related" countries (UMA-Egypt for example)

    ✔ That all the ISPs be connected to an IXP as traffic exchange point amongst themselves (peering).

• The role of access point for the international bandwidth for « small » ISPs

• A country's IXP can be used as wholesale for the purchase of international bandwidth for ISPs which are small consumers of international bandwidth and to reduce Mbps cost through volume effect.

b)   The reduction of the use of international bandwidth by setting up cache. Setting up cache tools at the IXP level would allow the reduction of the use of international bandwidth by "stocking" the most visited pages by African consumers (Facebook, YouTube, and Dailymotion, for example…). Setting up both IXPs and a transparent cache would allow the saving of a large quantity of international bandwidth "purchased" from submarine cable operators

c)   The priority axes:

    ✔ The landlocked countries, being « dependent » in terms of access to submarine stations

    ✔ The countries with a certain number of ISPs (and/or ASN) to increase national peering

    ✔ The group of countries with the same language or culture if they are interconnected

d)   Legal and regulatory framework:

    ✔ Setting up an enabling legal and regulatory framework in order to increase the efficiency of IXPs

    ✔ Independence of IXPs from the operators' cost (neutral)

    ✔ Supervising the usage cost by players)

Traffic Exchange Points, commonly called Internet Exchange Points (IXPs) are a key part of basic ICT infrastructure, necessary for ensuring low latency between networks and minimizing the flow of national/regional traffic that would otherwise travel outside the country/region. Africa is behind all other regions of the world in respect of IXPs, with less than 50% of the countries hosting these facilities, which are mostly concentrated in Eastern and Southern Africa, and there are no regional exchange points to keep international traffic within Africa on-continent.

Figure 23a: **Optimization of intra-African traffic routing and reduction of the use of   "wholesaler" international bandwidth to international bandwidth for ISPs (best prices)**
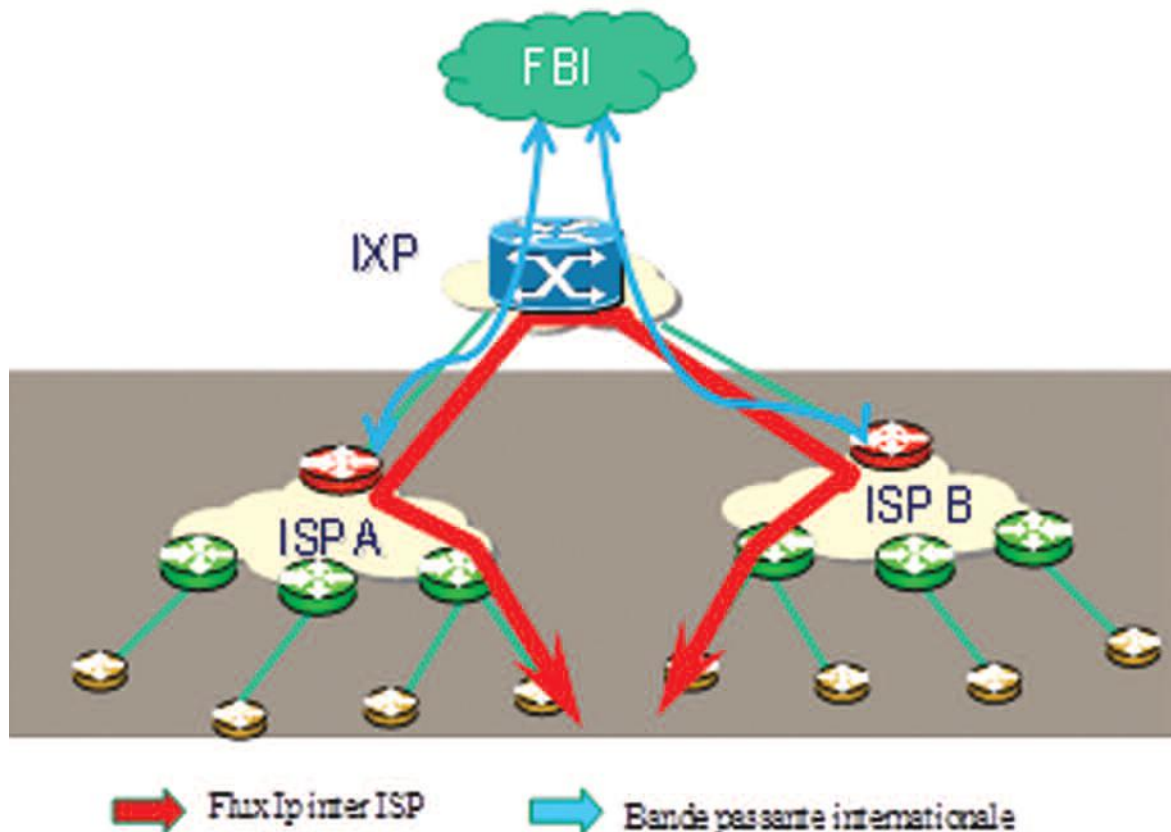
In addition, the membership of most of the existing IXPs that have been established is low, and has not reached a critical mass of operators to make them self-sustainable in most countries. Furthermore, local traffic is not always exchanged over IXPs even where they do exist, and few have additional facilities to minimize international traffic, such as cache servers, mirror servers and Content Services Distribution Networks (CDNs) such as Akamai and the Google Cache.

As a result, the lack of IXPs and the poor operation of the existing IXPs mean that, each year, millions of dollars are paid to internet transit providers outside Africa for traffic which could remain local and thus improve network performance at far lower cost.

The need to promote the development of IXPs has been recognized at the continental and regional levels, however this interest has not yet been fully translated into concrete policies which promote the establishment of IXPs, and there is a need to clarify the best way to ensure their implementation and how to develop their role in optimizing regional traffic flows.

It is expected that many of the constraints to IXP development will be addressed by the improvements to the policy and regulatory environment, and the AUC's recently established AXIS capacity building project to support IXP development with EC funding under the UNECA ARAPKE flagship projects program. However, this needs to be augmented with additional resources to accelerate the deployment of IXPs in the countries which do not have them, and to implement regional traffic exchange points at the hubs where international fibre cables meet, particularly where multiple submarine cables land.

Figure 23b: IXP in African countries
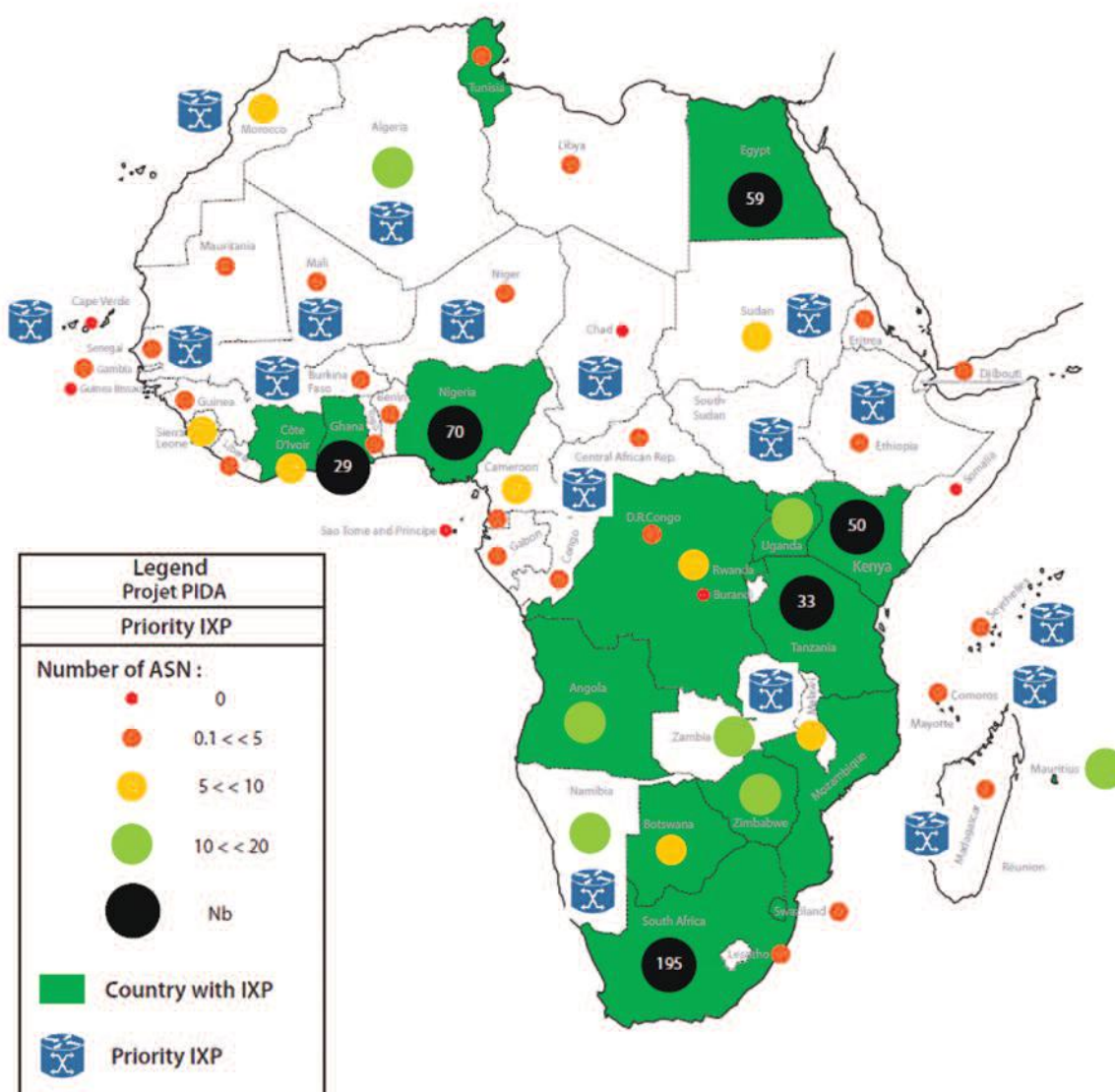
3.2.4 Regional projects on hold

As agreed by the stakeholders at the various AUC and REC meetings in September and October, 2011, the existing regional projects that have already been approved by the RECs and the NPCA will also be included in the PAP. Some of these will need to be updated and rationalized within the overall PIDA ICT program for which there may be some overlap with the individual land-based fibre projects identified (the missing links).

The projects that fall into this category are:

- EAC-BIN (overlay network leasing capacity for resale)
- COMTel (revised – missing links and traffic clearing houses)
- UMA Broadband Network
- ECOWAS Broadband Network (addressing national backbones with cross-border elements)
- SRII BB Network (linking incumbent operator networks)

- CAB Phase I, II
- Lake Victoria Maritime Communications Network
- NPCA Development and review of Business Plans in West, Central and North Africa

The ECOWAN project was not included; it is not part of the scope of PIDA because it is an ECOWAS project. In addition, two private sector projects have been proposed – the FINETIS North West regional optical fibre ring, and the extension to Phase 3 Telecom's OPGW network using the WAPP infrastructure.

Many of these projects were initialized many years ago and are still at a project stage. A good number of them are not up-to-date and don't take into account changes that occurred. They should be readjusted to the new regional context.

The final budget for some of these projects is awaiting additional information from the stakeholders.

3.3   List of Candidate Projects

During the diagnosis phase (Phase I), the Consultant collected data relating to a number of projects corresponding to the criteria listed below. The following Table 4 provides details of these projects with key information needed for the selection process.

Project	Regional Responsibilities	General Description and Comments	Estimated Cost (USD)	Cross-sector Synergies
Capacity Building Program (Soft Projects)			.	.
Unified capacity building program and development of an enabling environment	AUC, RECs	Promoting competitiveness ▪ Interconnection Catalogue (Each operator with a dominant market position must have his own catalogue available to the public) ▪ ICT Infrastructure financed by the public sector (Developing guidelines for land-based infrastructure financed by the public sector) Trans-boundary and regional infrastructure ▪ Ensure that the implementation of trans-boundary infrastructure is carried out with the same simplicity as deploying national ones Right of way ▪ Planning guidelines for any new construction requiring the implementation of fibre pipes and the necessary equipment The Trans-boundary Corridor Strategy ▪ Planning guidelines for any new regional corridor infrastructure in order to allow free access to fibre links Collecting ICT and trans-sector data ▪ Collecting and publishing quarterly data under the responsibility of national regulators ▪ Collaborative development of institutional frameworks to set up cross-sector decision-making assistance systems based on GIS Long term strategy of the broadband infrastructure ▪ Developing continental and regional guidelines on ICT infrastructure Landlocked countries charter ▪ The landlocked countries Continental Charter, to ensure that the cost of access to submarine cable landing stations are similar to those of the coastal countries Spectrum Management ▪ Optimal allocation of spectrum with rates reflecting the costs in order to promote national demand and maximize the offer of services.	**22 500 000**	
Qualitative and quantitative inventory of regional infrastructure	UNECA, NPCA, REC	Inventory of existing infrastructure: ▪ Exact mapping of infrastructure per country, owner ▪ Quantity of OF per cable and OF type of extension (OF per cable and type of OF and type of laying (buried, in ducts) ▪ Wholesale offer : rates per service	**750 000**	
Assisting NPCA in promoting and monitoring PIDA	NPCA, REC, funders	Monitoring the realization of PIDA, promotion to national players and regional players, technical and regulation assistance to regional institutions, transfer of continental guidelines to the RECs.	**3 000 000**	
Harmonization of the legal and regulatory framework	UMA	Developing an harmonization program following the feasibility study carried out in 2010/2011 and financed by the ADB	**600 000**	
Total soft Projects			**26 850 00**	

Project	Regional Responsibilities	General Description and Comments	Estimated Cost (USD)	Cross-sector Synergies
Program for strengthening interconnectivity between countries (ex missing link) (Hard Projects)			.	.
Libya – Egypt – short trans-boundary connections	COMESA, UMA	Required to extend the broadband infrastructure project to UMA in order to reach submarine cables in Egypt and other data centers. Based on the « ICT trans-boundary corridor »	260 000	Trans-boundary highways
Eritrea National Backbone / Soudan – Eritrea-Djibouti	COMESA	Priority project for COMESA. Required to extend the broadband infrastructure project to UMA in order to reach submarine cable in Djibouti.	36 400 000	Trans-boundary highways
Eritrea – Soudan submarine cable	COMESA	COMESA priority project. required to end isolation of landlocked Eritrea and reach submarine cable in Port-Sudan	20 000 000	
Kenya – Somalia (Cross REC)	EAC, COMESA, IGAD	Can be extended to Ethiopia in the mid-term. Dalcom announced that it has examined this road.	11 700 000	Road
Mozambique-Tanzania	SADC, EAC	Short link ; based on the ICT trans-boundary corridor	2 600 000	Bridge
Angola – Zambia	SADC, ECCAS	Link between national backbones, gives Angola direct access to a hub of 4 countries – Zambia, Botswana, Zimbabwe, Namibia	31 000 000	Power line?
Zambia - DRC	SADC	Short trans-boundary link	2 600 000	Road
Zambia – Namibia	SADC	Short trans-boundary link	260 000	Road
Zimbabwe - Mozambique	SADC	Short trans-boundary link	2 600 000	Road
Zimbabwe - Zambia	SADC	Short trans-boundary link	2 600 000	Road
Angola – DRC	SADC, ECCAS	Short trans-boundary link; based eventually on the ICT trans-boundary corridor. The section in Angola under construction until the border	11 700 000	.
DRC-Rwanda-Burundi (Cross REC) : backbone section in DRC	SADC-EAC	Large scale long term project proposed by OCPT. 600 km of backbone along the DRC border. Second section of 600 km along the DRC border until Bangui.	70 200 000	Congo River
Uganda – South Sudan (Cross REC?)	EAC + ?	Status of South Sudan not defined. SEACOM announced that it is studying the project.	14 000 000	Road
Congo Brazzaville National Backbone – RCA – DRC	ECCAS	CAB section, Phase 2?	26 000 000	Congo River
Gabon – Congo – RDC – Angola	ECCAS, SADC, COMESA	Phase II CAB Regional Project? Angola-RDC supported by SADC. The hypothesis is that Gabon national backbone is set up	7 800 000	Road
Equatorial Guinea - Cameroon/Gabon	ECCAS	Link between 3 countries. Specific analysis is required for national infrastructure project proposed by Gabon	780 000	Road
Nigeria-Cameroon (Cross REC)	ECOWAS- ECCAS	Based on the ICT trans-boundary corridor. It is necessary to adjust the Cameroon regulatory environment	4 680 000	Road
Nigeria – Chad via le Cameroon (Cross REC)	ECOWAS- ECCAS	Environmental problems predictable because crossing the lake is required. The trajectory across Niger or Cameroon can be more sustainable. It is necessary to adjust Cameroon's regulatory environment	7 800 000	Road via Cameroon
Backbone Niger National – Niger - Chad, Niger – Algeria	ECOWAS-UMA-ECCAS	Niger South road with dense population. Economic sustainability will be improved if the Algerian regulatory framework is compliant with the free access models of the strategic framework	8 100 000	Trans-Sahara highway to Chad. Northern road – pipeline
Niger – Nigeria	ECOWAS	Phase 3 has plans for this link, which can equally be projected within Project 14	3 900 000	Section of the WAPP Road and Oil
Backbone National Guinea – Bissau-	ECOWAS	Guinea is already proposed	31 200 000	Road

Project	Regional Responsibilities	General Description and Comments	Estimated Cost (USD)	Cross-sector Synergies
Conakry - Sierra Leone, Conakry – Cote d'Ivoire				
Backbone Liberia – Sierra Leone – Cote d'Ivoire	ECOWAS	The Government of Liberia intends to use World Bank funds to finance this backbone – ACE	20 800 000	. Road
Total Project « Strengthening inter-connectivity (missing link) »			**308 880 000**	
Projects of carrier to carrier				
Phase 3 Extension Nigeria – Benin – Ghana,	ECOWAS	Financing carrier to carrier project using OPGW optical cables in synergy with power companies. 3 000 Km optical cables	60 000 000	
FINETIS – West and North Africa ring	UMA, ECOWAS	Regional private project to deploy fibres. Public-Private partnership and setting up an operator to cover 16 countries are required to increase sustainability and share civil engineering costs. Legal and regulatory analysis can be carried out per country with potential adjustment to secure feasibility	300 000 000	
Total Carrier to Carrier Project Infrastructure			**360 000 000**	
Securing and strengthening continental infrastructure				
Securing and strengthening continental infrastructure	NPCA, RECs	Upgrading existing and recent infrastructure (capacity, technology, etc) Secure all countries access to at least 2 landing stations Promote additional sub marine cable projects to ensure that any country have access to at least two different cables	500 000 000	
Total security and strengthening of continental infrastructure			**500 000 000**	.
Internet Exchange Points (IXPs) Program				
Improve the operation of existing IXPs and deploy new ones	CUA / NPCA, RECs	Complements and strengthens AFIX project	12 900 000	
Total Traffic Exchange Points Program			**12 900 000**	
Approved Regional Projects				
Ideally, physical infrastructure, although some proposed projects include regional networks, to compete with or complete physical infrastructure				
EAC-BIN	EAC	Network to lease black fibres in order to compete with private projects (EABS and SEACOM) in order to guarantee low prices. **The business plan and concept must be reviewed to take into consideration recent developments and to be in compliance with the strategic framework.**	30 000 000	N/A
UMA broadband network	UMA	Realizing and securing the backbone linking UMA countries through a submarine cable station	203 400 000	.
Lake Victoria Maritime communications network	EAC	Mainly GSM mobile networks	8 300 000	.
Developing and analyzing Business Plans in North, West and Central Africa	ECOWAS, ECCAS, UMA, CEN-SAD, IGAD, NPCA	The study to be carried out will include 3 parts for 3 regions: West, Central and North Africa. Plans to deploy Special Purpose Vehicles to carry out the development of regional trans-boundary transport networks as indicated above.	1 800 000	

Project	Regional Responsibilities	General Description and Comments	Estimated Cost (USD)	Cross-sector Synergies
Extension of the AU Protocol on the political and regulatory framework for the broadband network AU-NEPAD (Kigali Protocol)	ECOWAS ECCAS UMA CEN-SAD IGAD	The Kigali Protocol was developed among 14 countries in East and Central Africa. It is urgent to extend it to the rest of the continent in order to facilitate the development of regional infrastructure. The extension of an enabling environment implies: ▪ Regional workshops to raise stakeholders' awareness (completed) ▪ Workshops to raise the intervening parties' awareness and reach consensus among countries (underway) ▪ Consultation, regional intergovernmental meetings ▪ Commitment with the countries to adhere to Protocol 5. Commitments with the countries to transpose the protocol within national laws and to issue the required operation licenses. This project will involve recruiting two policy and regulation experts who will be hired for a period of three years.	4 000 000	
Total approved projects (taking into consideration only the figures available to the Consultant)			**247 500 000**	
GENERAL TOTAL (USD)			**1 456 130 000**	

3.4 Regional Shaping of Candidate Projects and the PAP

It seems important to merge some candidate projects in order for them to be real infrastructure projects with a regional dimension. This grouping involves essentially REC projects namely the Missing Link projects.
The main reasons for such groupings are as follows:

● Presenting a multiplicity of "small missing link projects" does not show any regional strategy and is not « attractive » to financiers.
● After reviewing the context, some projects need to be analysed in synergy with the other sectors (transport, energy) in order to be economically viable.

● Other projects such as EAC-Bin, UMA-BB, are not compliant, stricto sensu, with the PIDA ICT strategic framework (infrastructure on an open access basis or carrier to carrier operators) or are based on obsolete data which has not taken into account the evolution of the sector.
● Some links can be built directly between operators (generally incumbent operators) as part of their "international business".

The ICT PIDA Study has therefore restructured the identified projects into broad themes to suggest that PIDA ICT be a master plan for the digital management of the continent and has added and modified a few points in order to have a coherent proposal in terms of efficiency and necessity.

Themes merged into programs within the PAP

1. Continental: Setting up an enabling environment
2. Per REC: Implementing new trans-boundary infrastructure in land optical fibre to complete inter-country connection and guarantee access to countries with submarine cable landing stations in synergy with other sectors (transport, energy) and with the private initiatives of carrier to carrier projects for regional coverage.
3. Internet Node eXchange: implementing internet traffic exchange points (IXPs) at the national and regional levels where needed.

3.4.1 Continental "soft" programs

3 programs are included in the PIDA PAP:
Setting up an enabling environment (Continental)
This program includes a large number of « soft » projects also known as Guidelines. They relate to major policy bottlenecks and the legal and regulatory frameworks. They also relate to continental digital

management plans in synergy with other sectors.
Due to the harmonization being different at the REC level as well as at the country level, the soft program has been implemented upon request of the RECs either for the purpose of improving the legal and regulatory framework in all the REC's countries (Regional improvement), or for the purpose of monitoring a particular project (Developing an enabling environment for a project).

Qualitative and quantitative inventory of regional infrastructure

This program is provided as a monitoring program for PIDA implementation. In fact, it seems necessary because:

• The efficiency of the PIDA program implementation[12] requires regular monitoring of the deployment of infrastructure (existing projects and underway).

• An efficient and effective implementation of PIDA will be possible only with a good knowledge of the existing infrastructure: Operators' land infrastructure; alternative infrastructure, amongst others, the ones deployed or being deployed by the transport and energy sectors …

But also a good knowledge of the major following characteristics: Quantitative aspect (Number of OF per cable); Qualitative (OF type), Type of extension (buried, in duct, OPGW…)

This program will identify and map the trans-boundary ICT passage points as well as the presence points of all the operators close to these passage points.

Assistance of NPCA in promoting, monitoring PIDA and raising players' awareness

This program will be an extension of the AU Protocol on the political and regulatory framework for the broadband AU-NEPAD network which is no longer necessarily a matter of urgency.

Synthesis of the continental soft PAP

Project	Amount	Note
Setting up an enabling political, legal and regulatory framework (2013)	22 500 000 $	Project PAP 2013
Qualitative and quantitative Inventory of the regional infrastructure – 2012-2015	750 000 $	Project PAP 2013
Assistance of the NPCA to promote, monitor PIDA and raise players' awareness	3 000 000 $	Project PAP 2015
Total	26 250 000 $	

3.4.2   Short Term PAP projects (2015) per REC

The 4 major expected results

1. Total continental interconnectivity (reducing inter-African traffic interconnected outside Africa)
2. Ending the isolation of landlocked countries
3. Ensuring access to submarine landing stations and competitiveness
4. Reducing use cost for consumers (Output of the three previous ones)

Project's geostrategic aspects and regional integration

Figure 24 summarizes the physical infrastructure of the short term PAP projects (2015) and shows its essential role in the management master plan to develop broadband as well as its federative role in regional and continental integration.

[12] Findings of the PIDA Study consolidated during meetings with the RECs

**Figure 24:** Global view of the ICT PAP 2015 impact on land infrastructures
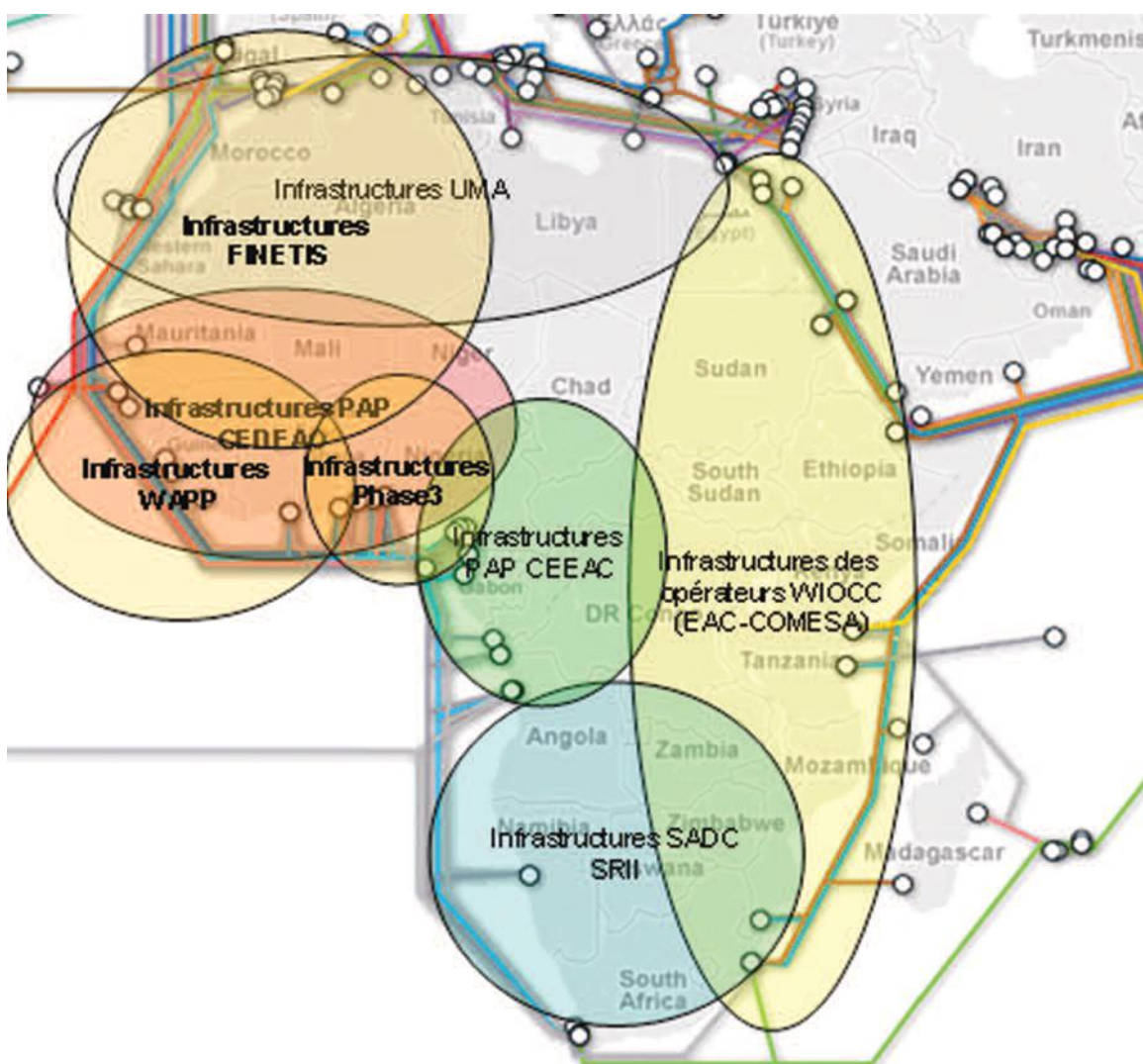
ECCAS program

With regards to ECCAS, the PAP involves:

● Setting up regional infrastructure linking countries to one another and strengthening connectivity to submarine landing stations.

● Strengthening connectivity between:

\- ECCAS -SADC-COMESA (North-South)

\- ECCAS and ECOWAS

● Ending the isolation of landlocked Chad and the Central African Republic ; and setting up ECCAS -COMESA connectivity (West-East)

Figure 25 shows the geostrategic aspect of the ECCAS project in consolidating regional as well as continental infrastructure. In fact, because of its geographical location, the realization of the ECCAS project is the founding element of continental interconnectivity.

Figure 25: Positioning the ECCAS PAP on the continental connectivity board
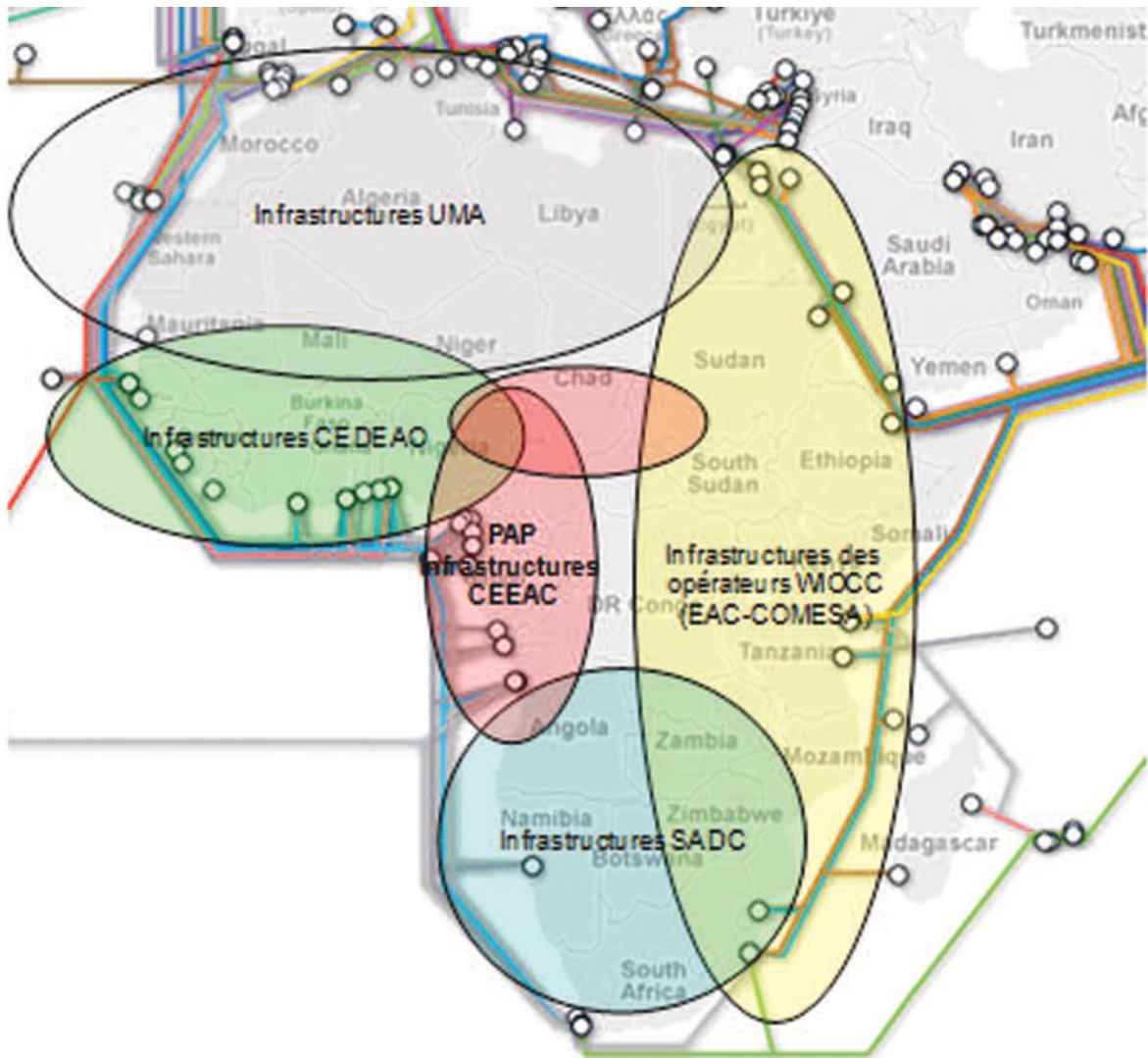
Table 5: Projects and amount

Project	Amount	Note
Project 1 Strengthening access to landing stations and interconnecting countries	85 000 000$	PAP Project 2015
Project 2 Ending isolation of landlocked countries /2ᵈ exit of Chad and Central African Republic	7 000 000$	To implement before end of 2013
Project 3 Ensuring land-based infrastructure, ending isolation of the Central African Republic	12 000 000 $ (option 4 000 000$)	To implement before end of 2013
TOTAL ECCAS PAP 2015	104 000 000 $	

ECOWAS Program

With regards to ECOWAS, the PAP is made up of 3 projects:

Project 1: Setting up regional infrastructure linking countries to one another and consolidating connectivity to submarine landing stations. 3500 km of infrastructure linking existing infrastructure[13] in Senegal to that of Ghana. This project must equally allow Guinea Bissau, the only country without submarine landing stations, to access the stations of other countries.

Project 2: Consolidating connectivity between ECOWAS-Chad through Niger and Nigeria (North-South)

Project 3: Consolidating connectivity between Burkina Faso – Benin – Niger, Phase3 Infrastructure Extension; Benin, Ghana…

[13] realization of some of this infrastructure can be merged with national projects (Cote d'Ivoire Tender July 2011- Guinea, Liberia, Sierra Leone).

Figure 26 below shows the geostrategic aspect of the ECOWAS project in strengthening North-South regional integration as well as continental integration.

Figure 26: **Positioning the ECOWAS program on the continental connectivity board**
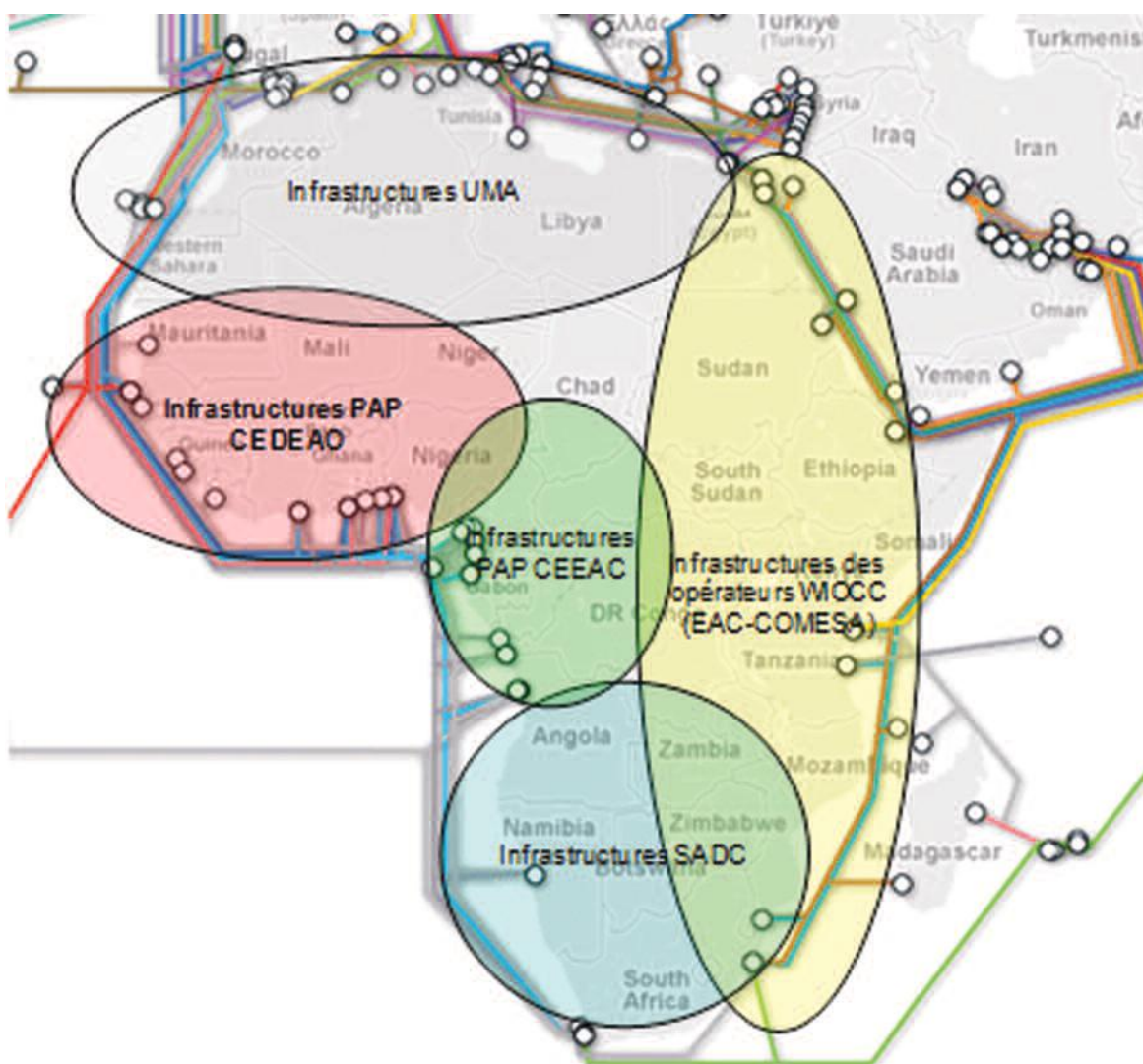
Figure 27 below highlights the geostrategic interest of the ECOWAS PAP for the 3 alternative projects (WAPP, Phase 3 and FINETIS) described subsequently.

Besides, these projects have a synergy in terms of sharing infrastructure to be implemented which will optimize even better the infrastructure as a whole.

Figure 27: ECOWAS and WAPP programs (WB), Phase 3 and FINETIS (PIDA PAP)
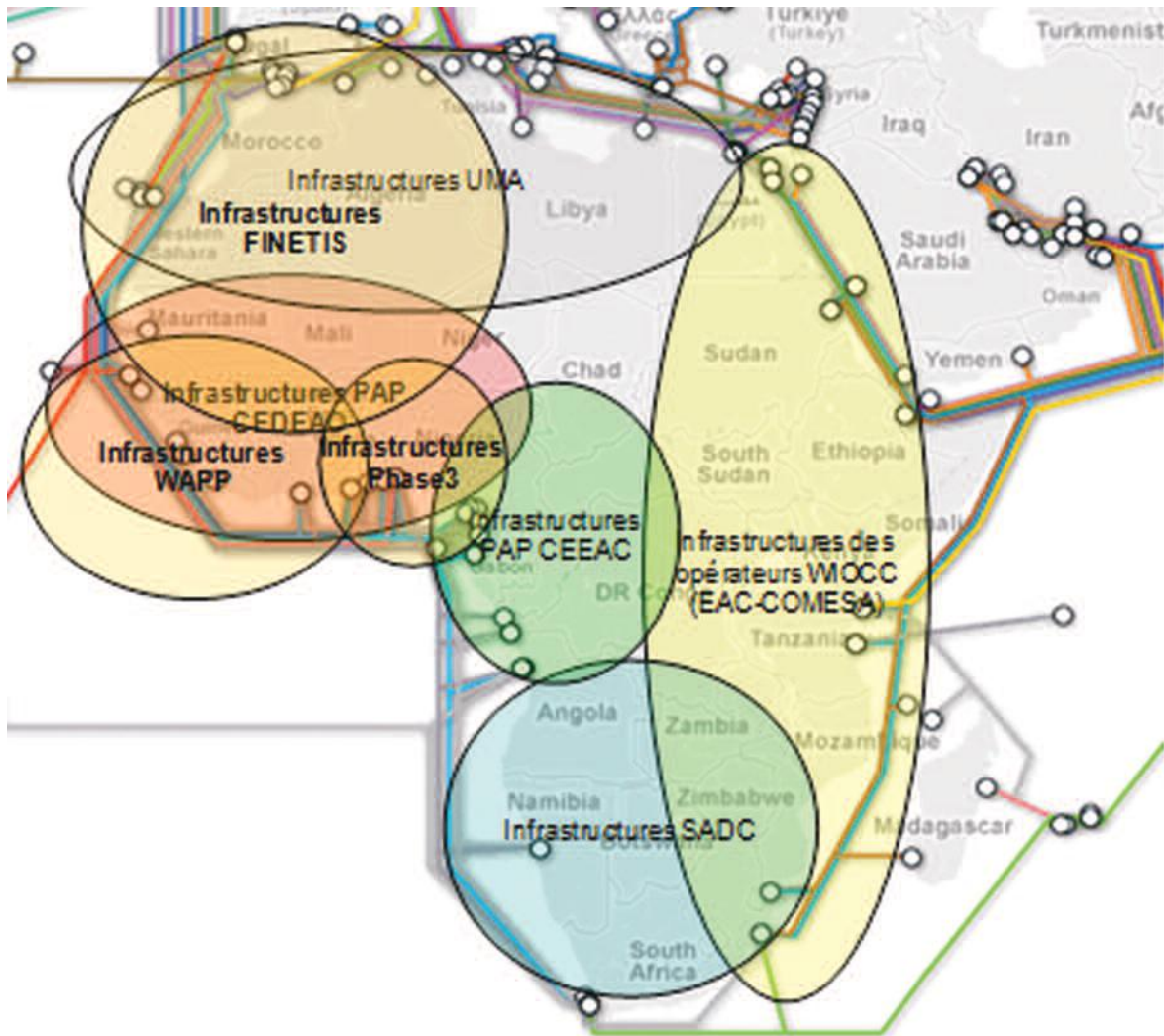
Table 6: ECOWAS PAP Projects

Project	Amount	Note
Project 1 Strengthening submarine stations and interconnection of countries	91 000 000 $	PAP Project 2015
Project 2 Mopti (Mali) – Niamey (Niger) – Zinder (Niger) – Connecting Nigeria	52 000 000 $	PAP Project 2015
Project 3 Strengthening Burkina Faso – Benin – Niger connectivity	10 000 000 $	PAP Project 2015 to realize before 2013
TOTAL ECOWAS PAP 2015	**153 000 000 $**	

COMESA/SADC/EAC and IGAD Program

The SADC-EAC-COMESA (Tripartite) and IGAD are currently very well equipped in terms of trans-boundary infrastructure with competition on the submarine cable landing stations.

As a consequence, the PIDA project and the PAP will build only few missing links and interconnections. These proposed projects cover the three regions, plus IGAD because some countries belong to several REC. The major PAP objectives are:

- Strengthening access to submarine cable landing stations in the region
- Strengthening interregional connectivity
- Supporting the creation of two national backbones (Democratic Republic of Congo and Eritrea)

● Connecting the last capitals which are not yet interconnected to their neighbours – namely Asmara, Mogadishu, Juba (South Sudan). We note in particular that these projects provide support to the new South-Sudan nation.

The major activities of the program are first of all to set up the following trans-boundary fibre links:

● Khartoum – Asmara – Djibouti
● Juba – Kampala (South Sudan – Uganda)
● Mogadishu – Nairobi (Somalia – Kenya)
● Angola – Zambia – Bujumbura (RDC – Burundi)

Figures 28a and 28b below provide an overview of some of the projects to be implemented within the PAP context as well as an overview of the 4 REC.

Figure 28a: Overview of the Tripartite PAP
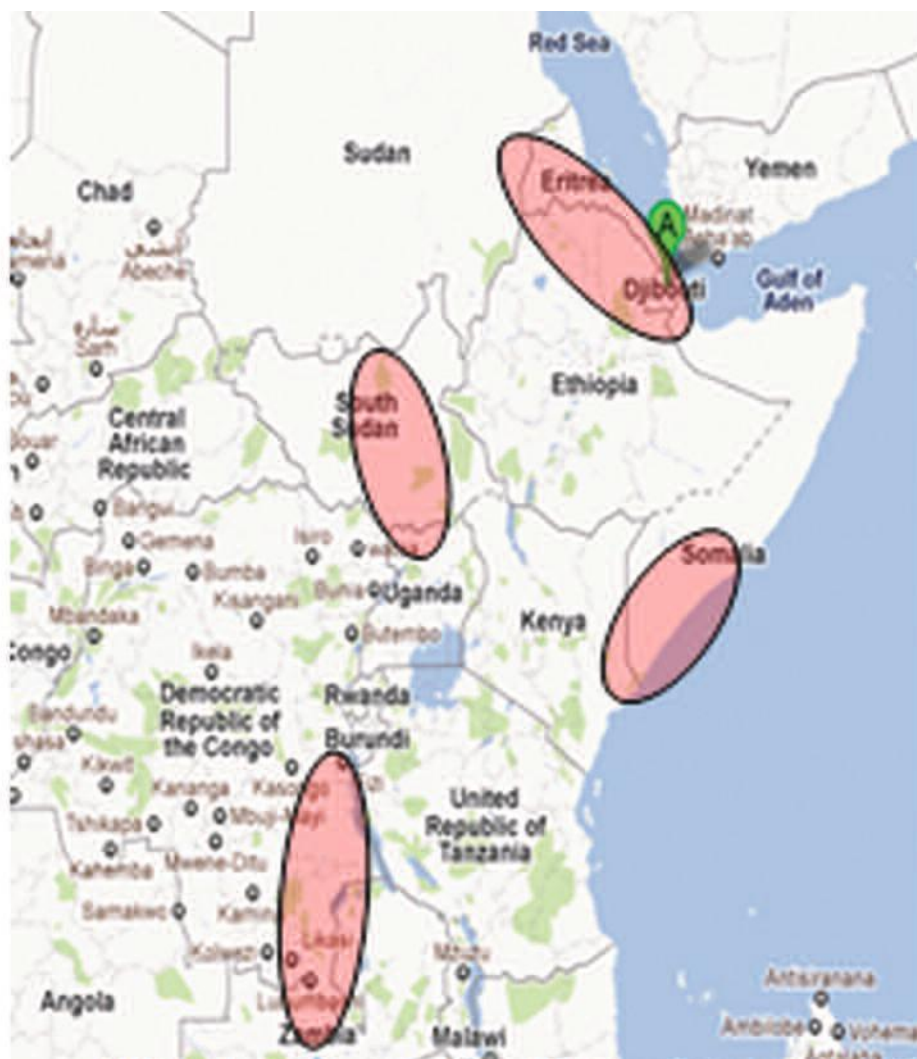
Figure 28b: Overview of the PAP connectivity 2015
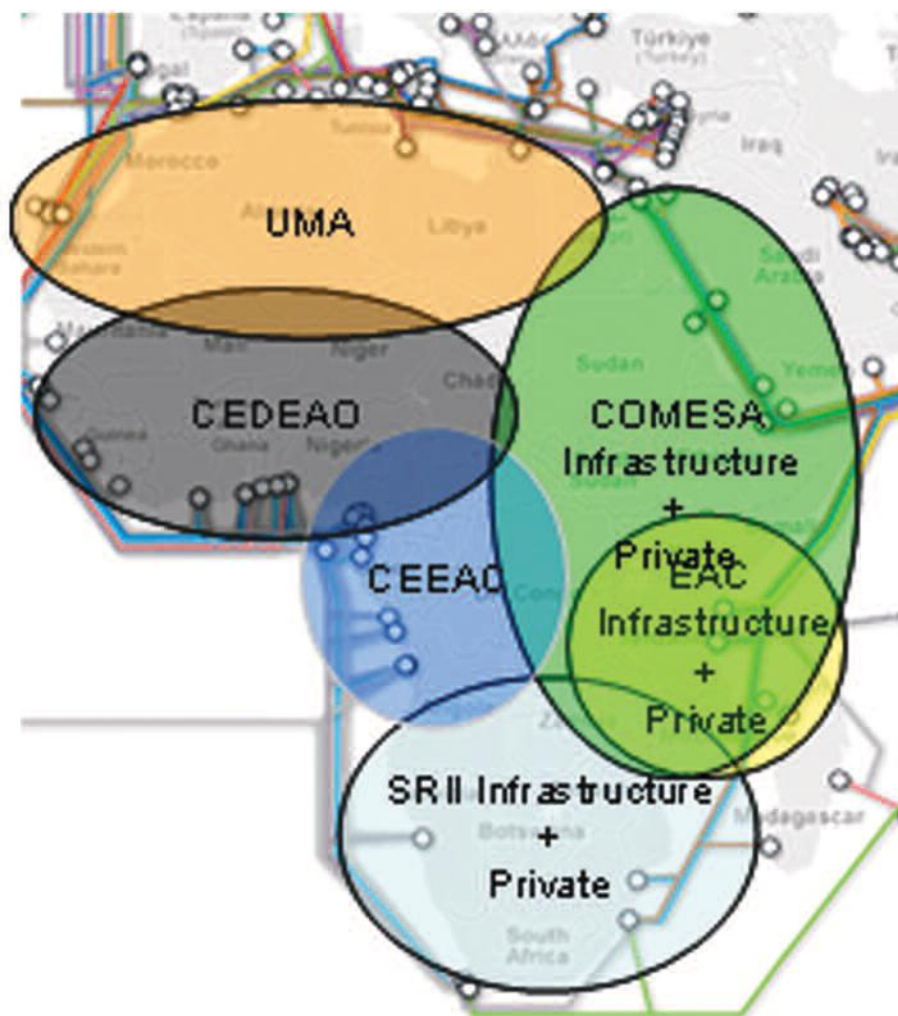
Table 7: Tripartite and IGAD projects

Project	Amount	Note
Project 1: Khartoum – Asmara – Djibouti	**36 400 000$**	PAP Project 2015
Project 2: Juba – Kampala (South Sudan – Uganda)	**14 000 000$**	PAP Project 2015
Project 3: Mogadishu – Nairobi (Somalia – Kenya)	**11 700 000$**	PAP Project 2015
Project 4: Angola – Zambia – Bujumbura (RDC – Burundi)	**12 000 000 $**	PAP Project 2015
TOTAL PAP COMESA-EAC-SADC-IGAD 2015	**74 100 000 $**	

UMA Program

Two (2) programs have been selected as part of the UMA PAP. They were the result of two studies carried out in 2010/2011.

Program for the harmonization of the political, legal and regulatory framework

A specific program is provided due to the specificity of the region. It is described in Section 4.3 in Chapter 4 of the Report.

However, UMA is also a beneficiary of the continental program.

Infrastructure program[14]

Apart from the harmonization of the legal and regulatory framework with particular focus on:

- The suppression of monopolies which still remain in some countries
- The strengthening of the use of existing infrastructure

[14] This project is included in the PAP at the request of the ICT Group during the Rabat meeting

• The wholesale offers of the dominant operators

• The strengthening of the use of alternative infrastructure.

UMA, subject to the extension of connectivity to Egypt, may play a key role in developing broadband in Africa and opening infrastructure which would help improve connectivity strongly:

• Sub-Saharan countries – Maghreb countries– Europe

• Countries of the same culture and Arabic language

• Accessibility to hub and data centres being installed in Cairo

It seems necessary therefore, to implement a harmonization in line with the PIDA strategic framework and to strengthen alternative infrastructure on the Senegal-ECOWAS-UMA countries-Egypt axe. This infrastructure can be implemented in synergy with the transport and energy sectors.

Figure 29: Trans-sector synergy Dakar – Cairo – Khartoum
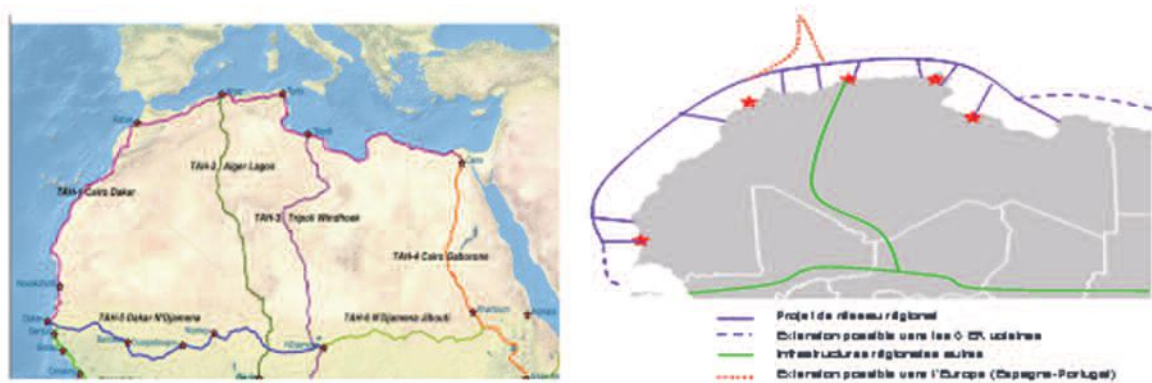
Table 8: Harmonization and infrastructure programs in UMA

Project	Amount	Remark
Establishment of an enabling political, legal and regulatory environment (2013) Harmonization of the legal and regulatory framework	600 000$	PAP Project 2015
Additional studies of the regional infrastructure feasibility	400 000$	PAP Project 2015
Regional infrastructure interconnecting the countries from Mauritania to Egypt	203 000 000$	PAP Project 2015
Total	204 000 000$	

3.4.3 Mid-term (2020) and long- term (2030) continental land infrastructure

Figure 30 below highlights the importance of strengthening, securing and increasing the density of land infrastructure by using appropriate strategies such as usables by ICT jointly with the sector applications (Smart Corridor, management and distribution of EHV and HV).

This program is the « large scale » PIDA ICT program and must be associated with:

• Land-use plans (cf. guidelines of the soft program) including the roads and the management of cities and buildings.

• PAP Programme (2020-2030) of the transport sector

• PAP Programme (2020-2030) of the energy transport sector

Figure 30 highlights the big priority axes in synergy with the transport and energy sectors.

Figure 30: Big priority axes to strengthen
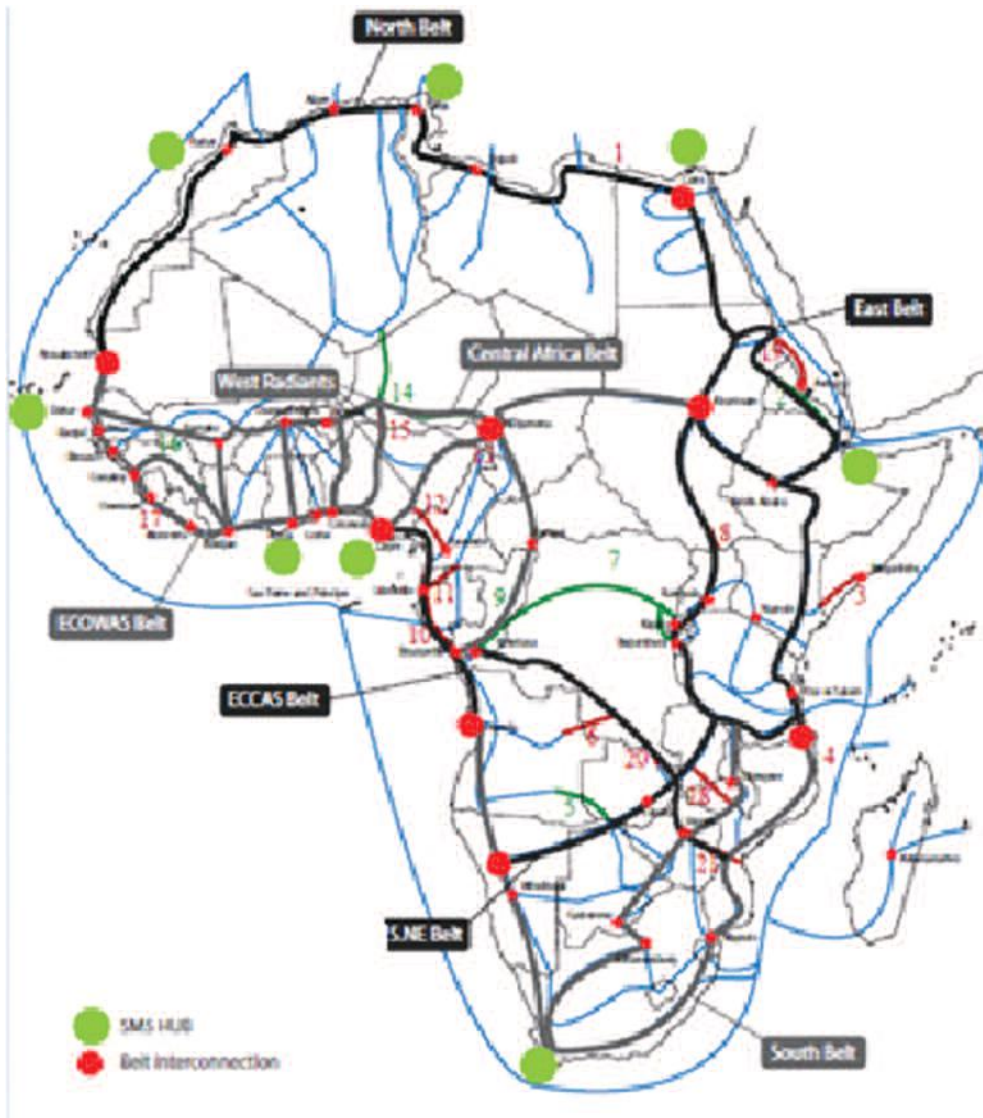
A provision of US$ 500 000 000 to support the development, routing security and enforcement of continental infrastructure by 2020-2030

3.4.4 Carrier to carrier project with regional coverage (ECOWAS-UMA)

These 2 projects involve:

- ECOWAS-Phase 3: Extension of alternative infrastructure in synergy with energy and carrier to carrier services.

- ECOWAS – UMA – FINETIS: Extension of alternative infrastructure to 16 countries of ECOWAS and UMA.

Figure 31 below shows the location of the 2 projects in a continental context and shows how the implementation of this infrastructure will strengthen competition on infrastructure.

Figure 31: Examples of alternative carrier to carrier operators (2011)
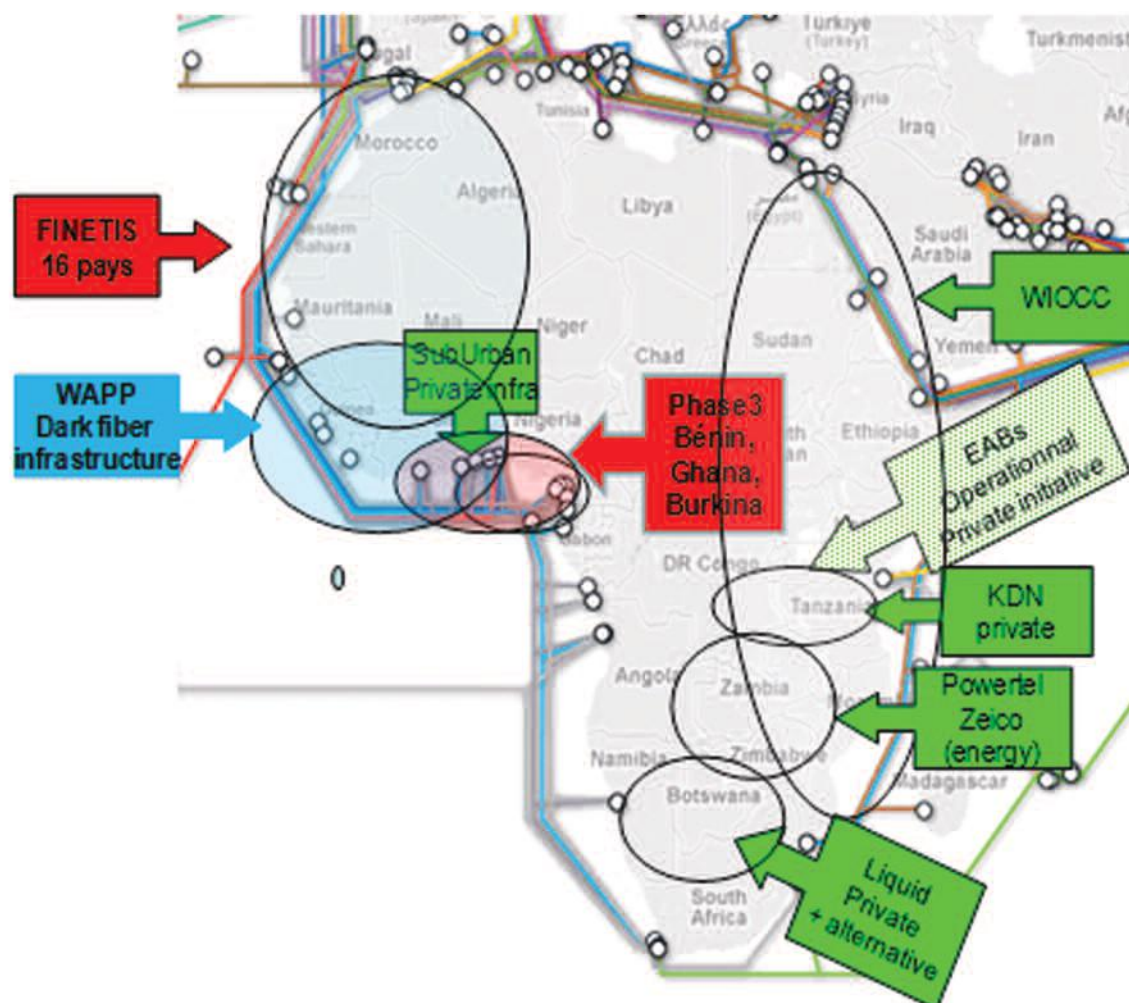
Table 9: Projects Phase3 and Finetis costs

Project	Amount	Remarks
Project 1 Phase 3 Extension of alternative infrastructure and implementation of a carrier to carrier in the Benin, Togo, Ghana...	**60 000 000 $**	PAP Project 2015
Project 2 FINETIS Setting up alternative infrastructure in 16 countries (UMA-CEDEAO) and establishing a carrier to carrier	**Phase 1 : 60 000 000 $** **Phase 1+2 : 300 000 000$**	PAP Project 2015
Total	**360 000 000$**	

3.4.5 PAP continental short term IXP (2015)

Accompanying measures for the study of the legal and regulatory framework to achieve an enabling environment by strengthening:

- The efficiency of the national IXPs
- The intra-African traffic flow (in association with the short term program setting up continental connectivity)

- The optimization of access to international bandwidth for players that do not have shares in the submarine cable consortiums (wholesale offer)
- The strengthening and security of access to all IP players with applications of the e-government, e-education, e-banking type…

This relates particularly to the countries without IXPs (+30) and the consolidation of the role of those already in operation.

Figure 32 shows the countries where an IXP must be operated and whose role must be consolidated.

Figure 32: **State of the national IXPs (2011)**
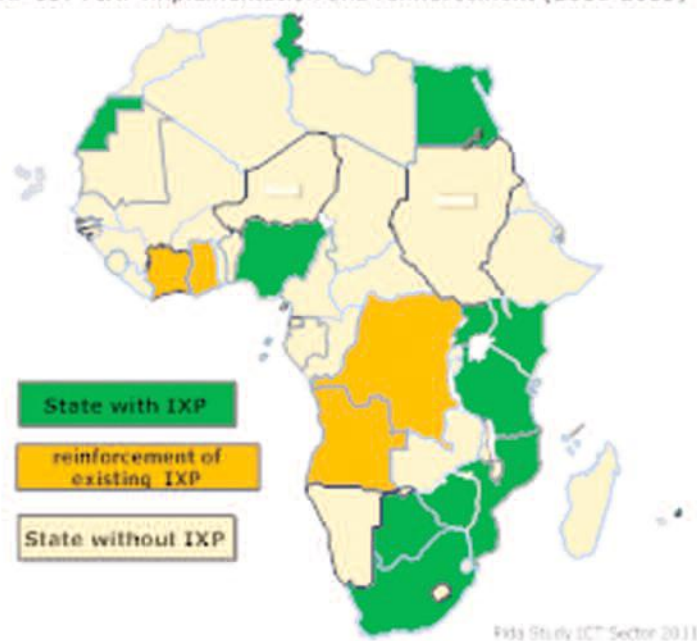
Project	Amount	Remark
Project 1 : **Setting up IXPs in the countries where they are not available and strengthening them where necessary**	**12 900 000 $**	PAP Project2015

3.5 PAP 2015 Synthesis and PIDA 2020-2030

Table 10: **provides a synthesis of the PAP and PIDA 2020-2030**

Region	Object	PAP 2015	PIDA 2020-2030
Continental	Soft	26 250 000 $	
ECCAS	Infrastructure	104 000 000 $	
ECOWAS	Infrastructure	153 000 000 $	
Tripartite and IGAD	Infrastructure	74 100 000 $	
UMA	Soft And Infrastructure	1 000 000 $ 203 000 000 $	
ECOWAS-UMA	Carrier to carrier Infrastructure	360 000 000$	
Continental	IXP Soft + hard	12 900 000$	
Continental	Infrastructure		500 000 000$
Total		**934 250 000**	**500 000 000**

4. IMPLEMENTATION STRATEGY FOR THE ICT PAP

4.1 Financing Broadband for Development in Africa

Broadband development is a challenge requiring a new strategic approach which depends on strategies for private sector investment mobilization, and where the regional institutions and Governments manage the delicate balance between the State's interests and the private sector's interests.

Despite the advantages of optical fibre networks, the pace of investment in this area has been slow because of limited pressure from competition, high investment costs resulting from the high cost of civil engineering works to construct ducts, regulatory issues relating to the issuance of permits and rights of way for access to streets, roads and other public land, as well as the limited sharing of optical fibre infrastructure by suppliers.

4.1.1 Diversity of the deployment potential and financing models

To bridge the gaps in broadband availability, three different financing and ownership models for the deployment of fibre infrastructure are considered:

- Initiated by the private sector where the environment encourages investment and there is a high demand for capacity
- Initiated by the State or other public investors to build infrastructure for all actors, managed independently
- A public private (PPP) model required by the operator

Because of the size of the market, the urgent needs, and infrastructural and operational problems facing Africa, it would be necessary to implement open access models for the deployment of some key optical fibre networks. The open access model is a framework enabling optical fibre cable carriers to share the use of the infrastructure. The model separates the roles of the service provider and the network operator, and provides services to operators on a fair and non-discriminatory basis. The aim is to ensure effective deployment and a competitive level playing field. This strategy is expected to quickly achieve the necessary continental broadband infrastructure while letting the market takes its course. However, this approach requires that non-discrimination in access is upheld and that the investment reinforces competition at the service level.

Figure 33: Regional project initialization block diagram
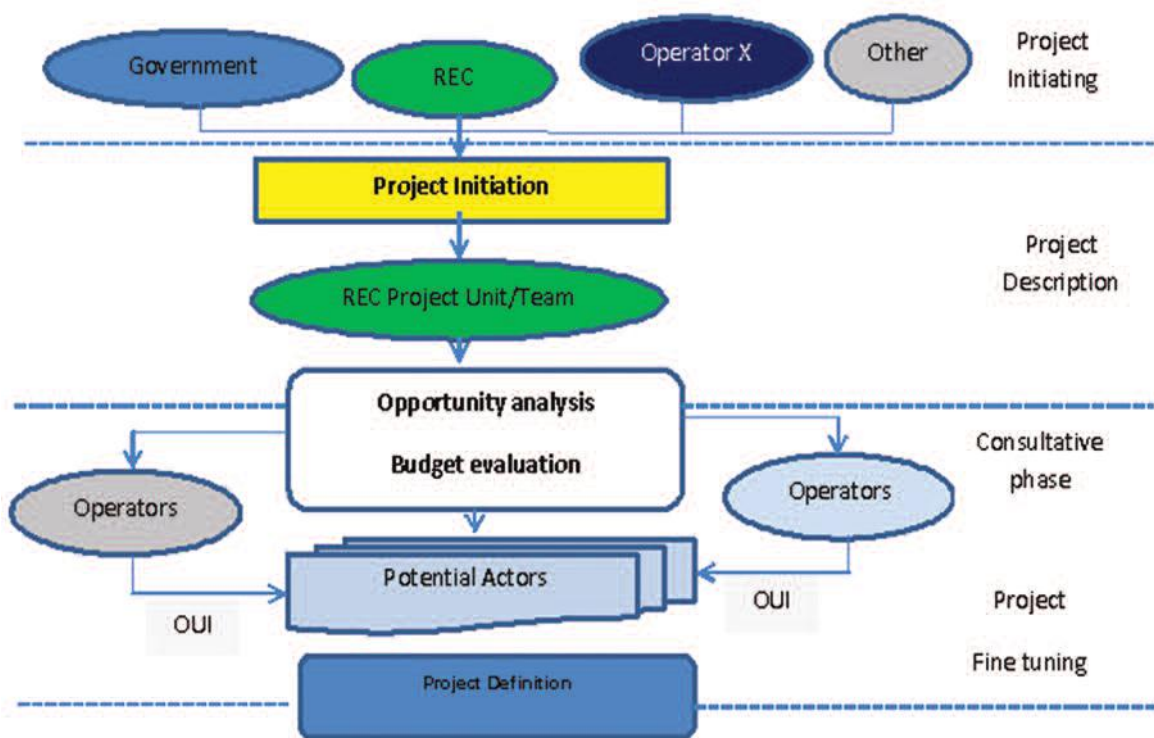
Ownership options

The most viable ownership and financing option will depend on the specifics of each project and the particular local environment at the regional and national levels. Different solutions are explained in previous reports: ICT Outlook for the Future and ICT sector brief. The key mandate of the solution adopted will be to supply an open access and technology-neutral fibre infrastructure. Where alternative infrastructure is used, the core task of the structure for operation and maintenance will be to maintain the optical fibre communication infrastructure, and to facilitate optical fibre connections to operators and others services such as collocation facilities and interconnection points between the different users. The institutions owning and maintaining open access links could be:

● An independent company created for the purpose
● A private company already offering such services (such as the tower companies' model)
● A specific department or service offer by an operator (for example the Openreach model of British Telecom)
● Road corridor authorities or Ministry of Transport
● Energy Pools or national Ministry of Energy.

Pricing strategy

In order to make this model financially attractive to operators and service providers, as well as to donors and public investors, pricing needs to be cost-based. This is expected to be achieved by operators paying the cost price for the provision of the service, plus maintenance costs. The strategy should be operator-neutral, providing a network that is open to all players on equal terms.

Deployment strategy

The infrastructure will likely be developed by stages, beginning with a variety of consultations:

● With stakeholders and governments to ensure that the presence of the required enabling environment and conformity with any digital infrastructure master plans if present
● With operators and service providers to align the programmes with their strategic development plans and reinforce the potential of shared facilities.
● With the potential investors to identify their interest and form of investment, IRU, rights of way etc.

**Figure 34: Implementation block diagram**
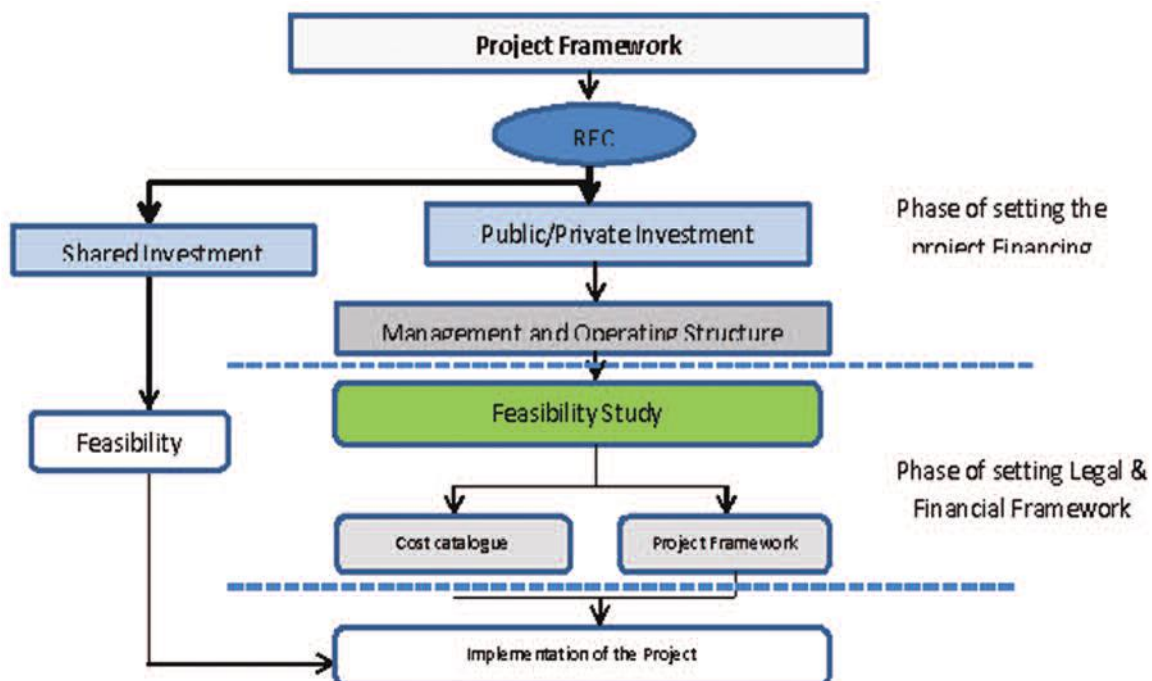
These consultations should provide an indication of the potential of the infrastructure for downstream usage at the national, district and rural levels, and allow the definition of a forecast price for usage by drafting a catalog and services price book (equivalent to a Reference Interconnection Offer -RIO- and a Service Level Agreement -SLA-).
In addition, the initiating institutions will need to

establish dispute resolution procedures for the various stakeholders during the implementation.

An overview of the proposed regional open access model for an optical fibre infrastructure showing key stakeholders, their responsibilities and the relationships between them is provided below in *Figure 35*.

Figure 35: **Overview of the proposed implementation strategy and funding process for regional infrastructure**
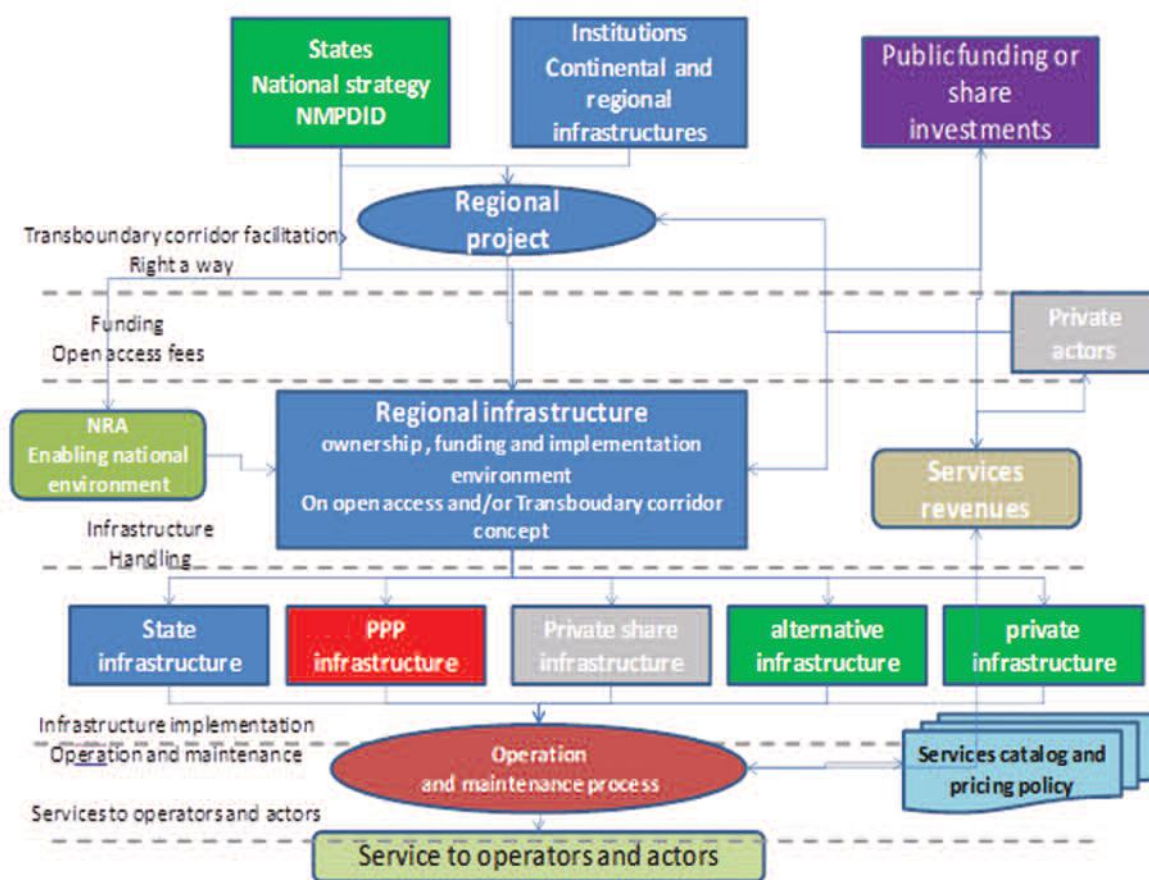
In the case of short trans-boundary links, which are the majority of the short term hard investment requirements, the model is similar to the one above, with the only difference being the potential synergy where there is a Trans-boundary-Regional ICT Corridor. The implementation and the funding of the projects would be based on an equivalent model with an oversizing of the link by:

- The deployment of large ducts for future usage by others actors (sustainability)
- The establishment of interconnection points (open interconnectivity)
- An analysis before funding the RIO of the two beneficiaries of the infrastructure to ensure reasonable tariffs for use of the link, as described in the definition of a regional infrastructure (see Outlook Report), so that other competitors can use the infrastructure on a non-discriminatory basis.

The unused parts of the infrastructure (e.g. free ducts) usually stay the responsibility of the investors or any other institution (Municipality, District authorities, etc) until they are reassigned to operators for right of usage. Maintenance of passive infrastructure is similarly described above.

4.2 Respective Roles of Regional and Continental Institutions in the Implementation of Programs and Individual Projects

The role of continental and regional institutions is outlined in Section 2. As explained in this Section, the regional institutions are incubators or facilitators of regional projects. They will not be expected to implement these projects, except to ensure their initiation, manage the agreement process and approve the deliverables. In this respect, the key responsibility of the regional institutions is to ensure the development of an enabling environment and act as a forum information sharing and discussion between all the stakeholders which have an interest in the project.

4.3 PAP Project Fiches

4.3.1 Continental soft project

a) Developing a political, legal and regulatory enabling environment (2013)

PAP Soft Program (Continental)
Developing a political, legal and regulatory enabling environment (2013)

Context and challenges

The analysis of the legal and regulatory environment and policies for the whole continent show that the political, legal and regulatory framework, because of its unsuitability to the new broadband environment, is one of the major causes for the underdevelopment of broadband in Africa. The priority will be to create an enabling environment for the development and use of broadband and at the same time for the gradual deployment of the required infrastructure at three levels:

- Continental
- Regional
- National

The realization of the PIDA PAP Soft Project will allow the broad axles of the infrastructure program to be reached which are:

- Facilitating the creation of ICT trans-boundary corridors on open access basis
- Facilitating and securing access to submarine stations
- Facilitating interconnection of infrastructure at regional level
- Ending the isolation of landlocked countries and securing access to submarine stations for landlocked countries
- Interconnection of the RECs (SADC – COMESA – ECCAS – ECOWAS – UMA – EAC – IGAD – CEN-SAD) in order to reduce the externalization of intra-African traffic (Voice, Internet...)
- Digital management of the African continent

As well as:

- The consolidation of competition on services
- Taking into consideration all the players without discrimination
- Setting up master plans for the management territory for Broadband
- Optimizing the use of existing infrastructure
- Optimizing investments by sharing infrastructure between public-private and private-public

The main challenges are:

- Accelerating the development of broadband in Africa
- Reducing the cost of use
- Facilitating crossing borders for flow of ICT
- Implementing a trans-sector policy for territory management
- Optimizing investments by sharing where possible between the private and public sectors and between players while meeting the expectations of the States, operators and consumers.

Objectives

- Developing an enabling environment for the development of infrastructure and private investments.
- Optimizing the use of existing infrastructure
- Facilitating the setting up of trans-boundary infrastructure and the interconnection of various national infrastructure at the regional level.
- The management of the African continent in order to become an e-society where ICT play a major role in economic and cultural development.

Expected results

- To meet the expectations of governments in terms of land use planning and those of the operators in terms of destination.

- Reduce the price of connection and use for consumers

- Provide the structural foundations of an e-economy.

- Enabling the flow of ICT traffic inside Africa

- Open the African economy to the rest of the world on equal foot in order to enable dissemination of creativity and culture outside Africa.

Program overview

Setting up an enabling environment is considered as a priority issue to be solved before the end of 2013.

The major points are dealt with in the Phase II Report at the candidate projects Section and in the Guidelines. The synopsis below provides the summary.

The different points (Guidelines, legal and regulatory adjustment) will be applied to continental, regional or specific projects (support to the implementation of physical infrastructure or optimization of the use of the existing one).

Beneficiaries

- All the continental, regional and national institutions
- The players through an enabling environment
- The consumers in order to improve services and reduce the costs of use

Implementation and management

Figure 36 below shows the implementation process:

Project cost

22 500 000 $

Financing

.

Implementation Process and Calendar

Project under the responsibility of AUC and the RECs with the objective to set up an enabling environment by the end of 2013

Can be partially transferred to the HIPSSA II program.

b) Qualitative and quantitative inventory of the regional infrastructure

PAP Soft Program (Continental)   **Qualitative and quantitative inventory of the regional infrastructure (2013)**

Context and challenges

During the PIDA Study, the Consultant had to carry out a very time-consuming research in order to identify the existing infrastructure but also the projects under development.

In fact, there is currently no follow up at the REC level, or they have no access to information regarding the ICT sector (market data and infrastructure) .

In respect of AICD, a minimal inventory was carried out but was not transferred to the institutions.

This lack of official information as well as the lack of quantitative and qualitative information do not provide an enabling environment for the institutions to efficiently implement the PIDA program and in particular its PAP.

The challenge of implementing the PIDA program is to intervene where necessary with precision, speed and on solid ground. It is characterized by :

- **The strategic challenge of implementing PIDA**

It is important to promote the development of quality optical fibre community infrastructure, in sufficient quantity and with a recognized geostrategic value.

The challenge is not to define active equipments which remain the prerogative of operators and are in constant development (transmission capacity) but to enable the implementation of passive and/or active infrastructure that can remove many constraints:

- Qualitative: to be able to support active equipments and to be sustainable.

- Quantitative: to be sufficiently well calibrated to meet needs.

- Tariffs: to be compliant with the community cost model.

- Geostrategic:

  ✓ To meet the expectations of the operators in terms of destination

  ✓ To meet the expectations of governments in terms of territorial digital development.

  ✓ To meet the reliability criteria required to build up a digital economy and society

- The efficiency of implementing the PIDA program required for regular follow up of deployed infrastructure (existing and ongoing projects).

Objectives

- Set up the mechanisms allowing institutions to officially access the information needed for their actions in relation to PIDA. For this purpose, various actions are required.

- Establish a legal and regulatory framework empowering:

  - The institutions (at the continental and regional level), and

  - The regulators and bodies at the national level

to have access to a number of data ; this part will be dealt with as a priority within the continental soft program.

- Set up a tool allowing the knowledge of:

  - Regional infrastructure implemented by governments and players with the related required information

  - Existing trans-boundary infrastructure (called ICT trans-boundary corridors)

  - the presence points of all the players close to the trans-boundary passage points

- Setting up a tool that allows the identification of existing regional projects ; underway, scheduled or planned as well as the information on the financing process and the financing institutions

Expected results

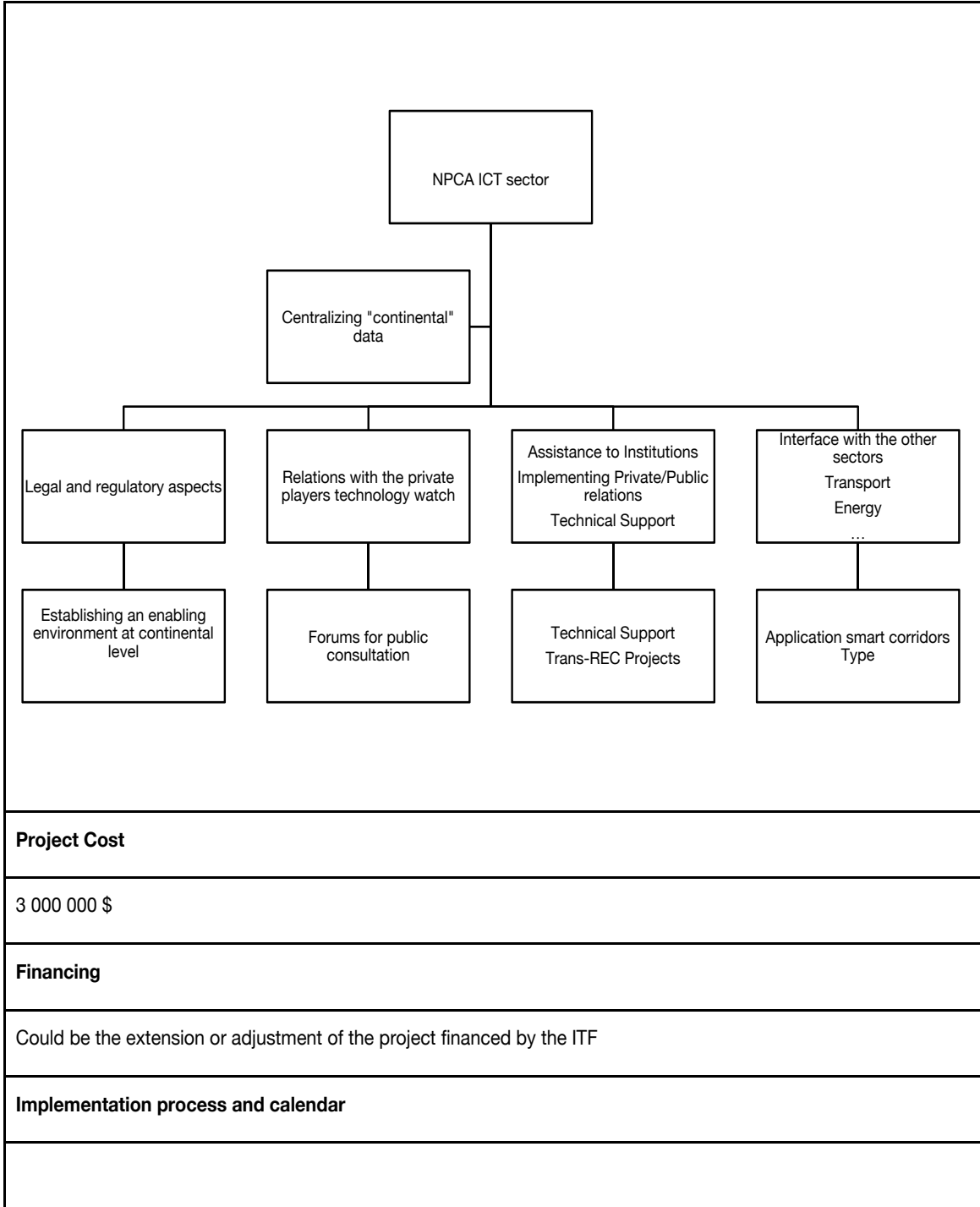- Cartographic and statistical knowledge of regional infrastructure

- Knowledge of quantitative and qualitative infrastructure data

- Knowledge of the conditions of use

- Optimization of investments for better efficiency of infrastructure implemented within the PIDA framework

Program overview

This program must be steered at the continental level and must become a real data base used for both implementation of new infrastructure or financing.

- Adjustment of the political and regulatory frameworks giving power to regulators (at national level) and institutions (at regional level) to collect data relating to infrastructure from players (Operators, owners of alternative infrastructure) and the associated data (Qualitative and quantitative)

- Setting up the tools to collect data at the regional and continental levels.

- Setting up a GIS

Beneficiaries

- All the continental, regional and national institutions

- The financing institutions namely the AfDB.

Implementation and management

Figure 37 below provides the process and scope of implementation:

Project cost
750 000 $
Financing
To be negotiated
Implementation process and calendar
PAP 2015: must be implemented as soon as possible in order not to reconsider everything. Some of the PIDA Study data (observatory…) can be used.

c) Assistance of the NPCA to promote, monitor PIDA and raise players' awareness

PAP Soft Program (Continental)
Assistance of the NPCA to promote, monitor PIDA and raise players' awareness
(2012-2015)
Context and challenges
In compliance with the IADA recommendations and in the context of the PIDA implementation, the NCPA should play an important role in building governments and private players' awareness in order to: • Optimize investments • Establish PPP or DSP in relation to investments on regional infrastructures and for their operation and maintenance. Like NEPAD in the context of Kigali, it seems important that the NPCA gives value to the knowledge previously acquired by orienting its activities in accordance with the PIDA strategic framework and the implementation processes. In fact, in order to reach consensus among the stakeholders of a regional or continental project and in order to take into account the following geostrategic challenges: • Meet the operators' expectations in terms of destination • Meet the expectations of governments on terms of territory digital development. • Meet the reliability criteria required to build up a digital economy and society It is necessary that an institution becomes the driver of the PIDA ICT implementation but also the trans-sector interlocutor to develop and give value to trans-sector investments. The forecasted needs involve capacity building for regulation as well as the implementation of infrastructure.
Objectives
The plan will be to establish dialogue and set up a consultation process between: • Regional Institutions • Governments and regulators • The private sector • The bodies in charge of the transport and energy sectors So that all the stakeholders join their efforts for the implementation of regional infrastructure. **Projected results** • Awareness and motivation of governments in order to facilitate the implementation and use of regional infrastructure • Implementation of infrastructure shared by many players or sectors • Facilitation of the implementation of « shared trans-boundary ICT Corridors » • Optimization of public funds for the development of trans-boundary infrastructure • Better use of alternative infrastructure by players and reasonable economic valorisation

Program overview

This program must be steered at the continental level and must become a real platform for dialog amongst the various components involved in regional infrastructure.
 	
Besides, it will also be used to raise players' awareness to optimize the use of infrastructure at the regional and national levels and assist governments in the potential use of funds and services/universal access which can equally be a stakeholder in investments.
 	
For this purpose, the program will be in charge of:
 	
• setting up public consultation to identify:
 	
   - the points representing regulation blockage and provide acceptable answers to all the parties
 	
   - The players' expectations in terms of need in the short and medium terms in order to anticipate demand by proposing the implementation of new infrastructure.
 	
• Holding work meetings or forums with players (Operators, ISP...) and understand their needs, expectations and demands.
 	
• Ensuring a technology watch and disseminating the outcomes to institutions, governments and regulators.
 	
• Providing legal, regulatory and technical assistance to regional institutions
 	
• The transfer of continental guidelines to the RECs and providing assistance for their transposition which can be extended to governments in the case of strategic projects such as:
 	
   - ECCAS Infrastructure (PAP 2015)
 	
   - ECOWAS Infrastructure (PAP 2015)
 	
• The synergy with Rascom to compensate the lack of land infrastructure such as:
 	
   - Links which are technically difficult to construct
 	
   - Set up of solutions such as the « smart corridors » type via satellite…

Beneficiaries
• All the continental, regional and national institutions • Financing institutions, particularly the AfDB.
Implementation and management
The implementation of this program must be carried out before the implementation of the infrastructure mentioned in the REC PAP. Implementing this program requires NPCA capacity building in particular: • legal and regulatory aspects • Interface with the private sector • Development and implementation of investment processes, price catalogues and economic assessment models.

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                          ┌─────────────────┐
                          │  NPCA ICT sector │
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                                   │
          ┌────────────────────────┤
┌─────────────────────┐            │
│ Centralizing         │           │
│ "continental" data   │           │
└─────────────────────┘            │
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Legal and regulatory aspects	Relations with the private players technology watch	Assistance to Institutions Implementing Private/Public relations Technical Support	Interface with the other sectors Transport Energy …
Establishing an enabling environment at continental level	Forums for public consultation	Technical Support Trans-REC Projects	Application smart corridors Type

Project Cost
3 000 000 $
Financing
Could be the extension or adjustment of the project financed by the ITF
Implementation process and calendar

4.3.2   ECCAS PAP

ECCAS PAP				
Context and challenges				
The analysis of the ECCAS Master Plan, with its updates, highlights the urgency to set up a number of regional infrastructure within the ECCAS. ECCAS countries interconnection and the consolidation of submarine stations as well as the end of the isolation of Chad and Central African Republic are the priority actions (2015) to be implemented. **Table 11** below provides the inventory of submarine stations, the land links to be set up and the players which can be potentially stakeholders of the project.				

Country	City	Stations submarine	ECCAS Project (PIDL-AC)	National players
Angola	Luanda	Ace WACS	Kinshasa-Matadi- Luanda link. (including Cabinda)	Angola Telecom Unitel Movicel ISPs
	Cacuaco	SAT3 SAEx		
DRC	Muanda	ACE WACS		Africell RDC Celtel Congo Supercell Oasis TIGO
			Brazzaville-Kinshasa link	VODACOM CONGO SemaTel Congo Chine Telecom OCPT SOGETEL STANDARD TELECOM ISPs
Rep. Congo	Pointe Noire	WACS		MTN Congo Warid Congo Azur Congo Airtel Tigo, Supercell ONPT ISPs
Gabon	Libreville	ACE SAT 3	Brazzaville- Libreville link	Moov Gabon Airtel Gabon Libertis S.A. (LIBERTIS) USAN-Gabon Gabon telecom ISPs
Equatorial Guinea	Bata	ACE Ceiba-1 (Malabo)	Oyem-Bata link	GETESA Orange Hits GE ISPs
Cameroun	Kribi	ACE	Libreville-Oyem- Yaoundé Camtel link network	MTN Cameroon Ltd Orange Cameroun S.A.
	Douala	SAT-3	Yaoundé- Nigeria link	Camtel
	Limbe	WACS		ISPs
Nigeria	Lagos	ACE		ALHERI ENGINEERING

		GLO-1 Main One SAT-3 WACS		LIMITED AirtelNG Emerging Markets Telecommunication Globacom Ltd MTN Nigeria Nitel Phase3 ISPs

Table 11: ECCAS submarine stations and players who are potentially investors or customers

Objectives

The realization of the PIDA PAP is based on 4 axes involving infrastructure development:

- Strengthening and securing access to submarine stations
- Country interconnection at the REC level
- Ending the isolation of landlocked Chad and Central African Republic (CAR) as well as securing access
- Interconnection among RECs (SADC-COMESA-ECCAS- ECOWAS)

The implementation of such projects within ECCAS allows the achievement of a number of objectives:

- ECCAS integration: Interconnecting countries to one another
- Regional and continental integration: The realization of this program is related to that of ECOWAS which will allow the interconnection of all the sub-Saharan RECs and with an efficient use will ensure that a good part of the intra-African traffic remains in Africa.
- Securing access to submarine cable landing stations for all the ECCAS countries
- Ending the isolation of landlocked countries and securing access for Chad and CAR
- Sector **synergy:** This infrastructure to be developed will equally serve the "smart corridor" project of the transport sector

Expected results

The implementation of these projects will help reduce considerably the exchange of intra-African traffic transiting outside Africa as it will be possible, amongst other matters, for:

- Intra ECCAS voice flow to be kept within the REC thanks to interconnection of ECCAS countries
- Inter REC voice flow to remain in Africa thanks to interconnection between the RECs (ECOWAS, ECCAS, EAC, COMESA, SADC)
- The Hub of Nigeria, Djibouti and Cairo to be accessible

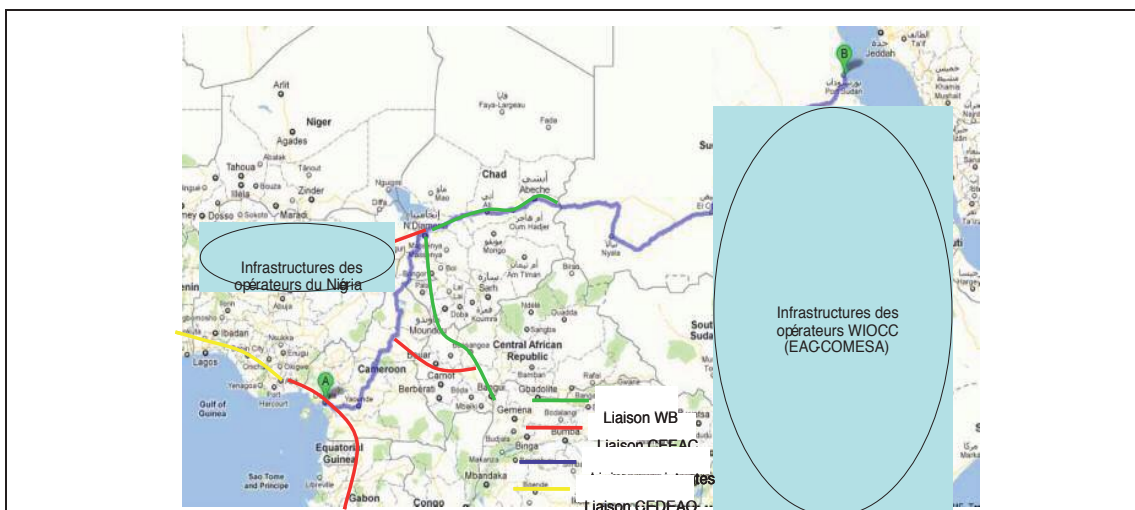Competition between submarine cables stations will strengthen:

- Connectivity to international bandwidth
- Competition between the stations and therefore reduce international Mbps rates
  - Regional and continental Integration
  - Geostrategic Aspect of the program

The 3 ECCAS projects play an essential role in regional and continental integration in association with the project of the World Bank (Bangui-Ndjamena-Soudan).

In fact, the geostrategic position of Chad shows that the program would enable integration:

- East-West : ECCAS – ECOWAs – COMESA – EAC
- North (UMA – ECOWAS) – ECCAS – COMESA – SADC

Figure 38 below shows these issues.

Infrastructures des opérateurs du Nigeria

Infrastructures des opérateurs WIOCC (EAC-COMESA)

Liaison WB

Liaison CEEAC

Liaison CEDEAO

Program overview

Project 1: Strengthening submarine stations and interconnecting countries at the REC level (SADC-COMESA and ECOWAS) (see **Figure 38**)

This project must also be integrated to the existing infrastructure :

• Camtel Cameroon Infrastructure (2010)

• Nigeria : setting up an international interconnection point in Nigeria to allow the interconnection of existing infrastructure

• Angola **:** Idem Nigeria

An option that can be developed would be to double Cameroon's crossing; this can be carried out by extending the fibre:

• In a Camtel duct if available

• Installing additional 700 km

The details of the Cameroon crossing are provided below in **Figure 39**

PIDA ICT PAP - ECCAS

Point of International Connection ● New Infrastructure ▬
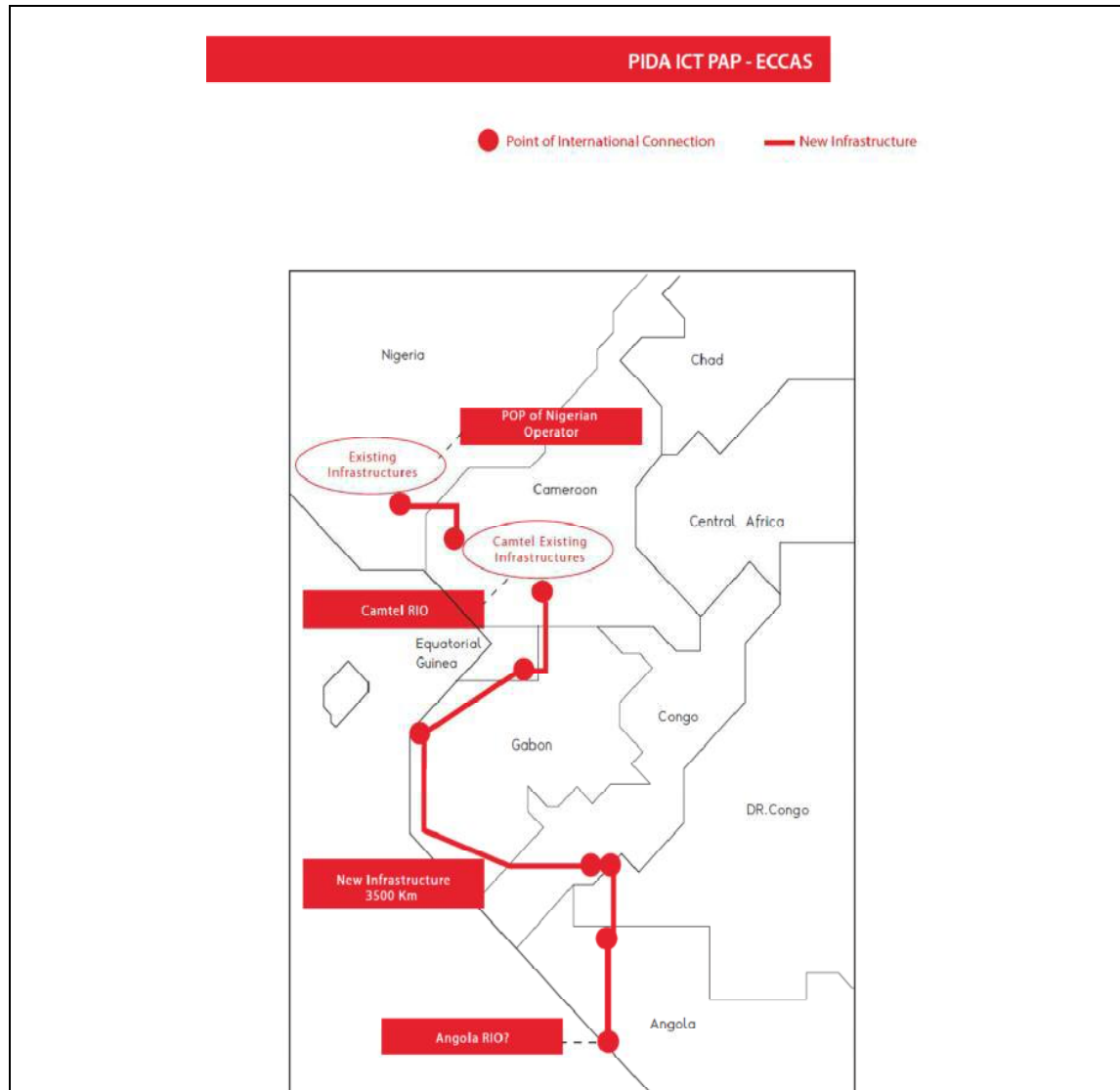
Figure 39: Project overview

Figure 40 below provides an overview of the interconnections in Cameroon.

Project 2 : Ending the isolation of landlocked Chad and CAR/2ᵈ exit

- Securing Chad land access and 2nd access to submarine cables for Chad and CAR

Figure 40 below also shows the infrastructure environment to end the isolation of Chad through:

- Cameroon[15]: International interconnection point at Kousséri (Camtel...)

- Nigeria : Interconnection point to be identified according to the presence of operators in Nigeria as well as the consolidation of access to submarine stations for Chad and CAR

It is important to note that this link will not secure the land link to Bangui-Ndjamena to be secured using another trajectory (Project 3).

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[15] Interconnexion with Camtel must be negotiated on the basis of a cost-oriented reference offer following problems encountered by the CAB World Bank project
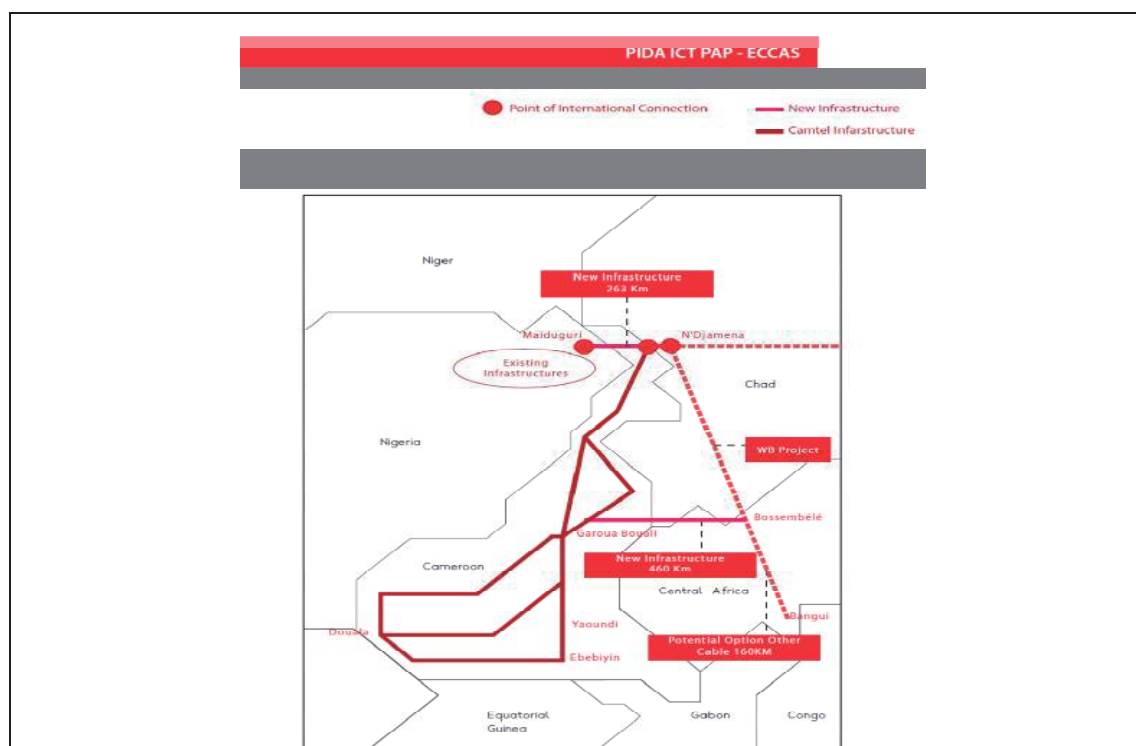
Figure 40: Project 2 and 3 ending the isolation of landlocked Chad and RCA via Cameroun and Nigeria and securing access of RCA

Project 3 : Securing land infrastructure ending the isolation of landlocked CAR

Within the configuration set up by the World Bank, the isolation of CAR will end only through land infrastructure linking Bangui to Ndjamena.

The objective of Project 3 is to secure this land link. Feasibility analysis in the short term (2013-2015) shows that a Bangui-Kinshasa link is not possible. Equally, the proposed situation will be to establish the link between Bossembele (Chad) and Garoua-Boulai (Cameroun). This solution has an advantage. The traffic coming from RCA goes directly to Cameroon to connect to Camtel infrastructure in Garoua-Boulai. It has a disadvantage. Between Bangui and Bossembélé, there is no land infrastructure (Bangui- Ndjamena); hence two alternatives :

- Bossembélé-Garoua Boulai : 460 km
- Idem + Securing Garoua Boulai Bangui by doubling the infrastructure using a parallel infrastructure project similar to that of the World Bank which will require other civil engineering works (other side of the road) between Bossembélé and Bangui : 160 km
- **Figure 40** above shows the project.

Beneficiaries

- ■ All the ECCAS operators (see table in Appendix to Phase I Report)
- ■ Submarine cable operators
- ■ « Smart corridors » applications of the transport sector

The Ndjamena- Cameroon and Ndjamena-Sudan link would help complete the « Central Africa Belt » and the West-East-South exchange of traffic (via WIOCC infrastructure) for the intra-African traffic and gives accessibility to sub-marine cables stations going to Asia or Europe for the two ocean facades of Africa.

These projects have a triple role:

- Regional infrastructure
- National backbone infrastructure in the countries
- End the isolation of rural areas and serving the less important cities

Implementation and management

Implementation

This infrastructure must be set up on an «open access» basis and structured around tha concept of «ICT

trans-boundary Corridors» between the various International Interconnection Points.

Their strategic aspects in regional and continental integration are associated with the sustainability requirement (>20 years). This necessitates that the project be established within a long term vision (2030) ; as a consequence of which:

- The civil engineering works realized will have as objective the extension of at least 4 independent ducts.
- The optical cable(s) will have a minimum capacity of 54/56 OF
- The use of optical fibre will be allocated partially:
  - National operators' needs
  - Trans-boundary operators' needs

Management

- The synchronization of the implementation process will be carried out by the REC which will manage, along with the national players and governments, their awareness, mobilization and participation.
- In some countries like Gabon, the regional sections can be included in the national projects subject to the condition that the regional section (dedicated optical fiber) be isolated and the operation and maintenance expenses remain independent from the national operation accounts.
- In some countries, a mixed ownership company with capital open to investors within a PPP framework could be set up.
- Some sections can be entrusted to corridor authorities (ending the isolation of landlocked Chad for instance)
- A price catalogue must be associated to the project

Synergy with other sectors

This infrastructure project, which is partially located along the regional roads, can equally serve the smart corridor applications if they are planned for these trajectories.

Project cost

Project N°1 :   85 000 000$

Project N°2 :   7 000 000$

Project N°3 :   12 000 000 $ (option 4 000 000$)

Total ECCAS PAP: 104 000 000 $

Financing

State, private or public operators, PPP, PSD (Public Service Delegation) and corridor authorities
A section can be shared with projected national infrastructure[16] (Gabon, Chad, Central African Republic)
Involving actors should allow the mobilization of Private-Public investments. Besides, one section in the form of IRU sales of 10 years during the launching of the projects may improve the attraction of the project to banking institutions and reduce the financing needs.

Calendar

Implementation
- Project N°2: absolute urgency to end the isolation of Chad in a first phase then Central African Republic in a second phase after implementing the World Bank project. Targeted date were: Q2, Q3 2012
- Project N°3 : Synchronize with the World Bank project of the Ndjamena- Bangui link (end 2012)
- Project N°1: Synchronize with some national projects (Gabon), other as soon as that becomes possible (Cameroon –Nigeria).

National projects must be identified (Gabon, Chad, Central African Republic...) in order to synchronize deployment.

Political, legal and regulatory environment in the ECCAS countries

National Infrastructure

Some countries have state infrastructure projects; Project 1 is partially included in the national sections.

It could be envisaged either to separate cables or to dedicate OF to regional connectivity.

Cameroon

Camtel has a strategic role, a copy of an extract of the 2010 interconnection catalogue is provided.

One option, if possible, will be to have regional optical fibres that cross Cameroon as infrastructure independent from that of Camtel.

Table 12: Extract of the Camtel 2010 Reference Offer[17]: National Mbps rates (Chad-Douala border)

[16] See Chad SITCOM tender July 2011

Chad-Douala land infrastructure rates	
2 Mbit/s	1 894 €
34 Mbit/s	710 €
45 Mbit/s	616 €
155b t/s	361 €

Table 13: Monthly international Mbps prices

Monthly International Mbps prices (SAT3) in €					
from Douala to	Distance (km)	2 Mbps	34 Mbps	45 Mbps	55 Mbps
South Africa (The Cape)	2 200	2 618 €	1 322 €	1 077 €	743 €
South Africa (Durban)	3 200	3 810 €	1 910 €	1 567 €	1 081 €
Angola (Cacuaco)	800	1 926 €	985 €	807 €	567 €
Benin (Cotonou)	450	1 651 €	848 €	696 €	492 €
Cote d'Ivoire (Abidjan)	800	1 926 €	985 €	807 €	567 €
Spain (Chipiona)	2 350	3 143 €	1 591 €	1 298 €	899 €
Gabon (Libreville)	275	1 513 €	779 €	641 €	454 €
Ghana (Accra)	575	1 749 €	897 €	736 €	519 €
Mauritius Island (Baie Jacotet)	4 600	4 059 €	2 031 €	1 648 €	1 122 €
India (Cochin)	5 000	5 224 €	2 628 €	2 138 €	1 467 €
Malaysia (Penang)	5 000	5 224 €	2 628 €	2 138 €	1 467 €
Nigeria (Lagos)	40	1 611 €	828 €	680 €	481 €
Portugal (Sessimbra)	3 050	3 693 €	1 865 €	1 520 €	1 049 €
Réunion (St Paul)	4 600	4 910 €	2 472 €	2 011 €	1 382 €
Sénégal (Dakar)	1 625	2 574 €	1 307 €	1 068 €	744 €

As a reminder, the 2010 and forecast international rates were for:

	Rates	
	2010	**Forecast**
Chad	70 Mbps	> Gbps
RCA	25 Mbps	> Gb

Group of countries
- Transparent passage rights to access submarine stations of other countries
- Open access to infrastructure
- Identified points related to the points presence of operators which are closest to borders
- Interconnection rates and/or operators reference offers of the various countries
- Price catalogue for the part included in the national project (Gabon for example)

Remark

The ECCAS remains the priority REC of the PIDA PAP as it is the REC where deploying land-based infrastructure will be most important (clear lack of infrastructure) and implementation of projects 1 and 2 will be the cornerstone of continental connectivity.

The infrastructure financed by public funds must be the subject of a price catalogue to be reviewed annually in order to update the rates according to the real transported traffic.

Selling IRUs to operators will help alleviate considerably the medium term financing needs.

[17] Given as indication subject to validity

4.3.3 ECOWAS PAP

ECOWAS PAP				
Context and Challenges				
The analysis of the ECOWAS Master Plan and the updates highlights the urgency of establishing regional infrastructure within ECOWAS. ECOWAS country interconnection and the consolidation of submarine cable landing stations as well as the opening up of landlocked Guinea Bissau which does not have submarine landing stations and therefore does not have access to international bandwidth via satellite. Besides, interconnection between Mali-Niger-Nigeria-Benin, Ghana and Burkina Faso will be established. This section will secure access to submarine landing stations for Burkina Faso via Ghana and Benin and will consolidate West-East interconnection, thus complementing UMA-CEDEAO-COMESA-EAC connectivity. ECOWAS country interconnections as well as the consolidation of submarine cable landing stations are priority actions (2015) to implement. **Table 14** below provides the inventory of submarine landing stations, land links to be established and the players who are potentially project stakeholders.				

Country	City	Submarine station	ECOWAS Projects	National players
Senegal	Dakar	SAT 3 ACE Atlantis -2 Glo-1	Dakar-Nouakchott (UMA)	SENTEL-Tigo Sonatel Orange Sudan Telecom Company Ltd (Expresso) Sonatel ISPs
Gambia	Banjul	ACE	Dakar – Banjul (seems it already exists or financed 2012)	Africell Comium Gambia Gamcell QCELL Limited Gamtel ISPs
Guinea Bissau	Bissau	-	Banjul-Bissau (seems it already exists or financed 2012)	Orange Bissau MTN Guinée Telecom ISPs
Guinea	Conakry	ACE	Bissau -Conakry	Cellcom Guinée INTERCEL Guinée MTN Guinea Orange Guinee SA Sotelgui ISPs
			Conakry-Freetown	
Sierra Leone	Freetown	ACE	(seems to exist and/or already financed 2012)	Airtel Sierra Leone Ambitel Comium Africell
			Freetown – Monrovia	
Liberia			Monrovia-Abidjan	COMIUM. Cellcom Lonestar Cell LiberCell LTC ISPs

				MOOV
Cote d'Ivoire	Abidjan	SAT-3 ACE WACS		KoZ MTN ORICEL Orange CI ISPs
Ghana	Accra	SAT-3 ACE GLO-1 WACS	Abidjan-Accra (seems it already exists or financed 2012)	Kasapa Airtel Tigo Vodafone Glo Mobile Ghana MTN GTC ISPs
			Accra Lomé (seems it already exists or financed 2012)	
Togo	Lome	WACS	Lome-Cotonou (seems it already exists or financed 2012)	Telecel Togo Togo Telecom ISPs
Benin	Cotonou	SAT-3 ACE		MTN Bell Benin Com TELECEL Glo mobile OPT ISPs
Nigéria	Lagos	SAT-3 ACE GLO-1 Main One WACS	Cotonou- Nigéria	ALHERI Airtel Emerging Markets Telecommunication
			Lagos-CEEAC (Cf. CEEAC)	Globalcom MTN Nitel Phase 3 ISPs
Cap Vert	Praia	Atlantis 2 WACS		C.V Movel, T+ TELECOM

Table 14[18]: ECOWAS submarine stations and players potentially investors or customers

Objectives

Completing ECOWAS DAKAR-Nigeria coast backbone will help fulfill a number of objectives:
- ECOWAS Integration: Interconnecting countries
- Regional and continental integration: the development of this program associated with that of ECCAS will allow the connection of all the Sub-Saharan RECs and UMA and ensure that a good part of intra-African traffic remains in the continent.
- Securing **access to submarine landing stations** for all ECOWAS countries namely:
  - Guinea Bissau which does not have a station,
  - Countries with one single station

The completion of the Mali-Niger-Nigeria-Cameroun-Chad link (in association with ECCAS projects) will strengthen the connectivity of landlocked countries and open a link between the West and East coasts of the continent.

- **Securing access for the landlocked countries: Niger, Mali, Burkina Faso**
- **Sector synergy : This infrastructure that is to be established or strengthened will equally serve the Smart Corridor Project of the transport sector**

Expected results

The development of these projects would help reduce in a significant way intra-African traffic transiting outside the continent and will allow, amongst others, :

- Intra ECOWAS voice flow thanks to interconnection between ECOWAS countries

[18] July 2010

- Inter REC voice flow in Africa thanks to interconnection between the RECs (UMA-ECOWAS- ECCAS, and through ECCAS projects towards EAC, COMESA, SADC)
- Accessibility to the hubs in Nigeria, and Senegal.

Ensuring competition between submarine cable landing stations at the REC level is essential and will strengthen:
- International bandwidth connectivity
- The competition between stations and therefore a decrease in international Mbps rates

Regional and continental integration

The 3 ECOWAS projects proposed by the PAP play an essential role in regional and continental integration in association with ECCAS projects: North-South and West-East interconnection.
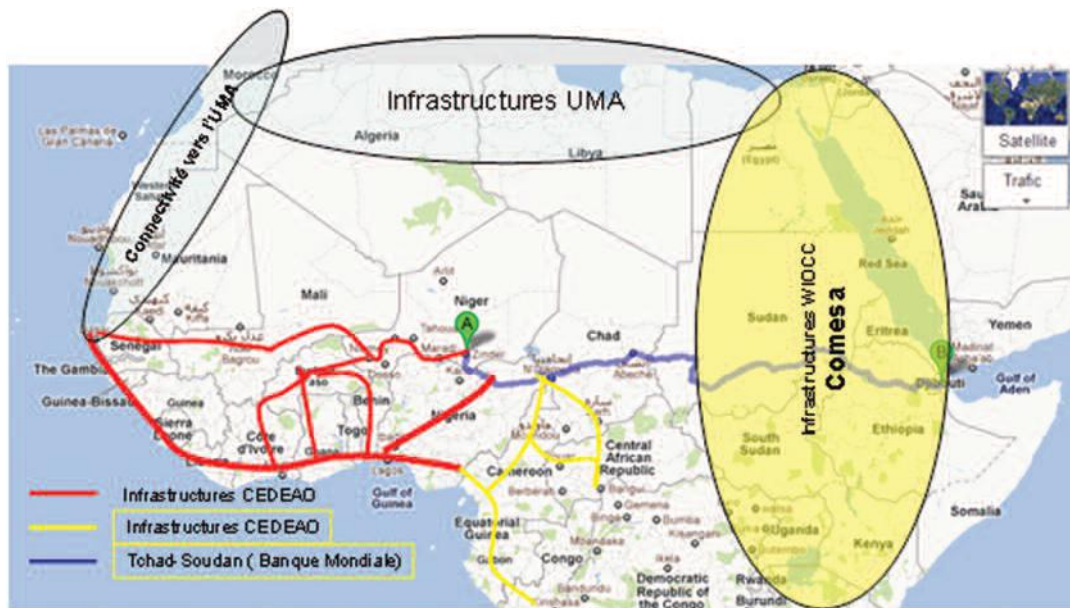
Figure41: Continental stake of ECOWAS infrastructure

Program overview

The consolidation of access to submarine cable landing stations and ECOWAS country interconnection as well as the improvement of ECOWAS – UMA, ECOWAS –ECCAS connectivity.

This project must also be integrated into the existing infrastructure or being planned at the national level (national projects with a regional component).

Figure 41 above provides an overview of the interconnections between ECOWAS countries. Because progress in the financing and deployment of the national infrastructure is not frozen, the project takes into consideration the link between Banjul (Gambia) – Abidjan[19] (Côte d'Ivoire).

Project 1 Coastal backbone Dakar/Banjul – Ghana – (Nigeria)

This backbone aims at:

- Interconnecting countries
- Ending the isolation of landlocked Guinea Bissau to access submarine landing stations
- Interconnecting ECOWAS to UMA via Mauritania
- Building additional 3 500 km of optical fiber

Note :

Nigeria : setting up an international interconnection point in Nigeria to allow the interconnection of the existing infrastructure

Mauritania : Ensuring that the Dakar – Nouakchott link is on "Open Access" mode

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[19] Côte d'Ivoire called for a tender for its national section in July 2011
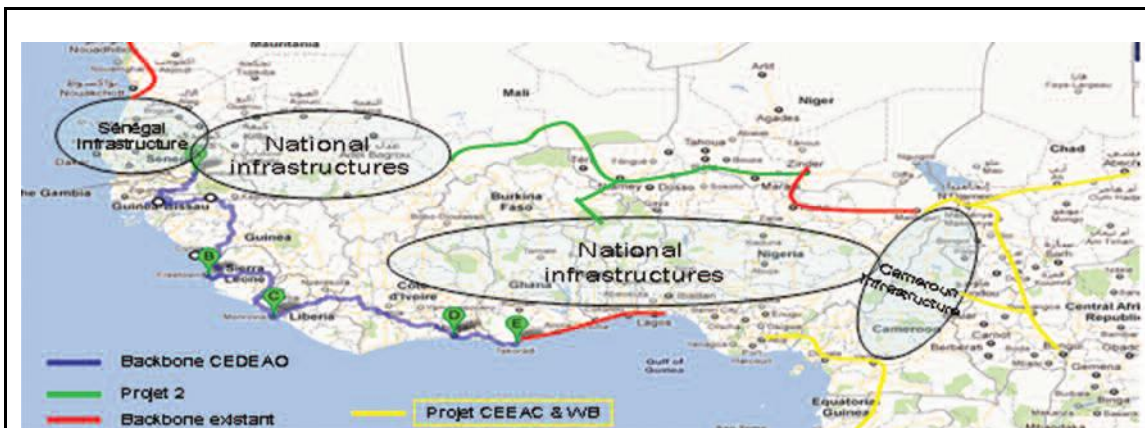
Figure 42: Overview of the ECOWAS PAP program

Project 2 : The Mopti (Mali)- Niamey – Zinder (Niger)- Nigeria-Chad-Sudan link
2 000 km

This link strengthens the interconnectivity of landlocked countries, and:

- Open a link between the West and East coasts and therefore strengthens continental connectivity
- Interconnect ECOWAS to the Zinder – Algiers project being implemented
- Interconnect ECOWAS to COMESA via Chad
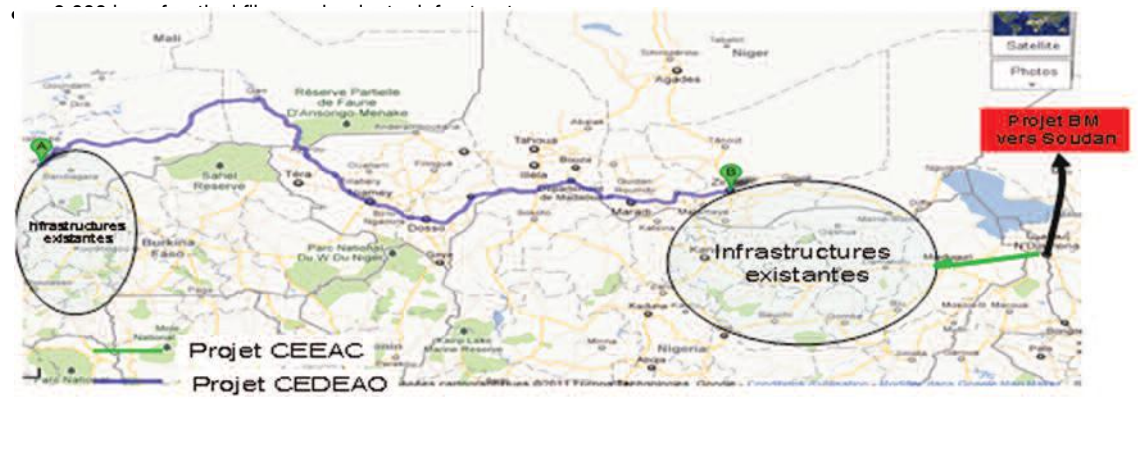
Figure 43: The Mopti (Mali) – Niamey (Niger) – Nigeria – Chad – Sudan link

Project 3 Consolidation of the project to end the isolation of landlocked Burkina Faso
- WAEMU Project
- Fada N'Gourma (BF) – Niger
- Fada N'Gourma- Benin border
- 350 km of optical fiber and duct infrastructure

Beneficiaries
- The operators of relevant countries, see preceding table and Appendix to Phase I Report - Submarine cable operators - All the continent by setting up a Maghreb-SADC and Maghreb-ECOWAS-COMESA line
Implementation and management
Implementation

This infrastructure will be set up on an « open access » basis and structured around the concept of « ICT trans-boundary corridor » between the various international interconnection points.

Their strategic aspect in regional and continental integration associated with the sustainability requirement (>20 years) require that the development of the project be carried out with a long term view (2030); therefore :

- Civil engineering works should install at least 4 independent ducts.
- Optical fibre(s) will have a minimum capacity of 54/56 FO
- The use of optical fibre will be allocated by section:
  - ✓ The needs of the national operators
  - ✓ The needs of the Trans-boundary operators

Management

- Synchronization of the implementation will be carried out by the REC which will manage with national players and governments their awareness, mobilization and eventual participation.
- In some countries such as Côte d'Ivoire, the regional sections may be included in national projects provided that the regional section (dedicated optical fibre) is isolated and that the operation and maintenance costs remain independent from the national operating accounts.
- In some countries, it can be subject to the creation of a joint company with capital open to investors within the PPP framework.
- Some sections can be entrusted to the corridor authorities if they exist.
- A price catalogue must be associated with the projects

Synergy with other sector

This infrastructure project is partially located on the regional roads and can equally be used for the smart corridor application if they are planned along these trajectories.

A price catalogue should be associated to the projects

Project cost	
Project N°1:	91 000 000$
Project N°2 :	52 000 000$
Project N°3:	10 000 000 $
Total ECOWAS PAP:	**153 000 000 $**

Financing

- The State, private or public operators, PPP and PSD (Public Service Delegation) and corridor authorities
- A section can be shared with planned national infrastructure[20]

Involving players will help set up Public /Private investments. Besides, the sale of a portion in the form of 10-year IRU during the launching of the projects could improve the project attractiveness to banking institutions and reduce the financing needs.

Political, legal and regulatory environment in the ECOWAS countries

All the countries
- Transparent rights of way in order to access submarine cable landing stations of other countries
- Open access to infrastructure
- Identification of operators' points of presence which are close to the borders
- Interconnection rates and/or reference offers of the various countries' operators
- Price catalogue for the section included in the national project

Remarks

The infrastructure financed by public funds must be the subject matter of a price catalogue to be reviewed annually in order to update rates according to the real transmitted traffic.
The sale of IRU to operators will help alleviate in a considerable way mid-term financing.

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[20] See tender by Chad SITCOM July 2011

4.3.4   Tripartite (SADC – COMESA – EAC) and IGAD PAP

<table>
<tr><td colspan="1">SADC - EAC – COMESA and IGAD PAP</td></tr>
<tr><td>Context and challenges</td></tr>
<tr><td>

As shown in **Figure 44** below, the SADC-EAC-COMESA (Tripartite) region, including IGAD, is now quite well equipped with cross-border fibre and competitive submarine landing stations. As a result there is only a few key priority transnational links that need to be completed before the regions are fully interconnected. The projects relate to the three regions, including IGAD, due to the fact that some countries belong to several regions, which would result in a repetition of projects for each region if they are separated.

The main objective of the PAP is to strengthen access to submarine cables in the region, strengthen connectivity and support the development of two national backbones (DRC and Eritrea) and connect the last remaining capital cities in the regions that are not yet interconnected to their neighbours – namely Asmara, Mogadishu, Juba (South Sudan).

</td></tr>
<tr><td>Objectives</td></tr>
<tr><td>

To establish the following cross-border fibre routes:

- Khartoum-Asmara-Djibouti,
- Juba-Kampala
- Mogadishu-Nairobi
- Kinshasa - Bujumbura

The implementation of these projects will lead to the completion of a number of projects:

- Integration within and between the three regions – SADC, EAC and COMESA and improved interconnection of countries within these regions
- Improved continental integration: The development of this program will provide connectivity between the tripartite region and UMA and ECCAS, while helping to ensure that more intra-African traffic is kept in Africa.
- Improved and secured access to landing stations in the three regions
- Connection of countries previously not connected such as Eritrea and South Sudan

Expected Results: Concrete outputs :

- 6-8 trans-boundary fibre links
- Two national backbones

Outcomes :

- Participation of Eritrea and South Sudan as equals to the rest of Africa in terms of connectivity
- Symbolic strategic support for the reconstruction of Libya
- Massive national development of connectivity for one of the poorest and least connected countries - DRC
- National interconnectivity and improved capacity pricing.
- Improved availability of regional and national capacity.
- Increased choice of routes.
- Increased reliability of networks.

</td></tr>
<tr><td>Project Overview</td></tr>
<tr><td>

The tripartite program relating to infrastructure development in Eastern part of Africa mainly consists of 4 missing links.

The project solves a number of interconnectivity issues between countries and also connects Burundi to ECCAS via Zambia and Angola.

</td></tr>
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Figure 44: Cross-border fibre and submarine landing stations in the Tripartite/IGAD region

Project N°1 : Eritrea

Establish Eritrea's first national fibre infrastructure and provide high-speed capacity to its neighbours, therefore reducing their current dependency on satellite. A second option could be to establish a submarine cable from Asmara to Port Sudan, possibly a festoon system serving communities on the coast along the way. A similar festoon system to Djibouti could be replicated if necessary.

Route:

1 400 km.

Project N°2 Juba-Kampala

This link would give the newly established country of South Sudan a new fibre route out of the country, and provide closer linkages with the East African Region. The link could comprise a possible extension of a South Sudan national backbone. The details of this would need to be established as part of the South Sudan's master plan for its national backbone and international connectivity.

Route: The distance is estimated at 800 km, the presence of road network is not clear and would require further data collection.

Project N°3: Mogadishu-Nairobi

This would provide the first international fibre link for Somalia, which is one of the few countries without a

submarine landing station. The link would also provide some national backbone infrastructure along the way to the Kenya border, where fibre infrastructure is already present relatively close to the border.
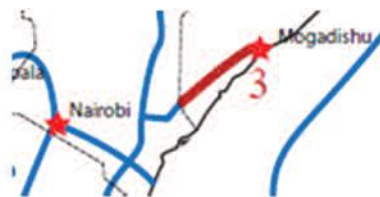
Route: The distance is estimated at 450 km.

Project N°4 Kinshasa - Bujumbura

The project, a direct link to implement in synergy with Transport (TH 10 Corridor project)) and which will be implemented within the "wide program" (PIDA 2020-2030).

The connectivity between DRC and Burundi will be established on the short term by Angola and Zambia.
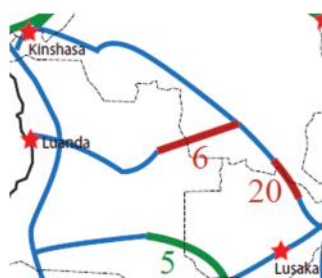
DRC-Angola/DRC-Zambia Spurs (6, 20): 450km

Beneficiary and/or target customers

- The domestic and international Internet and capacity providers, and the public in the Tripartite region, especially those in Eritrea, South Sudan and the DRC.

- The continent as a whole, through increased regional integration

Implementation and management

Implementation
- The infrastructure would be put in place on an "open access" basis, and structured around the concept of "cross-border ICT corridors" between the countries involved.
- Given the ongoing strategic importance, the projects should be implemented with a capacity   on the long term (2030), which means that:

    - The civil works will be carried out to implement at least four independent ducts.

    - Optical cables will have a minimum capacity of 54 optical fibres
- Interconnection reference offers would be required at each end of the link as part of the planning process to ensure project viability
- The total timeframe for the project would be 2 years.

Management
- The overall responsibility for ensuring the projects take place would be with the RECs concerned, supported by the AUC.
- The project ownership would vary depending on local conditions, but it is expected that individual coordinating and implementation teams would be established in each of the countries involved (Uganda, South Sudan, Egypt, Libya, Eritrea, Djibouti, DRC and Burundi), comprising the stakeholders involved – i.e. primarily the national governments and the private operators.
-

Project Cost

Project 1 (Sudan-Eritrea-Djibouti):   36 400 000$

Project 2 (South Sudan-Uganda):   14 000 000$

Project 3 (Somalia – Kenya):	11 700 000$
Project 4 (Zambia-Burundi):	12 000 000$
Total PAP :	**74 100 000$**

Funding

Funding for this project would be expected to come from a variety of sources, ideally a mix of DFI, government and private sector funding. For national backbone projects, the bulk of it would most likely be national financing. In the case of an open-access model for the links being adopted, a sale of 10-year IRUs to private operators would substantially improve projects' bankability.

Implementation process and calendar

It would depend on the availability of an enabling environment in the countries involved. Some countries will see immediate implementation, others might wait for 2 years or once the enabling legislation is put in place.

For the implementation of the current links, the schedule is likely to be as follows:

- Project development meetings, needs assessment, route identification, financing – month 2
- Financing agreement entered into– month 3
- Finalized environmental impact assessment, start of implementation – month 6
- Implementation complete – month 12

Policy and regulatory environment in the different countries

See the Phase I Report – the environment varies from full competition at all levels (wholesale and retail, and carrier services) to a single monopoly for all services. The situation in Libya and Eritrea shows that historic operators have a monopoly for all services. The situations in DRC and South Sudan are unclear. Open access to the backbone in Burundi and to the competitive backbones in Uganda.

4.3.5 UMA PAP

Harmonization of the legal and regulatory framework

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UMA PAP Soft Program

Establishing a political, legal and regulatory enabling environment (2013)

Harmonization of the legal and regulatory framework

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Context and Challenges

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The analysis of the legal and regulatory environment and policies for the whole continent show that the political, legal and regulatory framework, because of its unsuitability to the new broadband environment, is one of the major causes for the underdevelopment of broadband in Africa. Also, the priority will be to create an enabling environment for the development and use of broadband and at the same time for the gradual deployment of the required infrastructure.

The realization of the PIDA PAP Soft Project will allow the main axes of the infrastructure program to be reached. These main axes are the following:

- Facilitating the creation of ICT trans-boundary corridors on an open access basis

- Facilitating and securing access to submarine cable landing stations

- Facilitating interconnection of infrastructure at the regional level with Egypt and ECOWAS

- Interconnecting the RECs (UMA-SADC-COMESA-ECCAS-ECOWAS-EAC-IGAD-CENSAD) to reduce externalization of intra-African traffic (Voice, Internet...).

The priorities will be :
- Optimizing existing infrastructure by setting up wholesale offers
- Opening the use of existing alternative infrastructure and facilitating the implementation of alternative infrastructure.
- Opening international gateways (submarine stations) and « trans-boundary corridors » in order to increase interconnectivity of the region's players.

As well as:
- Strengthening competition for services
- Taking into consideration all the players and non-discrimination access
- Optimizing the use of existing infrastructure
- Optimizing alternative infrastructure

The major challenges will be:
- Accelerating the development of broadband in Africa
- Reducing the cost of use

In this respect, UMA countries play an essential role because of their strategic location:
- Countries oriented towards Europe
- Accessibility to a large number of submarine cables (including Egypt)
- The Mauritania- Libya belt allows the completion of the ECOWAS - COMESA (Egypt) interconnectivity which secures the central backbone: ECOWAS-ECCAS-COMESA and strengthens access to submarine hubs in Egypt and Djibouti.

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Objectives[21]

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Implement a progressive harmonization scenario based on the Member States' good will and whose two first phases would be :

In the short term
- a scenario called « convergence scenario » by the creation of work groups in a number of fields specific to the ICT sector regulation, initially in the following areas:

    - Conditions for the establishment and operation of telecommunication networks and services and universal service
    - Scarce resources management (frequency and number)
    - Open access (Interconnection, access and sharing ICT networks)

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[21] Bird and Bird, Adetef and Poly Conseil 2011 "Report on harmonisation in UMA countries"

In the medium term

- Provide UMA with a joint harmonization body, specific to the ICT sector, in charge of converging the regulations and legislation of the Member States in the areas and according to mechanisms which were jointly approved.

Expected results
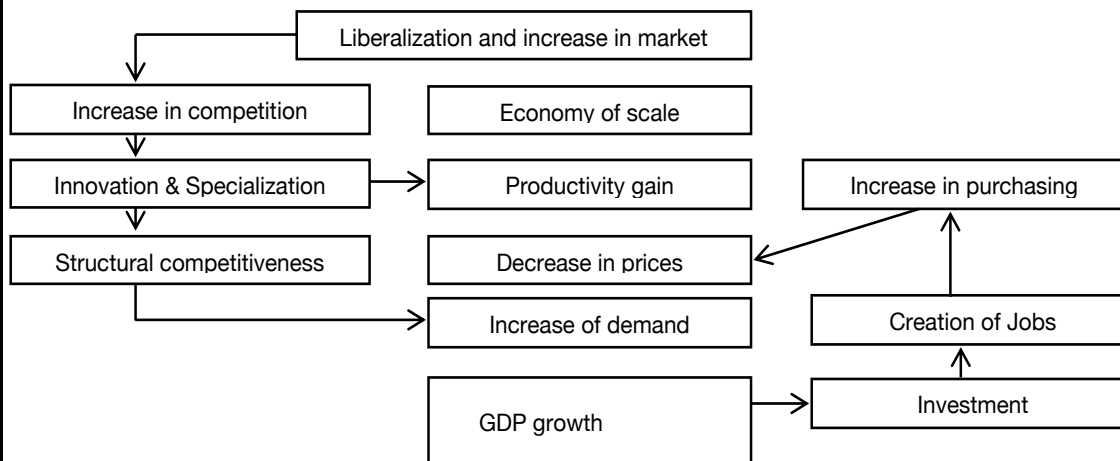
Source : Bird & Bird, Adetef-PolyConseil (UMA 2011)

Project overview

The development of an enabling environment is recognized as a priority issue to be solved before the end of 2013.

The major points are dealt with in Phase II report at the candidate projects and Guidelines Section and in the Soft PAP program.

The legal and regulatory framework harmonization plan includes the main points with objectives specific to the REC.

Particularly, the following issues are in line with the PIDA Study strategic framework:

- Developing a sustainable competition in the ICT sector;

- Democratizing access to telecommunication networks namely the internet network

- Strengthening infrastructure in terms of universal service; promoting the use of ICT in business and developing digital economy.

- Improving performance, security and reliability of the telecommunication infrastructure;

- Implementing the necessary measures to build up confidence in the digital economy

- Fighting cybercrime with particular attention given to cyber terrorism

Source : Bird and Bird 2011

Beneficiaries

The harmonization of this regulation at the regional level has an impact on regulators, operators and consumers.

- Some of the basic actions can be carried out jointly through a joint body. Similarly, the cost relating to regulation studies involving targeted countries can be reduced thanks to a harmonized regulation.

- Operators often belong to international or inter-regional corporations and aim at mutualising their

activities among countries. This can become even more complex when countries regulations are different or contradictory, which can often lead to inefficiencies in terms of cost, time and human resources.

- Consumers can also be affected by the lack of harmonization of international calls prices. For African countries, whose competition in long distance telephony is limited, the prices of international calls and high speed services are higher. The decrease in prices is correlated with competition which in turn is developed by harmonization.

Source : Bird and Bird

Implementation and management

The proposed plan reconsiders the main axes of the Study carried out in 2010-2011 by Bird & Bird, Adetef and Poly Conseil; the details are provided in the final report of this study.

In the short term (12 to 24 months maximum) : Setting up permanent work groups which suggest recommendations to the Member States.

The working groups' identified priorities (to be adjusted), which are also key topics of the recommendations of the PIDA Study:

- Scarce resources management,

- Rights of way,

- interconnection/access

- and cyber security/ cybercrime

In the mid term (beyond 24 months) :

Setting up a structure bringing together experts from UMA member countries representing regulators and ministry departments in charge of telecommunication and/or ICT in order to make the harmonization work undertaken more sustainable, **to assess its implementation and monitor the necessary evolutions.**

Cost of the project

600 000 $

Implementation process and calendar

It is essential that UMA establishes dialogue on a number of points with the neighbouring RECs namely ECOWAS and COMESA as interconnectivity between these 3 RECs remains the key link for the development of broadband at the continental level

Achieving and securing broadband in UMA countries

UMA PAP
Achieving and securing broadband in UMA countries

Context and challenges

In the mid nineties, the UMA countries decided to set up a telecommunication network linking the member countries except for Mauritania which refused to take part in the project. The realization of the project and its operation were entrusted to national operators.

Ever since, the telecommunication landscape has changed a great deal in the region in both regulatory and technical terms with more than one single operator per country, the development of the mobile, broadband and the evolution toward an "All IP".

UMA launched two projects in the ICT sector in order to make the Maghreb more attractive to national and foreign investments and thus foster development and regional economic integration: The harmonization of regulations (see project below), the achievement to and security of broadband access in the member countries.

Currently, the existing network is hardly used and is only used for voice transport only. All the internet traffic is sent directly abroad (mainly Europe through submarine cables belonging to incumbent operators).

In addition to the creation of IXPs the implementation of this project should enable the realization of infrastructure program broad axes, namely:

- Increasing interconnectivity of the players in the region
- Increasing interconnectivity with Arab countries if the network is extended to Egypt
- Facilitating the connection with neighbouring RECs.

This network, managed by an ad hoc body, which means open to all the operators in the region and not only incumbent ones, will equally allow:

- Competition in services to be strengthened
- all the players to be taken into consideration without any discrimination in access

The major challenges will be:

- Accelerating the development of broadband in the UMA
- Increasing existing infrastructure capacity to meet future needs
- Carrying part of sub-Saharan traffic to Europe or the middle East (via Cairo)
- Reducing the cost of use

In this context, UMA countries play an essential role due to their geostrategic location:

- Countries oriented towards Europe
- Accessibility to a large number of submarine cables (including Egypt)
- The Mauritania – Libya belt will help complete the interconnectivity between ECOWAS (Senegal) and COMESA (Egypt) which secure the central backbone: ECOWAS -ECCAS-COMESA and strengthen access to the submarine hubs in Egypt and Djibouti.

Objectives

- Cope with the technological mutation towards « All IP » and the predominance of data exchange during the coming years
- Compete and secure broadband networks in the UMA countries in order to provide sufficient capacity to all the region's operators to be used to exchange their internet traffic directly and develop economic exchanges (e-economy, e-banking….).
- Allow a network extension to the neighbouring RECs, COMESA via Egypt and ECOWAS via Senegal as well as to Europe so that operators may access directly big international operators.

Expected results

- Provide an open network to the region's operators in order to release competition and possibly directly access big international operators (if the network is extended to Europe)

- Improve and secure connectivity among UMA countries
- Increase the capacity available to face data traffic increase in the next 10 or 15 years.

Project overview

If the UMA countries agree with the objectives mentioned above, their political differences can delay for many years the realization of land infrastructure as noted during the PIDA presentation meeting in Rabat on 27 and 28 December 20011.

As a consequence, as all the countries have of a coastline, the proposed project depends on the use of a submarine cable which will help ''avoid'' political issues in the region.

A submarine cable of 4500 km will link the 5 UMA countries proposing two landing locations per country in order to help secure part of the national network.

Unlike the land networks, where optical fibre can be operated on demand, active equipments must be included in the project. In fact; because of the long distance, the cable must be equipped with active submarines. The landing stations must equally be equipped in order to ensure the operation of the whole infrastructure.

This network will be operated by an ad hoc body with a dedicated NOC – Network Operations Centre, in order to ensure the quality of communication from end to end. A reference catalogue will be published; the link rates will be based on cost.

Projet de réseau régional
Extension possible vers les CER voisines
Infrastructures régionales autres
Extension possible vers l'Europe (Espagne - Portugal)
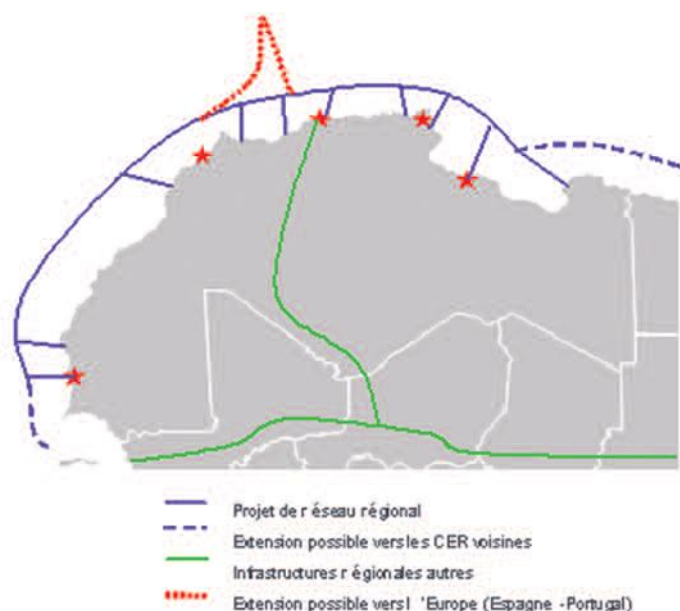
Figure 45: The UMA Regional Network Project

Beneficiaries

- All the operators of the region seeking to carry data traffic to other UMA operators
- The neighbouring RECs if they wish to join this project in order to connect
- Consumers, as competition can be entirely available and prices should decrease.

Implementation and management

Implementation

Given the mobilization of cable boats for cable-laying, the project can be realized in one single phase.

However, many services must be completed before contracting with a supplier:

- Define the precise route and landing points in each country

- Carry out an Environment Impact Study
- Set up a network operation company
- Draft the project's specifications
- Call for bids, analyze suppliers' tenders and sign contract with selected supplier.

This first phase should last 9 to 12 months.

The second phase will be the construction of the network. It should also last 9 to 12 months before the reception and commercial operation of the network.

Management

An operation company must be established for the management of this network:

- Launch the construction of the network, monitor the implementation and ensure the reception of equipments and commercial operation
- Ensure network supervision,
- Ensure network maintenance through maintenance contracts with a submarine cable maintenance and repair consortiums
- Ensure financial management of investments

Possible structure of the consortiums

- Private company
- Public-Private Company

Project Cost

Phase 1, studies :	400 000$
Phase 2, implementation :	203 000 000$
Total project :	**203 400 000$**

Financing

Financing can be provided through a PPP, consisting of all the national and regional operators of the area covered by the infrastructure.

Optimizing investments can be carried out by selling IRU during the implementation or after construction

Implementation process and calendar

It is indispensable that the UMA establishes dialogue on some points with the neighbouring RECs, namely ECOWAS and COMESA as interconnectivity between the 3 RECs is a key link for the development of broadband at the continental level.

4.3.6 Carrier to carrier project with regional dimension (ECOWAS - UMA)

Phase 3 Project

ECOWAS carrier to carrier PAP **Regional carrier to carrier using alternative infrastructure (Energy)** **Phase 3 : Extension from Nigeria to Ghana and to Benin**
Context and Challenges

The analysis of the ECOWAS Master Plan and its updates show the urgency to establish within ECOWAS regional infrastructure. An infrastructure connecting the various capitals and/or submarine stations of the area is included in the PIDA ICT PAP.
 	
The consolidation of alternative infrastructure and the implementation of regional private or public/private carrier to carrier are nothing but an economically reasonable update of the projects initiated by the RECs (Comtel, EAC-Bin, Nepad e BB...).
 	
The ECOWAS context shows three carrier to carrier projects complementary in terms of coverage out of which 2 are based on the use of alternative infrastructure:
 	
    ■ WAPP : project financed by the World Bank
 	
    ■ Phase3: carrier to carrier already active in Nigeria and having initiated an extension to Benin and Ghana.
 	
Setting up carrier to carrier on alternative infrastructure will help consolidate ECOWAS digital planning.
 	
Phase 3 project will help achieve many axes of the infrastructure program which are:
 	
    ■ The strengthening and security of access to submarine stations
 	
    ■ Country interconnection at the REC level
 	
    ■ The strengthening of competition on infrastructure and services
 	
    ■ The extension of broadband infrastructure coverage at the regional and national levels of the covered countries.
 	
    ■ The strengthening of interconnectivity between the existing infrastructure at the regional and national levels.

Objectives

The objectives of this project are:
 	
    ■ The strengthening of ECOWAS integration: Interconnecting countries ; within Phase 3 project: Nigeria, Benin, Ghana in its current form.
 	
    ■ Regional and continental integration: Phase 3 is part of the inter-REC interconnectivity strengthening
 	
    ■ The security of access to submarine stations for all the players of the countries covered by the project.
 	
    ■ Sector synergy: This infrastructure to be set up or to be strengthened is developed on the **infrastructure of energy operators in the relevant countries**.
 	
       - Power Holding Company of Nigeria (PHCN)
 	
       - Communauté Électrique du Benin (CEB)
 	
       - GHANAGRID Company (GRIDCO)
 	
Expected results
 	
    ■ Allow operators and ISPs which do not have their own infrastructure or which do not belong to a large group to have access to submarine cable landing stations without depending on their competitors.
 	
    ■ Improve regional as well as national coverage of the relevant countries
 	
    ■ Strengthen regional connectivity: Nigeria, Togo, Benin, and Niger...

Project overview

Project Phase 3 Benin and Ghana :
WEST AFRICA AERIAL FIBRE INTEGRATION PROJECT

Phase 3 in 2011

Phase3 Telecom is a national long distance telecommunications network operator licensed by the Nigeria Communication Commission (NCC) to provide transmission services in Nigeria. Incorporated in 2003 and licensed in 2006, Phase 3 Telecom secured a concession agreement with Power Holding Company of Nigeria (PHCN) to design, build, manage and expand a reliable and efficient optical fibre backbone on PHCN High voltage transmission lines. In Nigeria, Phase 3 presently has a optical fibre network of over 4,000 km deployed on High Voltage transmission lines and have commissioned several points of presence at sites located in key cities including last mile connectivity of clients on the network. All the major telecom operators, Internet Service Providers (ISPs) and major corporations are currently using its network in Nigeria.

The project included in PIDA ICT PAP related to the expansion of the network across the West Africa region :

- Phase3 has secured the right of way from Communauté Electrique du Benin (CEB), to deploy optical fibre within Benin and Togo, using the high voltage power lines.

- Phase3 has started the extension of the aerial national infrastructure in the two countries from their current combined length of 600km of fibre to over 3,000km.

Thanks to this development, Phase3's network shall become one of the most important regional land optical fibre networks linking Nigeria to the Republics of Benin and Togo, with potential connections to Ghana, Cote d'Ivoire, Burkina Faso from Togo, as well as anticipated, connection to the Republic of Niger from Nigeria and the Republic of Benin.

While this project shall bring about a cross border telecommunication infrastructure within ECOWAS Member States, it shall also cut down the high costs of telecommunication services to consumers as well as reduce redundancy on the transmission cable network, which will be beneficial to all telecommunication operators and Internet Service Providers in the region. This project shall also generate employment opportunities across the region
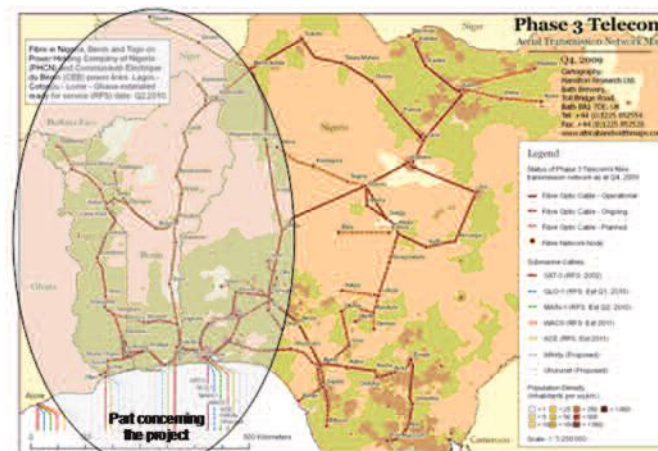
Figure 46: Overview of Phase 3 project

Beneficiary and/or target customers

This infrastructure initially targets existing regional telecommunication providers who currently operate in these countries and meets the transmission needs of operators who plan on interconnecting with existing operators in the countries.

This also positions Phase3 in these countries as the infrastructure provider for the distribution of broadband services to many regions.

The project shall also be seen as a key element for ICT development in the ECOWAS region but also in other RECs jointly with the different programs which are included in ICT PAP as shown in **Figure 47** below :
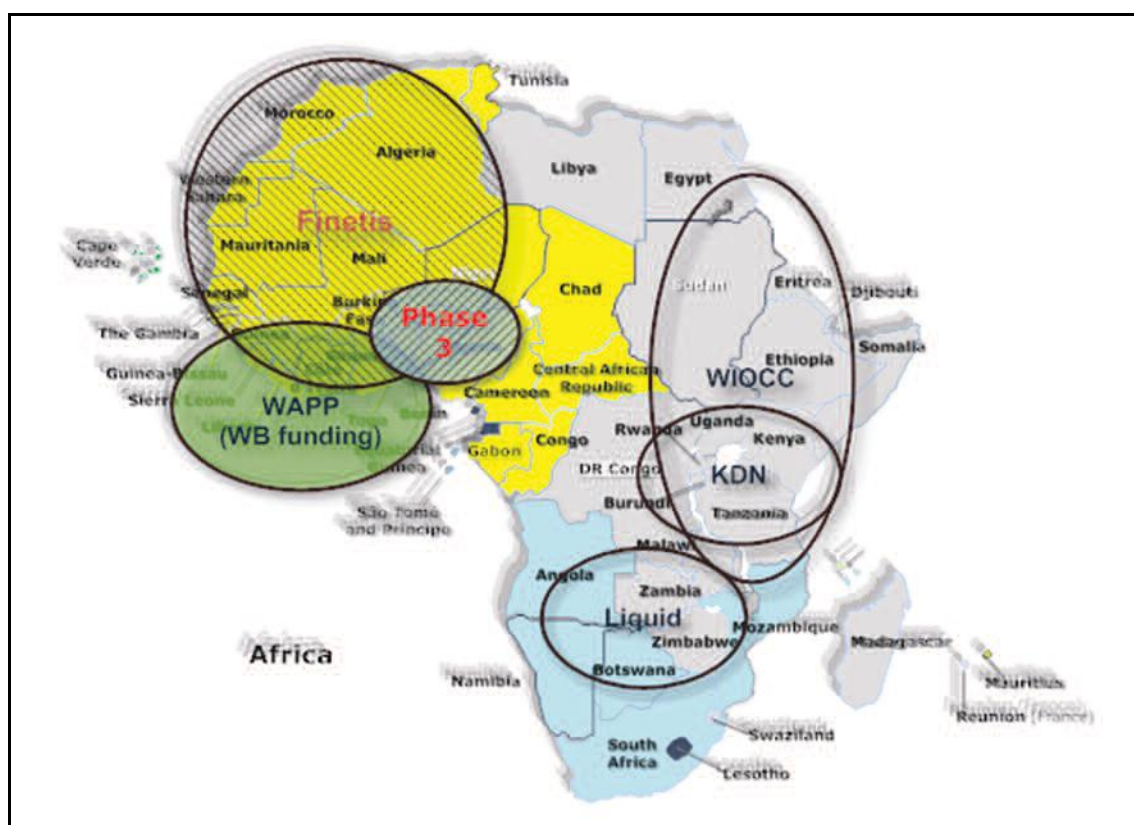
Figure 47: Synergy with "WAPP[22] **black fiber project"**

The Phase3 extension to different countries can be implemented in synergy with the WAPP black fibre project; To reduce investment, Phase3 which is a carrier to carrier will be a "customer" in countries where "the WAPP black fibre" will be implemented.
Implementation and Management
- This project, resulting from an agreement between a private company and public entities (Power companies), the implementation and management process will be carried out as described in Phase II Report.   - This infrastructure will be implemented by the various partners of the Consortium (Phase 3 and power companies).   - ECOWAS will have to make representations to the Governments and regulators to ensure that an enabling environment will be set up in the various relevant countries.
Project Cost
Deployment of 3000 km of OPGW cable: 60 000 000 $
Funding
Phase3 requires support, partnership and collaboration for recommendations to international financial institutions in order to obtain the funding required for an accelerated launching of the project and for the extension of the regional network.
Implementation process and calendar
Part of the Phase 3 project is active in Nigeria. Extension to Benin, Burkina Faso, Ghana would help accelerate regional connectivity and secure the countries' access to the various submarine landing stations.   The review of the regulatory and legal framework in ECOWAS must be undertaken as soon as 2012 as the current framework is hindering Phase 3 project; as well as the WAPP project (World Bank project at the feasibility study phase), Finetis project (cf. project fiche), and the Chad Cameroon-Nigeria connection and the Mali-Niger- Nigeria project.

[22] See WAPP Scambi Invest project (2011)

The review of the regulatory framework completes the decision taken by the ICT Ministers in Yamoussoukro in October 2011 on access to submarine cables. Infrastructure financing and the calendar will have to be discussed by Phase 3 and the AfDB during PIDA implementation.
Political and regulatory environment in the different countries
▪ Trans-boundary links ▪ Landlocked countries Charter ▪ Crossing countries to access a submarine cable landing station
Remark
The infrastructure financed with public funds should be the subject matter of a catalogue of prices revised annually in order to update rates according to the real transported traffic. The sale of IRU to operators will help alleviate considerably mid-term funding.

FINETIS Project

ECOWAS-UMA PAP
FINETIS : carrier to carrier
Context and challenges

The analysis of ECOWAS and UMA Master Plans shows the urgency to set up interregional infrastructure.
 	
The consolidation of alternative infrastructure and the development of regional private or public-private carrier to carrier operators are nothing but an economically reasonable update of projects initiated by the RECs (Comtel, EAC-Bin, Nepad e BB...).
 	
In the ECOWAS and UMA context, there are three complementary carrier to carrier projects in terms of coverage, two of which are based on the use of alternative infrastructure:
 	
   ■   WAPP : project financed by the World Bank
 	
   ■   Phase 3: carrier to carrier already active in Nigeria and having initiated an extension to Benin and Ghana.
 	
   ■   FINETIS
 	
Figure 48: Carrier to carrier projects
 	
Impact on regional integration
 	
The development of carrier to carrier operators on alternative infrastructure allows the consolidation of ECOWAS digital planning as well as better interregional connectivity, thus increasing competition in infrastructure and services to the operators of the ECOWAS and UMA regions.
 	
The FINETIS project allows the achievement of many axes of the infrastructure program which are:
 	
   ■   The strengthening and security of access to submarine stations
 	
   ■   REC countries interconnection.
 	
   ■   The strengthening of competition in infrastructure and services
 	
   ■   The extension of the broadband infrastructure coverage at the regional and national levels in the countries covered.
 	
   1.   The strengthening of interconnectivity between the existing infrastructure at the regional and national levels.

Figure 49: Current submarine cables
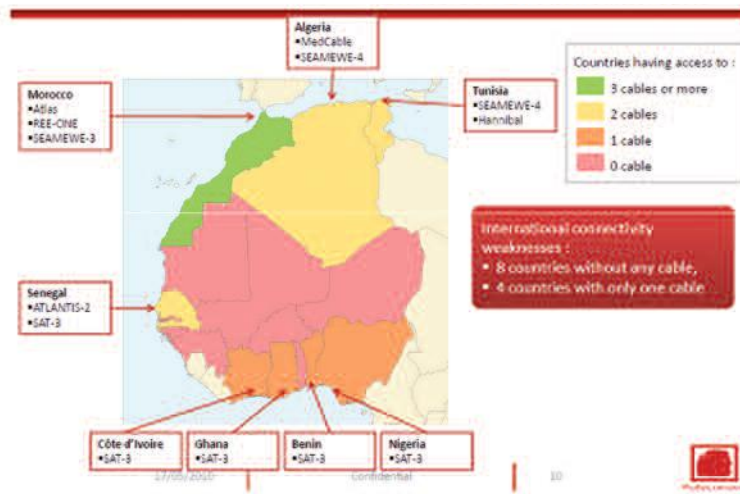
Objectives

The objectives of the project are:

- Consolidating ECOWAS integration: Interconnecting countries

- Consolidating UMA integration: Interconnecting countries;

- **Regional and continental Integration**: FINETIS is part of the inter-REC interconnectivity consolidation and particularly the South-North axe of the Atlantic side.

- **Securing access to submarine cable landing stations** for all the players of the countries covered by the project.

- **Sector synergy**: the FINETIS project aims to acquire IRU on some existing infrastructure or on that being deployed such as the Algeria- Niger-Nigeria link.

Expected results

- Allow operators and ISPs which do not have their own infrastructure or which do not belong to a large group to have access to submarine cable landing stations without depending on their competitors.

- Improve regional and national coverage in the relevant countries

- Strengthen regional connectivity: ECOWAS-UMA countries…

Project overview

The Finetis project covers 16 countries in ECOWAS and UMA. It is structured around:

- New independent infrastructure

- Purchase of IRU on existing infrastructure.

The feasibility studies and the business plan have been completed and the project is seeking funding for implementation.

It is attached to a Moroccan structure.

Figure 50: Overview of the FINETIS project
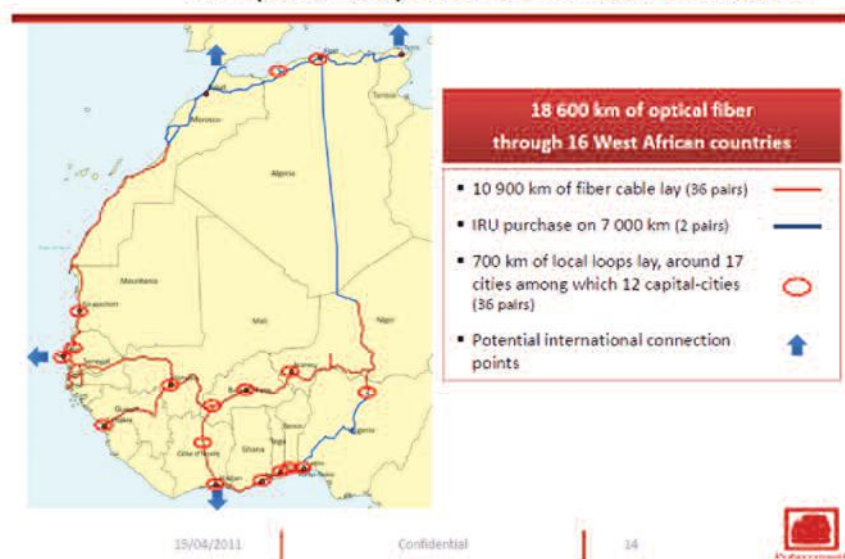
Table **15** below provides the current state of the phasing and the implementation stages.

Roll-out	Countries	km	Commercial launch
2014	IRU purchase from FINETIS Morocco	1500	Already deployed
2012 - 2013	Cable extension Morocco, Gambia, Mauritania, Senegal	4000	2012 & 2013
	IRU purchase North Algeria, Tunisia	1600	2014
2011 -2012	Cable extension Mali, Guinea, Burkina Faso, Niger	4900	2012
2014	Cable extension Cote d'Ivoire, Ghana, Benin, Togo, South Nigeria	2100	2015
	Cable extension Nigeria, South Algeria - Algiers	3800	

Table 15: Overview of the Finetis project

Context

Take-off of the Internet market, especially for mobile Internet in West African countries

Objective

- Providing West African operators with a complete international connectivity offer (optical loop, IP transit)

Strategy

- Development of optical loops in 16 countries

A large-scale project
- 16 West African countries interconnected
- 18,600 km of fiber, rolled out over 3 years (2012-2014)

16 countries covered by the project
- Morocco
- Algeria
- Tunisia
- Niger
- Burkina Faso
- Mali
- Senegal
- Mauritania
- Guinea
- Guinea-Bissau
- Gambia
- Côte d'Ivoire
- Ghana
- Togo
- Benin
- Nigeria

A simple, ultra-competitive offer
- First, IRU sales to finance the roll-out :
  2€ / meter / pair / 15 years
- Then sale of IP transit depending on the telecommunications regulator.

Beneficiary and/or target customers

Figure 51 below is an extract from FINETIS' business and financing plan and explains clearly the targeted

Figure 51: Finetis' potential clients for international bandwidth   Source FINETIS

Synergy with "WAPP[23] black fibre project" and Phase3

The Finetis infrastructure and network in different countries can be implemented in synergy with the WAPP black fibre project and Phase3; To reduce investment, Finetis which is a carrier to carrier will be a "customer" in countries where " the WAPP black fibre" will be implemented.

Implementation and Management

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[23] See WAPP Scambi Invest project (2011)

Project management from Morocco

- 7 teams operating simultaneously

- A team covers a 200 km radius on average (300 km maximum) and can intervene within 6 hours

Objective of providing quality service

- Network architecture ensures an availability of 99.98% (max 1h45min of service interruption per year).

Means of maintenance

- Operational centre in Rabat (Morocco) available 24h/24 x 365 days / yr

- 30 on-site teams deployed by operational centre

Project Cost

- Phase 1 :   60 000 000 $

- Phase 1 + 2 :   300 000 000 $

Funding

FINETIS requires support, partnership and collaboration to be recommended to donor agencies and international financial institutions for the provision of the required funding, the early implementation and the expansion of the regional network.

Implementation process and calendar

See above

Political and regulatory environment in the various countries

The analysis of the legal and regulatory framework must cover all the countries and, when necessary, be adjusted to create an enabling environment.

WAPP, Phase 3 and FINETIS are all driving projects for the development of broadband in West Africa and require adjustment of the regulations.

These 3 projects are amongst the projects initiated by the RECs in their infrastructure and broadband operator project pipeline (Eac-BIN, EABs, Comtel, Nepad e BB) and to a lesser extent SRII and UMA BB, WIOCC…

Remarks

4.3.7   IXP PAP (2015)

IXP PAP
Continental program
Context and Challenges

Internet Exchange Points (IXPs) are a key part of basic ICT infrastructure, necessary for ensuring low latency between networks and minimizing the national/regional traffic flow, which in case of non availability, would otherwise travel outside the country/region.

Africa is lagging behind all the other regions of the world in terms of IXPs, with less than 40% of African countries (only 20) hosting these facilities. There is also very little regional traffic exchange to keep international traffic within Africa.

Most of the existing IXPs are concentrated in Eastern and Southern Africa. The affiliation of most of the IXPs that have been established is also low, and has not reached a critical mass of operators to make them self-sustainable in most countries. In addition, local traffic is not always exchanged over IXPs even where they do exist, and a limited number of these IXPs have additional facilities to minimize international traffic, such as caching servers, mirror servers and Content Distribution Network (CDN) services such as the Google Cache.

African IXPs as of October 2011:

1. Angola: IXP-ang http://www.angola-ixp.ao/
2. Botswana: BINX
3. Cote D'Ivoire: CI-IXP http://www.ciixp.ci
4. Dem. Rep. of Congo: KINIX http://www.ispa-drc.cd/kinix.htm
5. Egypt: CR-IX, GPX and MEIX (Middle East Internet Exchange), http://caix.tra.gov.eg , http://www.gpxglobal.net/
6. Ghana: GIX http://www.gixa.org.gh
7. Kenya: KIXP Nairobi & KIXP Mombasa http://www.kixp.or.ke/ ,
8. Mauritius: MiXP http://www.gov.mu/portal/sites/mixp/index.htm
9. Malawi: MiX http://www.mispa.org.mw/mix.html
10. Mozambique: Moz-ix http://www.mozix.org.mz/
11. Nigeria: Lagos and Ibadan iBiX http://www.ib-ix.net/ and NIXP http://www.nixp.net
12. Rwanda: RINEX
13. Sierra Leone: (SLIX)
14. South Africa: JINX http://www.ispa.org.za/jinx/ and GINX http://www.ginx.org.za/
15. Swaziland: SZIXP
16. Tanzania: TIX and AIXP http://www.tix.or.tz , http://www.aixp.or.tz
17. Tunisia: ATI http://www.ati.tn
18. Uganda: UiXP http://www.uixp.co.ug/
19. Zimbabwe: ZINX http://www.zispa.org.zw/zinx.html
20. Zambia: ZIX http://www.zispa.org.zw/zinx.html

Most IXPs are operated by national associations of Internet Service Providers (ISPs). In some cases, Governments sometimes play a role in providing a neutral facility to host IXPs, but generally, the IXPs that have emerged have not benefited from any specific involvement of governments.

The total traffic across these IXPs is estimated at an average of 3.05Gbps in November 2010, showing a 50% increase compared to the previous year[24]. The majority of this traffic is generated by IXPs in Egypt, Kenya, South Africa and Uganda, countries with fairly extensive national backbones and more vibrant IXP markets (the Johannesburg IXP is responsible for two-third of the continent's total IXP traffic). As discussed in the Phase II Report, the lack of competitive backbones in terms of price is one of the main constraints with the use of IXPs, along with the lack of locally hosted applications which means that the bulk of the traffic is international, reaching 90% or more in some cases.

Since IXPs are more prevalent and more active in countries with more developed infrastructure, it is not surprising to find that 21 of the 23 operational IXPs are in cities connected to submarine fibre cables. At least 4 ISPs peer in more than one IXP in Africa. However, they use different AS numbers at each site, partly because these ISPs have been consolidated through acquisitions and mergers.

Apart from providing facilities for traffic exchange, IXPs also provide an important national location to host shared services such as caching-servers, time-time servers, mirror servers and domain name servers. So far 5 African countries have root- name server instances, which are all located at IXPs level.

As a result of the limited number of and the poor operation of existing IXPs, millions of dollars are paid to off-continent Internet transit providers for traffic which could stay local and exhibit much better network performance at far lower cost.

There are many reasons for the slow development of IXP, most of these non-technical reasons relating to capacity building needs, level of trust and policy environment.

The need to promote the development of IXPs has been recognized at the continental and regional levels, with the AUC and most of the RECs declaring the need for their establishment. However, this interest has not yet been fully translated into concrete policies which promote the establishment of IXPs, and there is a lack of clarity over how best to ensure their implementation and how to develop their role in optimizing regional traffic flows.

While it is expected that some of these issues will be identified and addressed to some extent by the AUC's AXIS project to support capacity building for improved IXPs, further resources are required to ensure that all countries on the continent have smoothly functioning IXPs and an adequate environment for regional IXPs to grow.

The PIDA program would seek to build on the AXIS activities and earlier work of the Internet Society (ISOC) to promote IXPs and improved peering in Africa, as well as the ongoing support by a variety of private sector companies such as Cisco and IBM.

Objectives

The IXP program's main objectives are:

To ensure that all local and regional traffic stay within the region. To achieve the above objective, it is envisaged to:

- Ensure there is at least one independent IXP in each country in Africa
- Ensure that all IXPs have the right enabling policy environment to function efficiently
- Support capacity building of IXPs to ensure they are able to respond to the needs of their participants and host any shared ancillary services needed – root servers, content servers etc.
- Assist all local network operators to route their off-network local traffic locally, and similarly, regionally
- Support awareness raising on the benefits of peering relating to exchange amongst potential IXP members
- Support the development of a set of metrics by which the performance of IXPs can be assessed.

Expected Results:

Concrete outputs:
- The establishment of at least 35 IXPs - in the remaining countries where they are not available.
- All local traffic exchanged locally in each country.
- Emergence of at least one regional exchange point in each region.
- The emergence of carrier neutral data centres associated with the IXPs in many locations

Outcomes:
- Improved **regional and national pricing capacity:** Creating a critical mass of traffic exchanges and members to attract off-continent and regional carriers to build links to the IXPs (and content providers to host their servers on these sites) as the most economic means of carrying their traffic, and thereby minimising the transit charges African providers (and therefore the public) have to pay to off-continent operators.

- **Improved regional and national performance capacity:** By improving the distribution and the affiliation of exchanges, users will experience improved performance of the Internet due to traffic travelling shorter distances over less congested links.
- **Improved local applications:** The achievement of the two objectives above help become more economic and efficient to host content and applications locally, thereby accelerating the development of local content and content generating industries.
- **Improved reliability of networks.** IXPs provide more locations to route traffic, thereby increasing the opportunities to establish backup circuits in the event of a link failure.

Project overview

The first stage of the project would be a stock taking and stakeholder consultation exercise to update current knowledge and plan the precise modalities of the implementation. This will involve meetings with the below following parties from which a steering committee will be set up :

- AUC

- Political decision-makers and regulators

- RECs

- AXIS team

- Internet society

- Packet Clearing House

- AfrISPA

- AfriNIC

- African Development Bank and other DFIs representatives

- Existing IXPs

- Equipment suppliers – CISCO, Juniper, IBM, HP

- Regional operators – Seacom, Liquid, Phase3, Suburban, Eassy

Following the consultations and drawing up of the final implementation plan, national activities will be established in each country, tailored to the particular local conditions and priorities identified in the consultations above.

It is expected that the next activities will be: 2 or 3 national workshops in each country; 2 regional workshops in each region; support for IXP implementation in 35 countries

Figure 52: Status in 2011

Beneficiary and/or target customer
- All of the domestic Internet providers in each country with their own networks   - The domestic capacity providers in each country   - The international Internet and capacity providers   - The public   - The private sector in particular those providing and those hosting local applications – e-gov, banks, cultural etc.
Implementation and Management
Implementation   - The implementation will be based on the initial stock taking and the stakeholders' consultation, using sequencing and conditionality criteria based on the ranking and prioritization criteria of the country needs. New IXP projects will be initiated in countries where they do not exist and there are more than two Internet Service Providers.   **Figure 52** above shows the situation in 2011 which was used as a starting point for determining the phasing of countries and activities.   - The total time-frame for the project will be 3 years.   **Management**   - AUC will be responsible for the project, which will allow best sharing of resources and co-ordination with the AXIS project. The AUC team will be in charge of managing the regional and national activities, establishing the performance criteria and the monitoring process.   - Individual implementation and coordinating teams will be established in each country, identified through the local workshop and the initial stakeholder consultation.   - Regulators will most likely be the institutions that will be hosting the meetings and workshops. They could even provide the operational facilities for IXPs where independent facilities are not available
Project Cost
Total PAP: 12 900 000$
Financing
It is expected that the financing of this project will come from a variety of sources, ideally a mix of DFI, Government and private sector funding. Most likely, AUC core activities will require DFI funding, but at the national level, it will be a mix of national government investment (and possibly municipal investment if municipality hosts for IXPs are found) and private sector funding from the local operator and the international industry sectors, in particular regional fibre network operators such as Liquid, Phase 3, EASsy, SEACOM, and ACE, the equipment suppliers – Cisco, Juniper etc, and the industries and civil society representatives and the Internet Society.
Implementation process and calendar
It will depend on the presence of IXPs and an enabling environment in the country. Some countries will see immediate implementation, but others might wait for 2 years after the enabling legislation is in place.
Policy and regulatory environment in the different countries
See Phase I Report – the environment changes and goes from full competition at all levels (wholesale and retail, and carrier services) to a single monopoly for all services.

5. ANNEXES

5.1 Guidelines for Improving Enabling Policy and Regulatory Environment for ICT Infrastructure Investment

This section provides some details on the scope of the guidelines for ICT infrastructure development that would need to be developed and adopted at the regional and national levels in order to accelerate the availability of pervasive affordable high-speed broadband. Below is a detailed description of the components of the Enhanced Enabling Environment Program (Table 16):

Guideline	Short description	EXPECTED OUTCOMES	Institution in charge of the implementation and management Requirements/ Remarks
Promotion of Competition	▪ Reference Interconnection Offer (RIO) ▪ Each operator with SMP shall also have an associated publicly available RIO providing wholesale prices for a) national bandwidth, international bandwidth, ducts, black fibre, other facilities such as collocation and information relating to interconnection point location ▪ Publicly funded ICT Infrastructure ▪ Development of guidelines for land-based infrastructure implemented with public funding. The guidelines will provide directives for a) the number of fibres, b) ducting, c) collocation and (passive) interconnection facilities, d) price catalogue based on cost oriented approach providing the same information as RIO, e) neutrality of operation and maintenance (non discriminatory)	▪ Optimize usage of available land-based infrastructure for other actors ▪ Facilitate interconnection between different fibre networks ▪ Management and regulation based on costs or benchmarks of wholesale offers ▪ Reduce wholesale prices ▪ Transport costs for all operators	▪ RECs are in charge of data collection on RIOs to analyze the needs for regional infrastructure program ▪ NRAs enforce the obligation to publish a RIO ▪ RECs ensure transposition by the national government, including Metropolitan networks or District infrastructure deployed by territory agencies with public funding, Any land-based infrastructure implemented by PPP, PSD (Public Delegation of services)
Trans-boundary and Regional ICT infrastructure Planning	▪ Ensuring the implementation of trans-boundary infrastructure as simple as deploying national infrastructure ▪ Governments of neighbouring countries take measures to facilitate trans-boundary infrastructure deployment, including rapid authorization and provision of access to rights of way. ▪ Planned trans-boundary infrastructure deployment to be declared by the actors to the local authorities (NRA, ICT/Planning Ministry). Encourage public consultation and the participation of all actors in regional projects. Forum where actors can analyze their potential participation in a "regional project". Provision of economic model of investments. Public consultation about regulatory bottlenecks ▪ Implementation measures for optical fibre facilities such as ducts, collocation rooms etc by complementary infrastructure operators (transport/energy) ▪ New infrastructure built with necessary public funding - based on open access principles with a catalogue of tariffs (wholesale price, IRU[25],share investment etc) with independent operation and maintenance (not operated by infrastructure users) ▪ Strategies for trans-boundary corridors - Identification of the potential International points of public consultation of actors	▪ Accelerated process to implement trans-boundary ICT infrastructure ▪ Simplified administrative process ▪ Improved sustainability/ROI of infrastructure ▪ Lower access tariffs ▪ Enabling environment for regional investment /trans-boundary infrastructure from multi-operators	▪ AUC, NPCA, RECs ▪ Transposition at the national level with ICT Ministry and NRA ▪ Implementation of priority guidelines and REC corridor Master Plans
Rights of way	▪ Planning guidelines for all infrastructure capable of ensuring appropriate installation of ducts and related facilities for the connection of units/power, in consultation and co-financing, with current and future telecommunication operators. ▪ Guidelines and regulations to ensure to the operator access to the below facilities and rights of way, including the construction of entry points and the laying of ducts, easily supported with easement and permitting systems. ▪ Local/municipal regulation planning authorities include: a) the implementation of	▪ Accelerated land-based infrastructure deployment ▪ Accelerated access to existing rights of way, ducts and fibres, ▪ Reduced time and deployment costs for	▪ AUC, NPCA, RECs ▪ Transposition at the national and local levels is required involving agencies in charge of infrastructure planning and management ▪ Prioritize the synchronization with other regional infrastructure priority projects, corridors etc ▪ Building capacity of local authorities is a high priority, but requires very extensive

Guideline	Short description	EXPECTED OUTCOMES	Institution in charge of the implementation and management Requirements/ Remarks
	wide ducting to secure planning authority's approval, b) the sharing of trenching required for all operators c) penalties for interference.	network development and maintenance	resources
Trans-boundary Corridor Strategy	▪ Planning guidelines for regional corridors to provide open access to regional fibre links ▪ Identification of investment requirements and institutional management arrangements to ensure that ducts and fibres are included in each trans-boundary link in the transport and energy sectors	▪ Low cost of trans-boundary links ▪ Simplify the implementation process	▪ AUC, NPCA ▪ RECs ▪ Corridor authorities ▪ DFIs ▪ Require agreement of States and adjustment of legal and regulatory environment
ICT Data Collection	▪ Quarterly data collection on ICT markets and NRAs[26,] infrastructure responsible for consolidating national data, making it public (under a consolidated form (to respect business confidentiality where needed and without identifying individual operators). RECs are responsible for ensuring that NRAs are able to do this and to consolidate data at the regional level. AUC is responsible for ensuring that RECs consolidate data and publish summary reports continent-wide. National regulation is also required to compel operators to provide data quarterly. ▪ Priority data points to be provided by operators : ▪ Number of active mobile subscribers ▪ Number of mobile broadband subscribers ▪ Number of land line subscribers ▪ Number of land broadband subscribers ▪ Coverage area and capacity details of any optical fibre network or any other physical infrastructure in use ▪ International capacity of each neighbouring country, the rest of Africa, the rest of the world (Mbps) ▪ Tariffs: Interconnection, call termination, wholesale and retail broadband capacity price ▪ Revenues and investment	▪ Improved planning through more up-to-date knowledge of ICT market development ▪ Improved ability to make appropriate reform/adjustments of ICT market policies ▪ Improved regulation at the national level ▪ Publication of annual ICT progress reports and quarterly updated online observatories at continental, regional and national levels	▪ AUC, NPCA, UNECA ▪ RECs ▪ NRAs ▪ May require harmonization of legal procedures for enabling NRA and RECs to enforce data collection from operators
Trans-sectoral Data Collection	▪ Collaborative development of institutional frameworks for cross-sectoral GIS-based infrastructure planning decision support systems ▪ Inventory of providers of infrastructure for ICT transport in order to assess access to existing rights of way within water and sewer networks (sanitary and stormy), gas/oil pipeline systems, canals, waterways, roads, rail lines, transport tunnels, bridges, electricity grids and including all masts. ▪ Development of procedures for all infrastructure facilities operators (public, private and alternative, municipalities) to provide data on their optical fiber infrastructure, including geographic coordinates, fees for access and current obligations to provide duct or other ICT facilities.	▪ Improved identification of opportunities to accelerate the deployment of network infrastructure ▪ Faster and cheaper coverage of broadband services	▪ UNECA & AUC, NPCA ▪ RECs ▪ NRAs ▪ Requires the participation of the various departments in charge of infrastructure management and land use planning at the regional, national and sub-national levels
Long Term Broadband Infrastructure Strategy	▪ Development of continental/regional guidelines on ICT infrastructure : ▪ Continental guidelines for broadband and land use planning ▪ Continental and regional land-based infrastructure assessment	▪ Accelerate and optimize broadband infrastructure implementation with a long term	▪ AUC/ NPCA and RECs to prepare the various guidelines and manage the transposition and application at the national level

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[25] Indefeasible Right of Use: Contract for provision of optical fibres, initially used in transatlantic submarine cables and now in land cables. Owner of IRU has an irrevocable right to use such property and the right to exploit and manage it. The IRU is signed generally for 10 or 15 years, is an intangible investment.

[26] International benchmarks on NRA web sites - EU, North America

Guideline	Short description	EXPECTED OUTCOMES	Institution in charge of the implementation and management Requirements/ Remarks
	▪ Access to sub-marine cable landing station ▪ Facilitation of trans-boundary infrastructure ▪ Metropolitan and district infrastructure in grey[27] areas with public or PPP funding ▪ Guidelines on priorities for private investment, PPP and public infrastructure ▪ Guiding principles – e.g. minimize distortion of competition in infrastructure and services, deployment and use of alternative infrastructure deployed by transport, energy, other utilities	vision ▪ Reduce ICT investment needs by reducing civil works costs or upgrade costs. ▪ Align with world trends in respect of management and transformation	
Landlocked country Charter	▪ Continental charter for landlocked countries to ensure ability to cross neighbouring countries to access sub-marine landing stations at similar prices to coastal countries : ▪ Landlocked countries could share costs with neighbours by jointly investing in the required infrastructure ▪ Operators may not be required to pay license fees if no services are provided in the country being crossed ▪ Availability of IRUs at affordable prices	▪ Security and affordability of access for landlocked countries	▪ UAC/ NPCA ▪ REC for enforcement
Spectrum Management	▪ Optimal spectrum allocation and cost-based spectrum fees to promote national demand and maximize the ability of operators to supply services. ▪ Regional and national frequency tables. ▪ Migration from analogue to Digital	▪ Improved coverage of low-cost broadband services ▪ Digital dividend	▪ AUC/NPCA at the continental level ▪ RECs at the regional level and regulatory associations ▪ NRAs

5.2 Main Outcomes of the Enabling Environment leading to Medium-Term Programs

5.2.1 Smart trans-boundary corridors - A new strategy for the deployment of ICT infrastructure

Most efforts to address the issue of fibre infrastructure in Africa were based on the «missing links approach" by facilitating the interconnection of the national infrastructure of incumbent operators. This approach has helped minimize the externalization of the required funding (as the costs are usually met by the operators themselves), but has contributed to the discrimination against new market entrants because it is not based on "open access" principle or strong interconnection regulation, resulting in high prices for access.

The strategy of addressing missing links and needed cross-border infrastructure through passive «ICT trans-boundary smart corridor» approach aims to address the needs of incumbents as well as new operators to establish needed infrastructure on a cost-oriented basis. These corridors would consist of:
- Optical cables for trans-boundary and national traffic
- Empty ducts for future deployment of cables
- «Shared facilities» for hosting intermediate points of interconnection along the roads
- IIn synergy with other sectors, these ICT corridors would be established in combination with road or power transmission lines.

[27] Areas not cost-effective or not attractive for private investment

Figure 53: Synoptic of a cross border infrastructure with "smart corridor" application for the transport sector
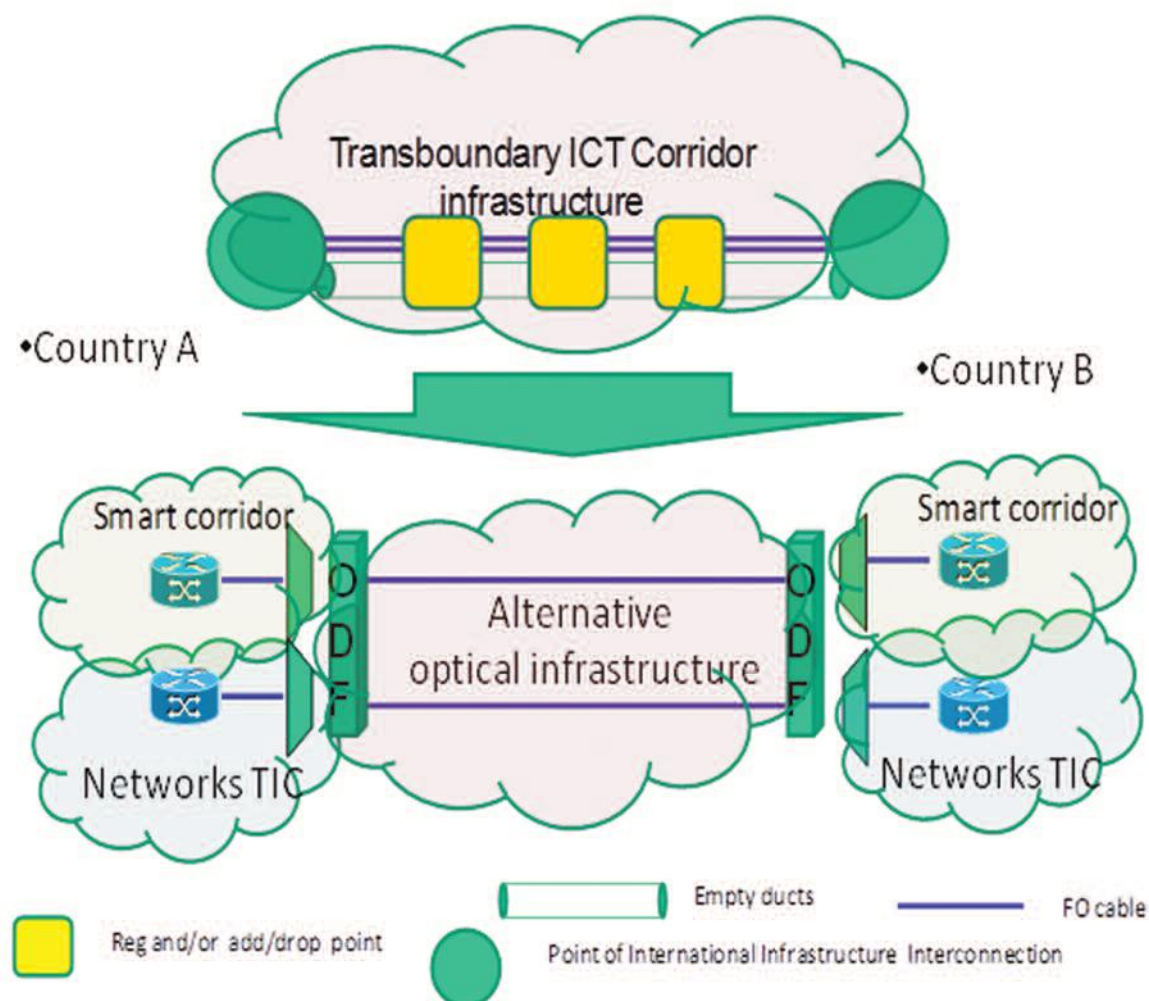
5.2.2 Example of alternative infrastructure on the road corridors and the energy transmission infrastructure

This part is an important one in the master plan for the management of the continent in terms of broadband infrastructure. Its realization and implementation are part of the plans:

Short term (2015)
Implementation of new alternative infrastructure related to opportunities in synergy with the other sectors (Transport, energy).

Medium term (2020)
As indicated in the Strategic Framework, the implementation of ICT infrastructure will be generalized during the construction/rehabilitation of road infrastructure, energy transmission or any other means likely to facilitate the implementation of infrastructure and reduce investment cost.

Long term (2030 and beyond)
Cannot be provided into details; however it is more

than likely that it will be necessary to:
- (Adjust the legal and regulatory framework to be in tune with the sector evolution
- Strengthen the national and regional connections to replace the dying infrastructure (the oldest optical cable infrastructure) and replace once again the active equipments which will have become obsolete (the operators' tasks).

Note on sustainability
However, if the pre-infrastructure (pipes…) was installed according to the state-of-the-art procedures (quality of installation, maintenance….), the investments would be less important as pre-infrastructure costs between 10 and 25 k$/km, the additional extension of cables would cost around 3K$/km

Synergies with the transport sector
The consolidation of large scale regional infrastructure will be necessary in the short or medium terms in order to remedy to the technical deficits (lack of quantity or quality) of the existing infrastructure and the necessity to strengthen connectivity and competition.

Road Corridors and the trans-African highway

The road corridors as well as the Trans-African Highway will be natural vectors for the consolidation of ICT infrastructure at the national and regional levels, in the short, medium and long terms. Besides, road corridor intend to implement a large scale "smart corridor" program that would allow the increase of road transport efficiency at the continental and regional levels. This program requires ICT infrastructure for its own needs. As a consequence, the deployment of new optical infrastructure known as "alternative infrastructure" along the 40 corridors, (70.000 km) could be shared between the "smart corridor" application and the use for ICT.

Railroads

The rehabilitation of some railway lines (Lobito-Lubumbashi...) is also an opportunity to increase national and regional connectivity by adding to these works optical cables that will be shared between the sector (internal management) and the ICT sector by providing « black fibres » to the operators.

Implementation facility, operation and maintenance structure

The implementation of alternative infrastructure independent from any commercial service offer (Operators, carrier to carrier…) is one of the keys to the development of broadband in Africa. It will allow the strengthening of competition between the players using such infrastructure while optimizing investment cost thanks to the implementation facility and the sharing of infrastructure.

Besides, the Corridor Authorities, the Power Pools, power and railway companies are structures perfectly fit for the implementation, operation and maintenance of these alternative infrastructure.

### Long term vision for the management of transport infrastructure

Figure 54 below shows corridors and their strategic importance in the ICT context as they cover the major axes required for the development of broadband in Africa. Besides, they have the advantage of having a holding structure (corridor authority) for operation and maintenance. They could play an important role in strengthening existing infrastructure and competition.

Figure 54: Potential alternative infrastructures «road corridors »
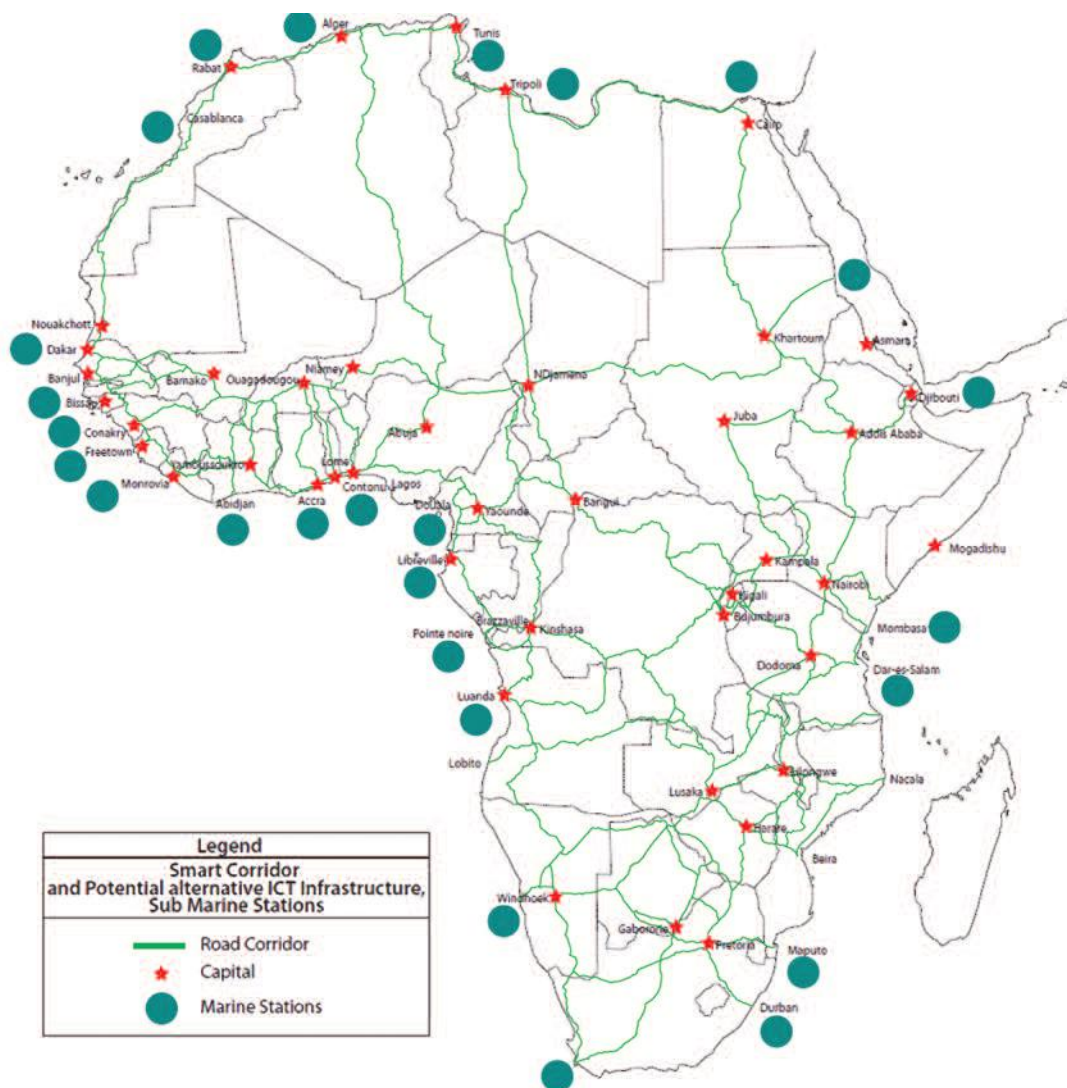
The analysis and comparison between Figure 54 above and the strategic regional infrastructure map (Figure 19) show the key role of this program in strengthening regional infrastructure. This is reinforced by Figure 55 below which shows some corridors with fibres.

Figure 55: **Illustration of some corridors with fibers**
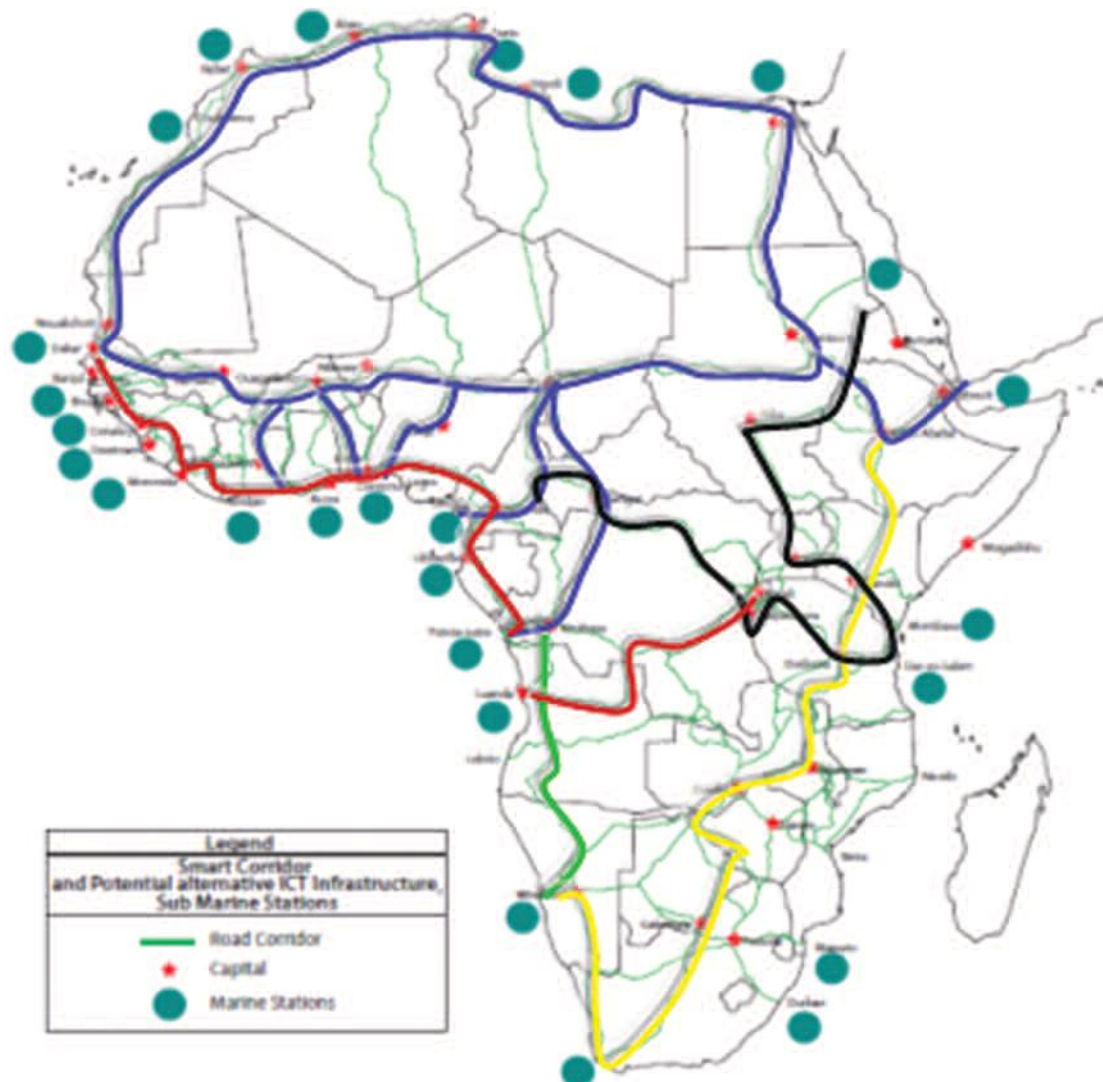
The details of this large-scale program are provided in the PAP summary in Section 3.3 here-after whose total project cost is estimated at US$ 2 billion compared to the savings made thanks to the optimization of road transport costs[28] as well as savings on national infrastructure (Backbone et backhaul) required to strengthen national infrastructure in the context of broadband development and therefore partial replacement of existing radio infrastructure which have become obsolete within the broadband environment.

Note on the creation of smart corridor applications (see transport sector)

Figures 56 and 57 below relating to the "Ndjamena-Dakar" case provide two potential scenarios; the choice of a corridor is only for illustration purposes.
Illustration of scenarios for the implementation of "smart corridors"

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[28] See Transport Sector investment

Figure 56: All satellite Solution
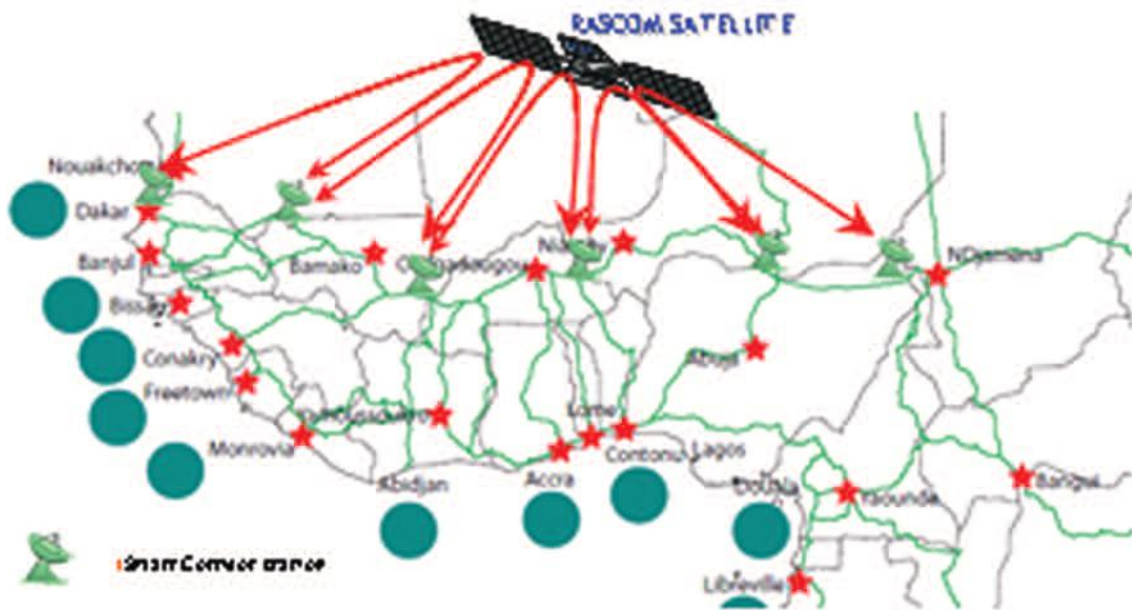
Figure 57: Optical fibre satellite solution

Figure 58: Example of a Smart Corridor Ndjamena-Dakar on OF infrastructure
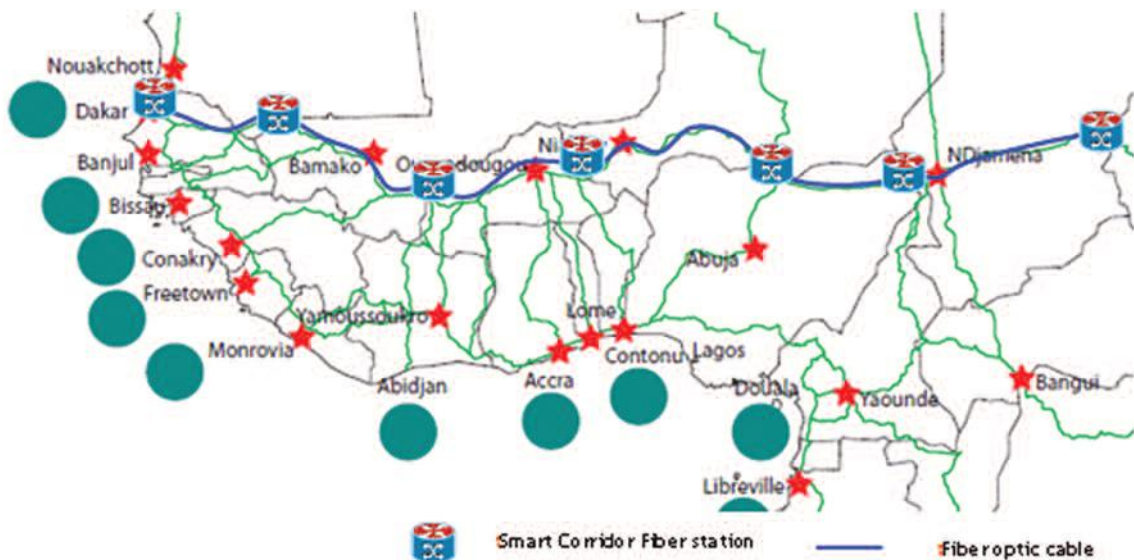
Considerations related to operation and maintenance

The "road corridor" units, having an authority or the Power Pools, having a legal structure are tailored to ensure the operation and maintenance of passive optical infrastructure as well as the commercialization of black fibre to regional and national players.

Besides, this passive infrastructure is perfectly appropriate at the national level to increase ICT penetration in the cities and rural areas they cross.

Considerations related to financing

The total amount of required financing for the land infrastructure program along the road corridors could be mobilized in an advantageous way by involving the operators of the various countries interested in using this infrastructure for their national and international links; the sale of a large number of IRUs would allow de facto a substantial reduction of global investments by refunding part of the loan thanks to IRU payments by the operators.

Besides, for some areas with limited population and that could also be covered, part of the financing can be obtained from the "Universal Service" available in the majority of countries.

Extension to the Trans-African Highways and the Energy Transport

Figures 59 and 60 below show the major advantage in using the trans-sector synergy to develop alternative regional large-scale ICT infrastructure.

In addition, the transport sector with the Smart Corridor application or energy, with the need for automated management and regulation systems also need optical infrastructure along their infrastructure.

Figures 59 and 60 below show how energy transmission infrastructure and road corridor management by 2020 are likely to play an important role in the strengthening of IT infrastructure.

Figure 59: Trans-African highways

Figure 60: Energy Transport 2020
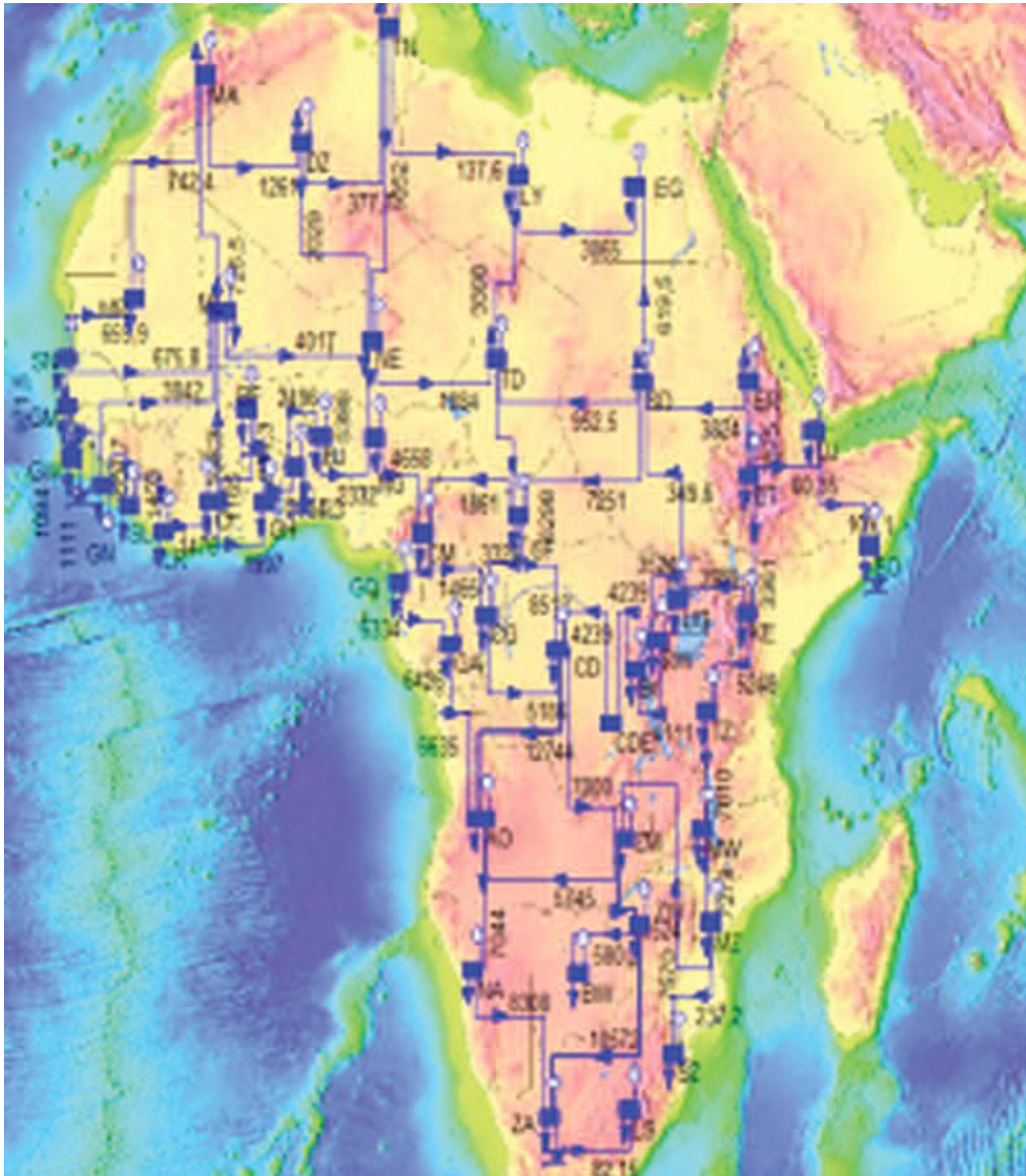
5.2.3 Development of continental and regional backbones and master plans

It is expected that data collection on the ICT market and infrastructure in relation to the Enabling Environment Program will lead to much improved capacity to develop continental and regional backbones and master plans. Based on the mapping of the existing and planned/under construction infrastructure, the continental and regional infrastructure potential is likely to bridge the gaps in broadband development objectives on the medium term. To identify the most cost effective means of establishing infrastructure, it is necessary to deepen the analysis on existing infrastructure by consolidating the information gathered as follows:

- Technical details of available and planned transboundary and national optical fibre infrastructure (quantity of fibres, quality) and laying method (duct, aerial poles etc)
- Technical details of available and planned transboundary alternative infrastructure capable of supporting optical fibres for telecommunication purposes (fibre, ducting etc)
- Associated facilities - interconnection points (passive and active), collocation points
- Ownership of infrastructure
- Business model status : Open access, monopoly pricing, regulated pricing, etc

Following the analysis of the above at the continental and REC levels, the stakeholders would be in a position to develop continental, regional and national Master Plans accordingly[29]. The AUC, NPCA, UNECA and RECs would need to support the preparation of Master Plans at the different geographic levels with the involvement of:

National governments in order to optimize

29 SADC has already begun the process of developing an ICT master plan

continental and regional infrastructure through the use of national infrastructure and by taking into consideration national land use planning requirements.

All the operators (telecom operators, ISPs, submarine cable providers, and alternative infrastructure providers) should contribute to the Master Plan, through public consultation or any other appropriate approach (forum).

5.3 Project Implementation Logical Framework

The logical framework matrix for the proposed PIDA ICT sector programs is provided in Table 17 below, with the expected results, associated assumptions and progress indicators.

OBJECTIVES	STRATEGIC POLICY INITIATIVES	EXPECTED OUTPUTS	EXPECTED OUTCOMES	PROGRESS INDICATORS
Implementation of continental and regional broadband infrastructure	▪ Broadband land use planning at the continental and regional levels (Medium and long term Master Plan) with involvement of all the regional actors	▪ Development of coherent continental and regional broadband infrastructure ▪ Synchronization of different national infrastructure deployments to increase regional connectivity and security (associated with national plan) ▪ Increase direct interconnection between actors ▪ Development of a broadband highway across Africa	▪ Desired levels of continental and regional connectivity ▪ Efficient use of the existing and potential infrastructure ▪ Reduction of International capacity prices (intra and out of Africa) ▪ Reach Kigali goal of "Connecting capital cities" ▪ Development of regional carrier to carrier providers ▪ Development of PPP or multi actor projects ▪ Expand regional connectivity between actors due to reduction of shared investment cost	▪ Coordination of regional projects by RECs and NPCA ▪ Inter-states agreement for regional infrastructure signed (facilitation of process) ▪ Effective interconnection of operators through the use of "regional infrastructure" ▪ Development of international interconnection (between operators) ▪ Assessment of the development of intra African ISP peering measured ▪ Levels of connectivity to submarine stations on competitive basis ▪ Size of international bandwidth per country (Mbps)

Creation of an enabling environment and reinforcement of "open access" to existing continental and regional land – based infrastructure	▪ Strengthening of the legal and regulatory environment, especially ending monopolies on:
	  - Land infrastructure
	  - International gateways
	▪ Harmonize legal and regulatory frameworks
	▪ Market liberalization, including spectrum access
	▪ Rights of way optimization
	▪ Promote the share of infrastructure development and multi actor infrastructure program (PPP or Private actors)
	▪ Provide tax incentives for infrastructure
	▪ Price regulations based on cost oriented benchmarks for:
	▪ Leased line and bandwidth
	▪ Dark fibre
	▪ Ducts and poles
		▪ Increased use of existing infrastructure by fast growing national and regional market
		▪ More competition in broadband services
		▪ Ideal levels of regional connectivity between all the actors
		▪ Maximize performance of existing infrastructure
		▪ High level of local and international traffic exchanges at IXP level, leading to sufficient economies of scale for international network operators to build their own networks into Africa
		▪ Build economies of scale for regional and national network operators
			▪ Price reduction of voice and broadband services
			▪ Extension of broadband services to more remote areas where it is possible (short term)
			▪ Expansion of regional and national investment due to the increase of financial resource mobilized
				▪ Increase the numbers of broadband subscribers per country
				▪ Level of ISP peering observed at the IXP level
				▪ Number of ASNs in each country
				▪ Price of international incoming and outgoing calls
				▪ Price of broadband access and usage
				▪ Average broadband speed
				▪ Price of local hosting
				▪ Number of local web sites
				▪ Number of ISP licenses
				▪ Price of wholesale capacity

Improve the use of alternative infrastructure	▪ Development of access to existing alternative ICT	▪ Developed national and regional land-based infrastructure	▪ Ideal level of connectivity at the regional and national level	▪ Number and length of alternative infrastructure open to ICT use

OBJECTIVES	STRATEGIC POLICY INITIATIVES	EXPECTED OUTPUTS	EXPECTED OUTCOMES	PROGRESS INDICATORS

	infrastructure
	▪ Investment in ducts and fibres on all trans-border transport and energy links
	▪ Land use planning and specific guidelines and instructions with other sectors for the sharing of civil works:
	  - Transport
	  - Energy
	  - Water
	▪ Sanitation
	▪ Municipality
	▪ Housing
	▪ Pre-declaration of civil works to other actors
		open to all actors
		▪ Competition in land-based infrastructure at the regional and national levels
		▪ Facilitate ICT infrastructure deployment through pre implementation of facilities made by other sectors:
		▪ Civil works (trenching)
		▪ Ducts
		▪ OPGW (optical fibre on aerial energy links)
		▪ Pre-cabling/duct planning, specifications for the construction of office buildings, housing estates...
		▪ Facilitation of the delivery of broadband services
		▪ PPP investment in ICT infrastructure
		▪ Operation and maintenance by corridor authorities, power utilities, or specialized company
			▪ Accelerated increase of the scope of broadband infrastructure
			▪ Facilitate the management of "utilities' operation" such as "smart corridors",
			▪ Expansion of regional and national infrastructure and associated investment due to a decrease of civil work costs or facilitation of deployment
			▪ Acceleration of ICT infrastructure deployment
			▪ Improved territory coverage mainly for low density and rural areas
				▪ Price of domestic and international capacity
				▪ Number of alternative optical fibre cable infrastructure used by ICT actors
				▪ Number of passive infrastructure operators

Improve the efficiency of the use of international bandwidth and internet performance and reduce costs for local users	▪ Implementation of IXPs (Internet exchange Points), caching and other hosted services	▪ Less intra African traffic, traffic of countries going outside of Africa ▪ Optimization of the use of international bandwidth ▪ Decrease of bandwidth costs for end-users ▪ Faster reactivity compared to all other local web sites ▪ More competitive markets in capacity trading	▪ Decrease of foreign currency payments to international operators for international bandwidth ▪ Elimination of foreign currency payments to operators for intra-African traffic transit	▪ Number of IXPs ▪ Quantity of traffic exchanged ▪ Number of operators peering (international, regional and national) ▪ Presence of caches ▪ Waiting list/speed of local networks

Improve management of ICT data at the continental, and regional levels	▪ NPCA and RECs:
	▪ Coordination and monitoring of the efficiency of ICT continental and regional infrastructure development in close relationship with :
	  - Governments
	  - NRAs
	  - Actors
	▪ Coordination and monitoring of legal and regulatory
		▪ More effective management of ICT sectors
		▪ Comprehensive knowledge of continental and regional infrastructure
		▪ National, regional and continental Master Plans
			▪ Development of a regional infrastructure shared by many actors based on PPP private investments
			▪ More efficient identification of necessary infrastructure and broadband strategies
				▪ Annual continental (AUC, NPCA, UNECA) and RECs progress reports including :
				▪ REC market data on main indicators per country :
				▪ Number of land lines
				▪ Number of mobiles
				▪ Number of broadband subscribers
				▪ International capacity in use and available in the future
				▪ The volume of Intra-African traffic exchanged off-continent
				▪ Bandwidth prices per country for :

OBJECTIVES	STRATEGIC POLICY INITIATIVES	EXPECTED OUTPUTS	EXPECTED OUTCOMES	PROGRESS INDICATORS
	harmonization and implementation ▪ Preparation of regional guidelines for land use planning and monitoring of the implementation at the national level ▪ Collection and consolidation of market and infrastructure data at the national, regional and continental levels			▪ National Interconnection ▪ International capacity ▪ Wholesale capacity ▪ Voice termination ▪ Broadband subscription ▪ ICT revenues and investments ▪ Detailed GIS based on infrastructure data ▪ Progress per country in terms of policy and regulation ▪ Number of national, regional and continental master plans