

Underdeveloped ICT areas in Sub-Saharan Africa

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As universal service in terms of ICTs provision cannot be achieved in the times agreed for several international bilateral and multilateral aid organizations. It is important to create mechanisms to reduce the lack of use of ICTs in sub-Saharan African countries.

This paper specifically analyses the different ICT underdeveloped areas in the sub-Saharan African countries and the factors explain such status. At the same time, the paper proposes a set of policy guidelines that might help improving the current situation in several areas such as investment, employment, infrastructure and technology in order that some countries may overcome unfavourable ICT development. The main research question is: is there any chance that sub-Saharan African countries can overcome the critical situation in which they currently are? And if so, what are the key components and processes to develop and to do changes. In this way, a proposed framework is provided for the examination of policy makers, investors, and other stakeholders in the ICT field in these countries.

Keywords: *sub-Saharan Africa, ICT, development.*

1 Introduction

This paper will examine the current situation of sub-Saharan African region in terms of a series of well spread ICT indicators, most of them made available public by the International Telecommunications Union (ITU). In doing such examination this paper will follow this structure: Section 1 will examine the most important ICT indicators, Section 2 will analyse the status of the investment and revenues in the ICT markets in the region. The regulatory framework is examined in Section 3 and the last section will discuss the indicator and the possible ways in which the countries in the sub-Saharan region might grasp opportunities to develop and efficiently use ICTs for their development.

1.1 Indicators' analysis

Before commencing with the indicators' analysis herein proposed, it is important to bear in mind that the availability of up-to-date information and indicators related to Africa is scarce due to several problems affecting several African nations. ITU, the organization in charge of collecting this type of information and creating indicators cannot operate adequately if the information to be given by the telecommunications authorities in member countries is not given on specific deadlines. Nevertheless the above, this paper aims to provide the most accurate status of the reality it is examining.

Around one sixth of the world population lived in Africa in 2008, which is the second region most populated region after Asia. Even though the latter, Africa accounts around two percent of the world's Gross Domestic Product in the same year. Further, in Africa, the distribution of wealth is uneven between countries. For instance, South Africa accounts for 25% of Africa's total Gross Domestic Product (GDP). More specifically, regarding Information and Communication Technologies (ICTs), Africa lacks of investment-intensive infrastructure such as landlines and fixed broadband ([2] and [6]). That is, two percent of the world landlines are in Africa while Asia for instance had a share of 48 percent. Obviously, Africa has great potential to improve its telecommunications usage and infrastructure deployment. Furthermore, due to prohibitively high tariffs and limited computer literacy, the number of broadband subscribers in Africa is small. In terms of broadband subscribers, Africa has a growth of 0.4 percent with respect to the world. In 2006, Africa had an around 3.8 percent of the world's Internet users Figure 1 and in 2007 there were fifty million Internet users. The share of Africa's Internet users is higher than its share of landlines and broadband subscriptions due to the popularity of public access points or Internet cafés. This is particularly true for rural areas and villages, where the connectivity goals are more difficult to meet. Slow growth in landlines leads

Africans to use mobile telephony as means of communication. Mobile telephony has a higher coverage rate in the region. Cheaper infrastructure and larger regional penetration, cheaper handsets, competitive markets and business models oriented to the needs of the poorer segments of the population. Nevertheless, the share of Africa with 7.2 percent of the worldwide subscribers shows a lot of potential growth. Also, the African mobile market is still far away from saturation while the trend in several countries in the world is towards a second mobile per person. Africa had a mobile telephony penetration of 22 inhabitants of 100. Obviously, the African telecommunication market has recently begun its rise. As the mobile boom has already proven, Africa has a strong demand for ICTs. This demand needs to be satisfied in order to insure the vital participation of Africans in the Information Society. Currently, it is broadly accepted that access

to ICT can contribute to economic development. Up to 2008, all sub-Saharan countries lag behind in most of indicators related to the numbers of fixed telephone lines, mobile phone users, number of computers, Internet subscribers and broadband internet subscribers. However, the Compound Annual Growth Rate (CAGR) in the mobile telecommunications market has increase rapidly.

In 2008, 127 ITU Member States had a private landline incumbent. The privatization of state-owned incumbents in developing countries in the 1980s and 1990s took place mainly through investment from high-income countries. Africa has the lowest share of private owned operators' worldwide in 2008 and African fixed line operators are less attractive to investors. In fact, incumbents may obtain a mobile or wireless local loop license, in order to attract potential investors.

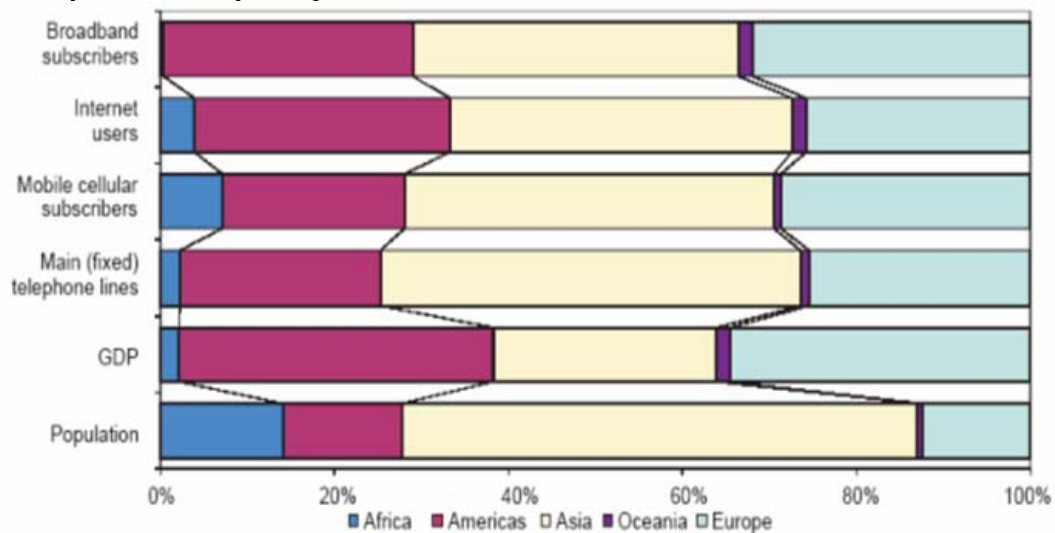


Fig. 1. Population and Gross Domestic Product (GDP), main (fixed) telephone lines, mobile cellular subscribers, Internet users and broadband subscribers by region, 2006 (Source: [5])

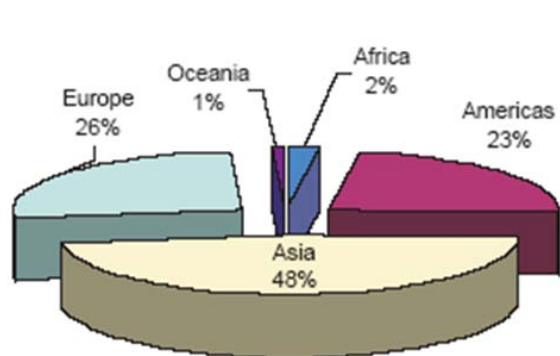


Fig. 2. Percentage of landlines by continent, 2006 (Source: [5])

had a two percent share from the total worldwide (Figure 3). Figures 2 and 3 maintain the trend observed for 2006, 2007 and 2008. Most of Africa's main telephone lines are concentrated (80 %) in just six countries: Algeria, Egypt, Morocco, Nigeria, South Africa and Tunisia (only 2 sub-Saharan African countries: South Africa and Kenya). Generally, Africa's landline penetration was 3.1 per 100 inhabitants compared to 39.7 in Europe. The world average in 2006 was 19.4 main lines per 100 inhabitants, more than six times higher than the penetration rate of Africa.

In 2006 Africa had 28.5 million landlines and

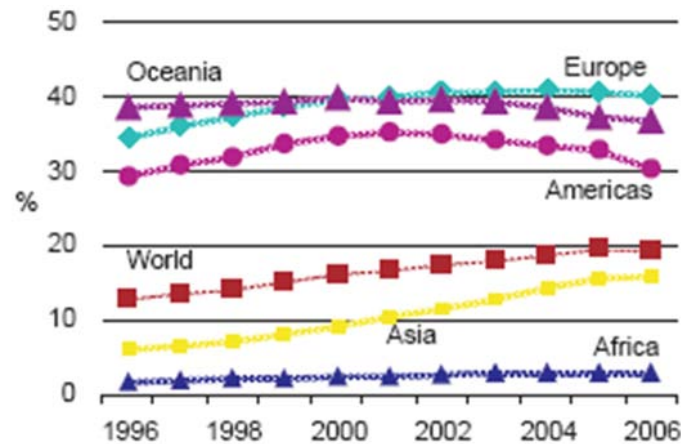


Fig. 3. Number of landlines per 100 inhabitants, World, 1996-2006 (Source: [5])

Even more, in the majority of sub-Saharan African countries does not exist a clear definition of ICT. Even though the efforts carried out by ITU to increase the knowledge and awareness of ICTs in the continent, it is necessary the existence of points of departure, i.e. common definitions and standards to carry out further development. Tele-density in Sub-Saharan Africa is rather low, particularly in rural areas (see Figure 4). Also, the gap between urban and rural areas in terms of telecommunication access is significant due many people are living in rural areas. In 2004 was estimated that around two-thirds of the population in the region resides in rural areas. Efforts are being carried out to include small villages to use some form of ICTs, however, there is lots to

be done in this field. Furthermore, it is estimated that 55% of villages' population are unconnected without access to fixed, mobile and/or data services. Although many African countries have achieved connecting some rural areas, they have not proven successful. In the case of mobile communications penetration the situation is better. However, it is important to bear in mind that while 45 percent of Sub-Saharan African villages were covered by a mobile signal in 2006, it does not indicate connectivity. Currently, it is believed that mobile telecommunications reach 55 percent of Sub-Saharan African villages and the use of Internet has grown in 2008 to 1 percent [4].

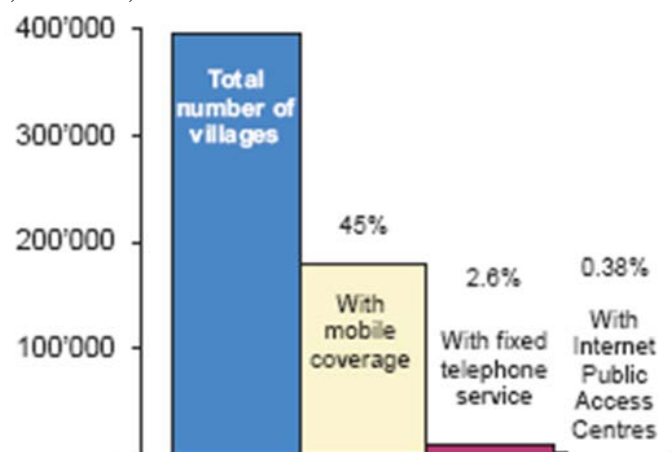


Fig. 4. Villages with access to telecommunication services sub-Saharan Africa, 2006 (Source: [5])

1.2 Mobile telecommunications

The African mobile telephony market is known for its outstanding growth rates, above the 45%. In 2007 more than 60 million mobile cellular were added to the subscriber base (Figure 5). Sub-Saharan Africa experienced the larger number of new subscribers. Looking at the Figure 5, it is seen that by the end

of 2006, mobile penetration in Africa was at 22 subscribers per 100 inhabitants while Asia had 29.3, the Americas 61.9, Oceania 72.7 and Europe a penetration rate of 94.3. It is expected that high rates of growth continue in the next years in sub-Saharan Africa where the mobile telephony represents the main source of revenue in terms of telecommunications services provided.

Key players in the mobile telephony markets are Vodacom South Africa, MTN South Africa, MTN Nigeria and Celtel. In fact, it is expected that latter mentioned players will challenge and

are challenging key mobile telecommunications operators in the sub-Saharan region.

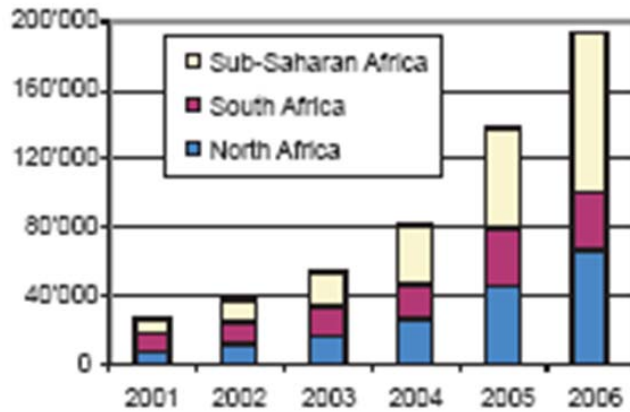


Fig. 5. Mobile cellular subscribers in thousands, Africa, 2001-2006 (Source: [5])

As seen on the Figure 6, up to 2006 the distribution of revenues coming from the different sectors in the telecommunications markets show that Africa as a continent has got a high percentage of gained revenues from the mobile communications market. It is also

possible to generalise that this situation can be seen in Northern Africa and sub-Saharan Africa. Further, this trend is also true for the current market situation.



Fig. 6. Distribution of telecommunication revenues, World, 2006 (Source: [5])

Figures 5 and 6 cannot unfortunately be updated with more recent data; however, there are telecommunications business expectations showing similar trends as compared to the information presented on the figures discussed.

1.3 New business models in the sub-Saharan Africa ICT markets

From above, it is necessary to explain the high growth in the mobile telecommunications market in the sub-Saharan Africa region. One of the

main aspects factors explaining it is the acquisition and implementation of a new business models. These new business models operate in the following manner. The abolition of cross-border roaming charges from some mobile telecommunications operators has responded to the particular needs in Africa, where often strong cross-border relationships exist. It is known that pre-paid services, low subscription prices, and low recharging cards have contributed to the African mobile boom.

Furthermore, Africa reached 198 million mobile cellular subscribers during 2006 and the number is expected to increase during the next years. In fact, the latest figure given by the ITU database shows that in 2007 the number of mobile cellular subscribers in Africa was around 275 million [3]. In this way, as shown in Figure 7, customers earning more than 40 USD per day can afford to purchase post-paid mobile services, because they are able to pay regular bill. Lower income groups living on 4 to 40 USD a day are less likely to pay a monthly subscription fee. Hence, prepaid business models enable companies to offer their services to these persons without large financial risk. Moreover, average revenue per customer is

higher in the upper customer segment of the pyramid and easier to predict, so companies serve these customers first to saturation. To open up new markets based on cheaper prepaid offers or phone-sharing to reach the customers at lower levels of the pyramid. In fact, the customers at the bottom of the pyramid may be of less income but the market is large. Accordingly, it is possible to make a lucrative business in these segments on a large scale, since the demand for ICTs is not limited to customers with more purchasing power.

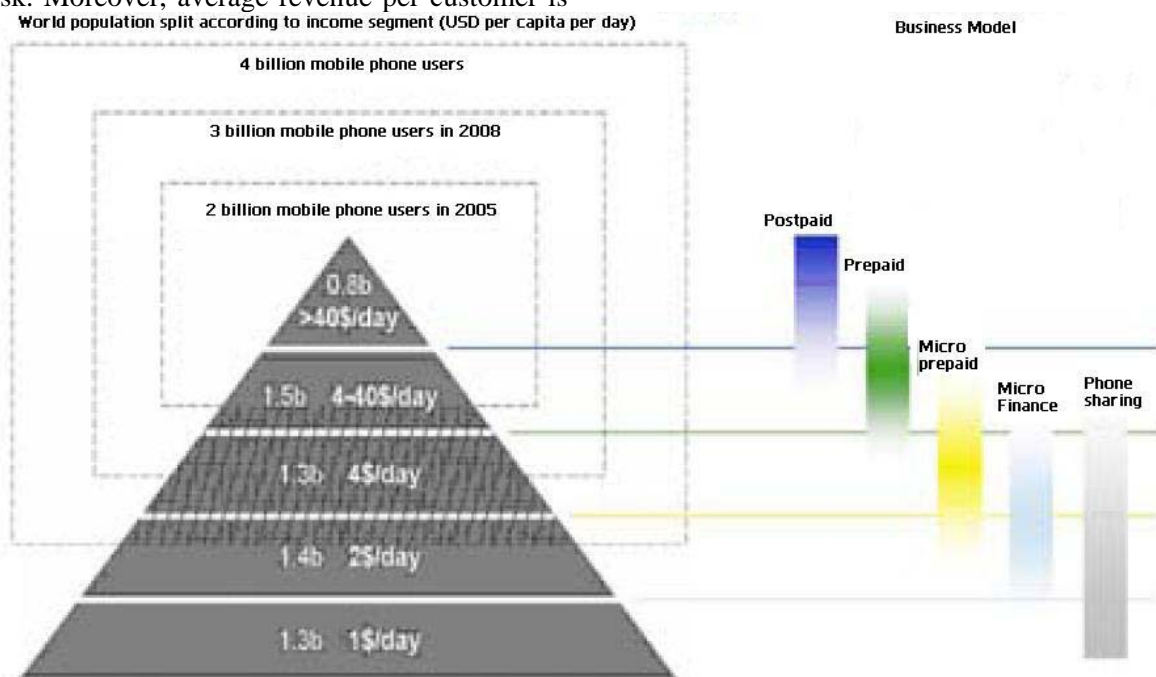


Fig. 7. New business models enable growth into low income segments (Source: [4])

1.4 The Internet

Less than three percent of the world's Internet subscribers are located in Africa (Figure 8). This means that taking into account the population of Africa 1.3 percent of the inhabitants were subscribers to an Internet Service Provider (see Figure 8). It is estimated that the number of effective Internet users in Africa is considerable higher at

4.8 users per 100 persons when considered public access, e.g. internet cafes (see Figure 9) that only residential access due to uselessness of the Indicator at the African level. The most important factors for the low access to internet in Africa are: affordability, lack of fixed line infrastructure and low level of ICT literacy.

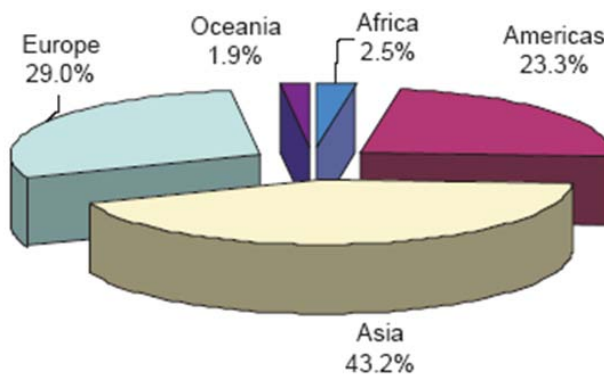


Fig. 8. Internet subscribers, World (Source: [5])

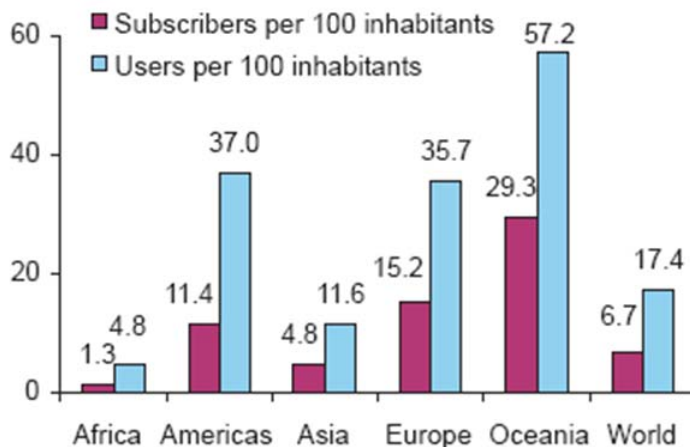


Fig. 9. Internet subscribers and uses, world, 2006 (Source: [5])

Taking into account the Seychelles provides a mistakenly vision of ICT development in Africa due this place has got all ICT indicators that only

serve for individuals coming from abroad (see Figure 10).

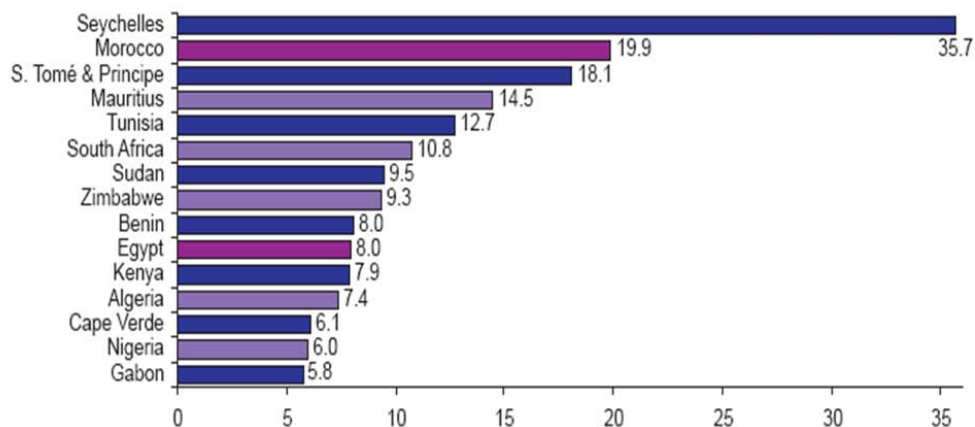


Fig. 10. Internet users per 100 inhabitants, 2006 (Source: [6])

Currently in Africa, the mobile phone is used only rarely to access the Internet, also due to its slow speed of (9.6 kbps) available through GSM. The Internet is a phenomenon that allows multi-way communication or the presentation and searching of information. Many Web 2.0 applications for e-government for instance are created for the Internet. More local content available

could be an incentive for the population of Africa to use and to learn how to use the Internet. Additionally, the world, including the international development community, could learn more about the local conditions of its focus groups. Not only the quantity, but also the quality of these services, poses limitations and frustrations to the African users. The poor quality of Internet services

is partly due to infrastructural shortcomings, low Internet bandwidth, unreliable electricity, outdated end-user technology, interconnectivity issues, large software solutions or the small number of 18 African Internet Exchange Points in 2007.

1.5 Broadband Internet Access

The African broadband operators typically serve telecommunication services to limited numbers of wealthier at extremely high prices for bandwidth and voice. As mentioned above voice and data prices being lowered, while volumes continue to increase. Not only companies, but also governments are very keen on getting fast broadband access to make use of applications like e-commerce or e-government. The availability of reliable broadband access is crucial for investors and enables governments to take informed and transparent decisions. However, sixteen countries in Africa rely on a single 10 Mbps Internet con-

nection or less. In many sub-Saharan countries, broadband was available in 2006. There have also been reduced efforts to increase the Internet speed by different telecommunications providers. However, these efforts require investment that due to the global financial crisis have been dramatically reduced.

Regarding broadband subscribers, Africa has around 1.3 million broadband customers in 2007. This means that one tenth of all African Internet subscribers had signed up for a broadband access. Again, also in broadband subscriptions, the gap between the African regions is high. More than 75.5 % of the broadband subscribers were located in the four northern African countries, i.e. Algeria, Egypt, Morocco and Tunisia. Since most of these subscribers are concentrated in that region, Sub-Saharan Africa had a much lower broadband penetration of 0.12 per 100 inhabitants (Figure 11).

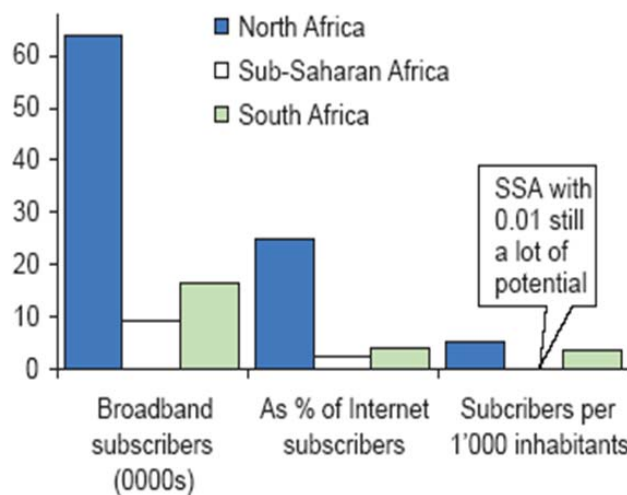


Fig. 11. Broadband Internet in African regions (Source: [5])

Expanding access to broadband services is a challenge and a chance for Africa to benefit of the Information Society. Therefore the establishment of access to the global backbones will be crucial for the development of Africa's telecommunication markets as well as to other sectors.

2 Investment and revenue

2.1 Revenues

Africa accounted for 37.6 billion USD, a share of 2.9 percent of the worldwide revenues in 2005 (see Figure 12). Within Africa, the total telecommunication revenue was distributed quite

evenly among the three African sub-regions. The average revenue per telephone (fixed and mobile) subscriber amounted to 248 USD. Regarding the revenues per subscriber, Africa is almost on the same level as the Asian market. The average revenue per telephone subscriber was much higher in South Africa at 355 USD. In Africa, the low average revenue per subscriber is probably due to the majority of mobile and prepaid users spending limited their resources in a very cost-controlled manner.

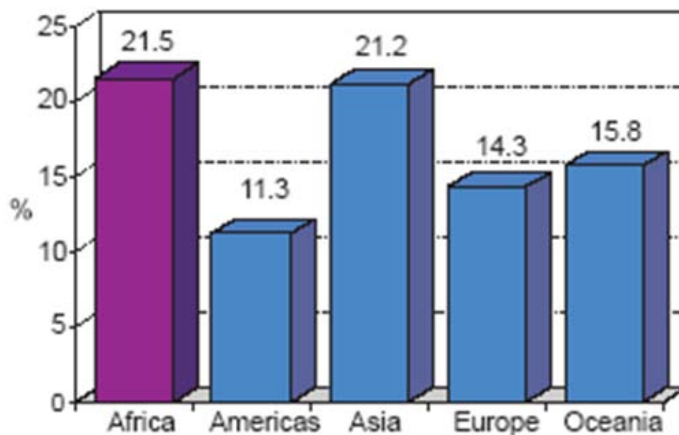


Fig. 12. Investment in telecommunication services as % of revenue, World (Source: [5])

2.2 Investment

Around 4% of the world investment in telecommunications was invested in Africa (Figure 13). Africa had an investment per capita of only 12.9 USD, while Oceania had an almost 14 times higher investment per inhabitant. Regarding this difference, it is quite obvious that Africa needs more investments in telecommunication in order to participate better on the Information Society as well as in the regional and global economy. Looking at the investment as percentage of revenues in 2006, it can be seen that Africa actually

received a relatively high percentage of 21.5. The investors did see Africa as a place to invest their revenues. This leaves reason to hope that investors understood that doing ICT business in Africa has a future. ITU 2008 report shows that Africa has so far seen annual investments in telecommunication services increasing each year. It will be crucial to see the statistics for 2009 or in future dates that provide a clear indication of how the global financial crisis has affected or not such investment pattern.

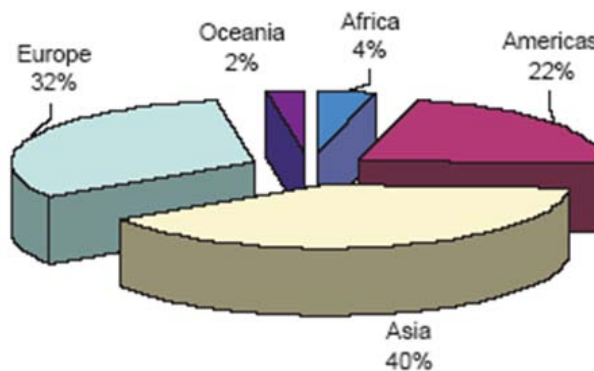


Fig. 13. Telecommunications Investment, World (Source: [5])

During the last 5 years, the number of employees in the ICT sector was increased in Africa, which currently is divided as follows: 11% works in mobile cellular companies. Within these five years, an increase of total subscribers per employee took place (Figure 14). Since the total subscribers include fixed and mo-

bile cellular subscribers, it is likely that the ratio is mainly improved due to the mobile boom. Also, this development might be due to more efficient structures and processes among operators, caused by privatization.

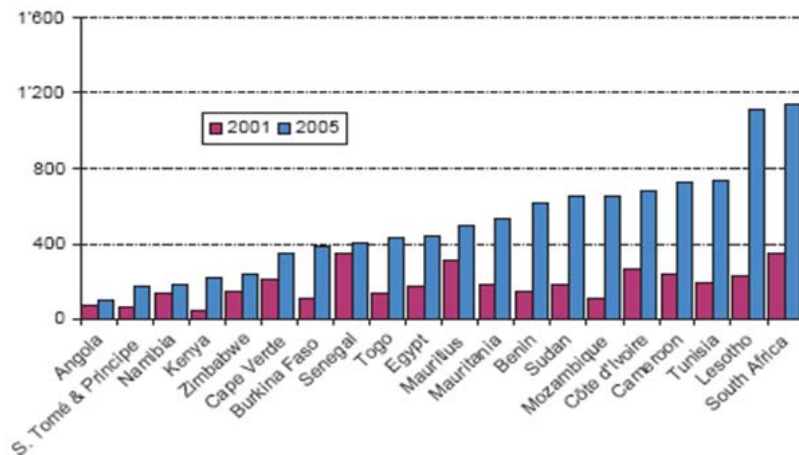


Fig. 14. Subscriber by employee (Source: [5])

Employers are hiring graduates and competing for high-qualified graduates. A study being carried out by the ITU focuses on the visible changes visible regarding to the numbers of employees, gender, age and health status of the ICT staff. In order to insure its future competitiveness, Africa needs to ensure to educate people in related subjects and keep or attract professionals with relevant skills.

3 Regulation and strategy in the sub-Saharan Africa area

In 2008, 126 ITU Member States had a private

fixed-line incumbent (see Figure 15). The privatization of state-owned incumbents in developing countries took place mainly through investment from high-income countries. Africa, was the continent with the lowest share of private owned operators. However, privatization is progressing at fast pace. The privatisation boom in Africa's telecommunication market has taken place mainly in the mobile sector, while other markets are less attractive, i.e. fixed telephony and Internet.

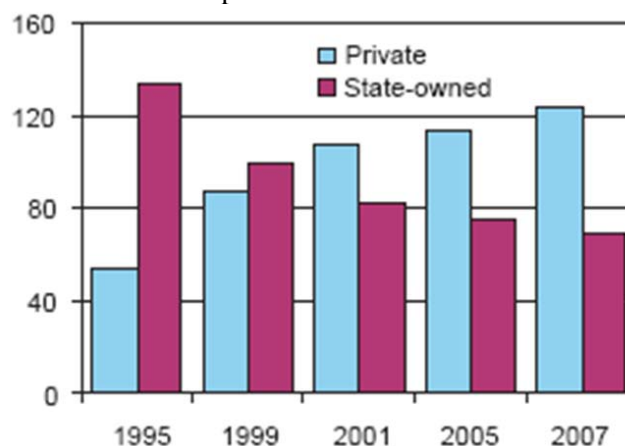


Fig. 15. Private and state-owned landline operators, world, 1995-2007 (Source: [5])

In Africa, the number of monopolies in fixed line services is rather large and it is expected that the number of privatised telecommunications operators will increase sharply in the near future and fixed line telephony is the least competitive service in Africa

The Internet market is the most competitive one in Africa, with 68.6 percent of the economies allowing full competition and another 11.8 percent partial competition (see Figure 16). Within Af-

rica, the largest number of monopolies is found in Sub-Saharan Africa where 51.1 percent of the fixed line markets and 12.5 percent of the Internet markets are under the monopoly of one operator. With 48.8 percent of its cellular mobile markets, Sub-Saharan Africa has achieved a higher level of privatization than Africa as a whole.

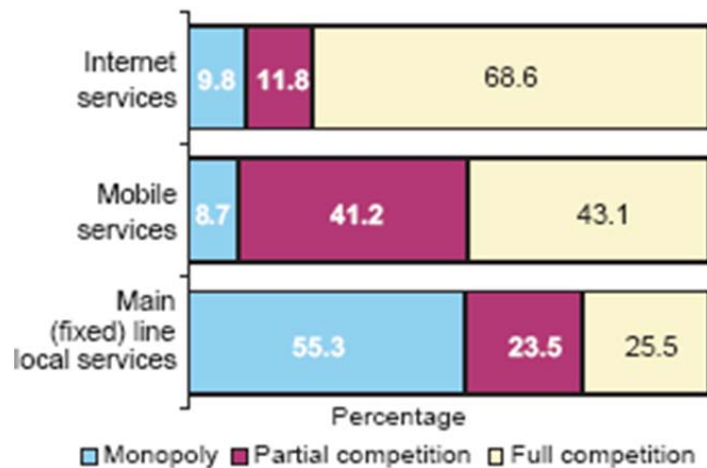


Fig. 16. Level of competition, Africa (Source: [5])

4 Regulatory environment

In order to create and keep competition in the telecommunication market functioning, a robust regulatory framework should be established, usually with an independent regulatory authority. In 2008, the majority of ITU member countries had a regulatory authority [1]. At the end of 2007, 86 percent of the African economies had established such an authority and this percentage is expected to increase to a 100 percent in the next 5 years.

Although the number of African authorities is high, the staffs of a well-functioning regulatory authority needs to be well educated, trained and networked with colleagues from other countries in order to exchange its experiences and ideas on new emerging issues, such as 3G/4G, VoIP, NGN or Internet security. Further, the ICT environment is changing very fast and it is of paramount importance to keep track of the policy and regulatory frameworks, technologies, applications and services, this represents a challenge for governments and regulators worldwide.

5 Discussion and conclusions

From above presented, it can be observed that the sub-Saharan African Internet market is mostly competitive with 68.6 percent of the economies allowing full competition and another 11.8 percent partial competition. This market also has got the largest number of monopolies, where 51.1 percent of the landline markets and 12.5 percent of the Internet markets are under the monopoly of one operator. These markets have achieved a higher level of privatization than Africa as a whole that is 48.8 %, especially in mobile telephony markets.

Furthermore, Africa has experienced the higher CAGR of mobile communications than any other continent. However, Africa has lowest rate of

Internet access in the world due to cost and lack of infrastructure.

Some of the likely solutions to improve the socio-economic and technological status of sub-Saharan countries are the following (without any hierarchy):

- Africa is lacking in investment-intensive infrastructure especially in landlines and fixed broadband.
- Exist prohibitively high tariffs and limited computer literacy,
- Effectively de-regulate the system
- Promote competition getting local investment
- Effective coordination on humanitarian international aid (UN agencies and NGOs)
- It is broadly understood that ICT might have positive implication for the country but the efforts are small.
- Absence of stats of e-business using ICTs only available for Algeria and Egypt.
- Promote Exports and Imports (LDCs)
- Reduce costs of access (landlines, costs per minute local and international.
- Improve infrastructure (lack of local/national investment, change of foreign ownership,
- Increase training to operate ICTs and stop likely brain drain processes
- Increase healthy competition to reduce monopoly or oligopoly market structure
- Reduce foreign ownership in the telecommunications market
- Constantly update inadequate regulatory and legal framework supporting ICTs

More specifically, due Africa lacks a good fixed line infrastructure, wireless access is considered a solution to bridge the digital divide. Currently, neither 2 G nor 2.5 G (GSM/GPRS) have fulfilled these high hopes, due to expensive handsets, their focus on voice transmission and regu-

lators' hesitation to license UMTS. High hopes are set on broadband wireless access on the basis of WiMAX. This means a user could have the same speed of data transfer as with fixed broadband access through, for instance, cable or ADSL. Broadband wireless access could in both the licensed and the unlicensed band be deployed for wireless metro access, last-mile/first-mile and large area coverage. This indicates several advantages of broadband wireless access:

- New, cost-effective and flexible standards for wireless technologies such as WiMAX
- Providers, possibly also local champions can offer broadband services to geographically challenging areas [2].
- Public service applications, i.e. e-government or e-learning can be used via these technologies. Furthermore, many models for financing these services are possible: local municipality could enter into partnerships with business owners; wealthier users might be charged more for the use than poorer neighbourhoods, or free public access points could be established all over the city.
- Companies can easily observe and direct their production-chain and do e-business.

With the support of global players such as *Intel*, it appears that the WiMAX standard could become dominant. The technical challenges of interoperability and quality of service provisions and often insufficient spectrum management could surely be overcome since WiMAX has already addressed the security concerns and *Line in Sight* thematic of Wi-Fi. This means that companies holding a 3G licence can now provide WiMAX services ([2], [3])

New Wireless Internet Service Providers (WISP) could emerge from among current mobile opera-

tors and Internet Service Providers.

Lastly, nevertheless there are pioneer activities regarding the deployment of WiMax technologies in selected areas of Africa such as Kenya, Uganda and Tanzania for the provision of government services including health and education. However, even though there are exciting opportunities to implement broadband wireless technologies, it should be noticed that last mile wireless solutions rely on strong fixed infrastructure. Further, creating major ICT access is a challenge to African and foreign governments, the private sector and the civil society.

References

- [1] A. Gillwald and C. Stork, "Towards Evidence-based ICT Policy and Regulation: ICT access and usage in Africa," *VOLUME ONE 2008 Policy Paper Two*, 2006.
- [2] ITU, *HRD/HRM Survey on Current and Future Needs and Priorities in a Converged, Competitive Telecommunications/ICT Environment*, Geneva: ITU, 2009.
- [3] ITU Indicators Database, http://www.itu.int/ITUD/icteye/Reporting/ShowReportFrame.aspx?ReportName=/WTI/CellularSubscribersPublic&RP_intYear=2007&RP_intLanguageID=1, 2009, last accessed 3 June 2009.
- [4] ITU, *African Telecommunication/ICT Indicators 2008: At a Crossroads*, Geneva: ITU, 2008.
- [5] ITU, *Telecommunication/ICT Markets and Trends In Africa 2007*, Geneva: ITU, 2007.
- [6] ITU, *Final Report on Proposed Institutional and Strategic Framework To Facilitate Accelerate Planning, Design, Development, Operation And Management Of A Broadband ICTs/Telecommunication Infrastructure For East Africa (EAR II)*, Geneva: ITU, 2007.



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