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Trends in Adoption of Open Source Software in Africa

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ABSTRACT

In the context of limited financial resources and capacities, Africa can examine how to better use the opportunities presented by the emergence of free and open source software (FOSS) to leapfrog into the information age and bridge the digital divide through reduced costs and less dependency on imported technology. This paper examines the adoption trends of open source software in Africa and seeks to establish the current global placing of the continent in adoption and use of FOSS. To get a better view of the current FOSS situation in Africa, the study explores the penetration of FOSS into Africa software market and how various Governments react to the use of FOSS. Through scrutiny of literature on adoption and use of open source software in Africa as well as previous and emerging initiatives to promote the use of open source software in the region, the paper presents preliminary findings of the trends observed. Further using the data gathered the paper attempts to forecast the future of FOSS in Africa and the probable implications on the development agenda of the continent.

Keywords: *Adoption, trend, free software, Open source software, status of adoption of free and open source software in Africa*

1. INTRODUCTION

In the recent times there has been a move by developing nations to adopt a development approach that accelerates development by skipping, less efficient, more expensive or more polluting technologies and industries and move directly to more advanced ones. One such move is the crusade to adopt free and open source software (FOSS). Although there are paradigmatic differences between free software and open source software, it is often difficult to clearly distinguish these differences. Thus the term Free and Open Source Software (FOSS) is adopted in this paper to capture both paradigms. The definition of open source software is derived directly from that of the free software foundation [1]. According to this foundation the term "free" in the context of FOSS implies liberty and not gratis. It is a matter of the users' freedom to run, copy, distribute, study, change and improve the software. More precisely, it means that program users have the following four essential freedoms: (a) Freedom to run the program, for any purpose, (b) Freedom to study how the program works, and adopt it to once need (c) Freedom to redistribute copies so you can help others. And (d) Freedom to improve the program, and release the improved program version to the public: By doing this one can give the whole community a chance to benefit from the changes

The philosophy of free and open source technology lends itself to making technology available to the masses at relatively low cost compared to proprietary software. As noted by Reijswoud and Topi [2], contrary to the generic software development paradigms which are based on the idea that software has to be fully developed and tested before it is sold in the market, the development approach for open source software (OSS) is such that basic functionality is programmed by the initiator(s) and then made available for others to test, use and/or modify. Distribution of the code makes it possible for any software developer to change or extend the original product. Hence Open Source software is under constant development because anyone in the world can change it. This development approach harnesses the power of distributed peer review and transparency of process. The promise of this approach to software development is better quality, higher reliability, more flexibility, lower cost, and an end to predatory vendor lock-in common with proprietary software.

According to the Free and Open Source Foundation for Africa (FOSSFA) [3], the reasons for migrating to FOSS are typically attributed to several factors including: (a) the expectation of direct cost savings from affordable software for individuals, enterprise and government, (b) less dependency on imported technology and skills, (c) the hope to better develop national IT expertise via access to source code, (d) universal access through mass software rollout without costly licensing implications, (e) access to government data without barrier of proprietary software and data formats, (f) ability to customize software to local languages and cultures, (g) lowered barriers to entry for software businesses. The most often quoted benefit in relation to the developing world is the reduction of purchase and license costs of the software [2]. Software and licenses are paid in hard currency and put an extra burden on the often disastrous, financial situation of developing countries. However, although the free and Open Source Software environment in Africa is significantly less expensive, proprietary software is still widely used [4]. The main reason for this observation is piracy of proprietary software. Pirated software is distributed and shared by individuals, government departments, academic institutions and other organizations. This situation denies developing nations a chance to build capacity in IT expertise. Some studies have suggested that, in underdeveloped markets, toleration of piracy is a rationale business strategy for major commercial vendors because it favors industry-leader lock-in and undermines FOSS competition [5].

This paper seeks to bring into perspective the current status of the adoption and use of FOSS in Africa. Further by tracing the evolution of adoption and use of this

technology in the continent the paper attempts to forecast future of the said technology and its projected impact on the development of the continent.

2. RESEARCH METHODOLOGY

Integrated Literature survey research approach was adopted in this paper. To identify relevant research and other FOSS activities or projects in Africa, a traditional search was conducted using the key words "free and open source software in Africa". Only articles with the combined key words "free software", "open source software" and "Africa" were selected. Further to identify factors influencing adoption of FOSS in both industrialized and developing economies, the phrase "factors affecting adoption and use of free and open source software in developing and developed countries" was used . For a global status of FOSS the search phrase "International status of free and open source software" was used. This tactic resulted in identification of key research papers, technical reports and literature related to FOSS activities in Africa, factors influencing adoption of FOSS and the international status of FOSS. A critical review of the selected literature addressing the study area was then conducted to identify the global standing of Africa in adoption of FOSS and extract relevant secondary data that would give an indication of the evolution of adoption of FOSS in the continent. The review was also aimed at identifying the drivers and limiting factors of the adoption agenda.

3. INTERNATIONAL STATUS OF FOSS: WHERE IS AFRICA?

This section examines the global status of FOSS with regard to development, adoption and use as well as policy with an aim of identifying Africa's global standing

A. An Overview Of The Level Of Foss Development, Adoption And Use

According to a Report on the International Status of Open Source Software by CENATIC foundation [6], Africa trails in the development and adoption of open source software. The report notes that the continent lacks even the minimal means necessary for developing FOSS. This is attributed to inexistence of public promotion policies and the high rate of illegitimate software use. This observation concurs with that of Osorio [5] that major commercial vendors tolerate piracy in underdeveloped markets because it favours industry-leader lock-in and undermines FOSS competition. However South Africa stands out in the continent with a commendable OSS index near the worldwide average. This is attributed to: (1) an economy that is superior to those of the other countries on the continent and (2) support from the government and nongovernmental organizations, such as the Shuttle worth Foundation.

The correlation between the degree of development of information society (IS) and the variability of the extent of the development and adoption of FOSS is depicted in figure 1 [6]. From the figure there is a high level of correlation between economic development, IS and Adoption of FOSS. Thus North America, Western Europe and Australia have strong economies and have high IS and FOSS development indices while Africa, Latin America and Eastern Europe are found at the opposite end of the spectrum, with their countries registering low IS and FOSS development indices.

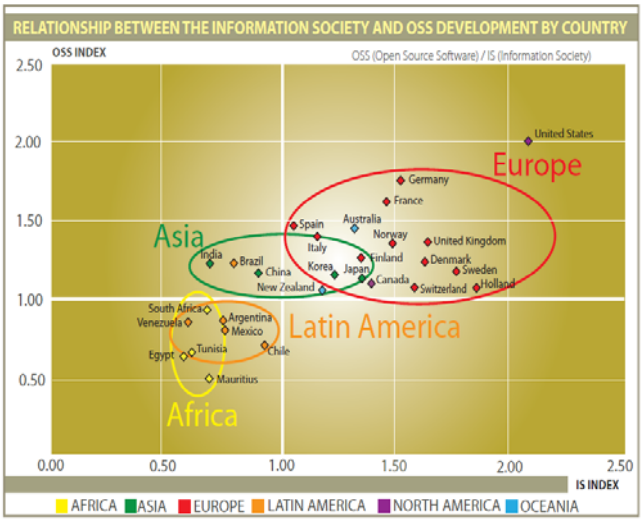

Fig 1: Relationship between the Information Society and FOSS Development by Country [6]

United States stands out as the world's leading Information Society with an IS index greater than two and also takes a lead in FOSS development index. This is to be expected from a country that is home to both the large multinational software companies (IBM, Microsoft, Sun Microsystems, Oracle, etc.), including those from the new generation that sprang up with the Internet (Google, Yahoo, etc.), and the world's most prominent OSS distribution companies (Sun Microsystems, Red Hat, Novell, etc.), and whose universities have made an indisputable contribution to the creation and development of OSS [6].

According to a survey done by centre for strategic and international studies (CSIS) in 2006 Europe took the lead in the number of initiatives for the implementation of FOSS as table I shows. It would therefore be expected that in terms of adoption Europe takes the lead but the National Open Source Software Observatory report whose source is Europe suggests otherwise. The report places North America at the front and Africa at the tail of the adoption queue. European countries are less extreme when it comes to implementation policies [7] hence the reason why they don't take the lead in adoption. This is an indicator of the strength of an effective policy as a driver to adoption of FOSS. Further the observation points to political good will as a critical player in the Adoption agenda of FOSS.

TABLE I: FOSS INITIATIVES AT NATIONAL LEVEL EXCLUDING SUPRA-NATIONAL INITIATIVES PROMOTED BY THE UN, THE OECD OR THE EU (SOURCE LEWIS 2006) [7].

Regional distribution of approved initiatives												
	Mandatory				preference				R&D/Advisory			
Year (20- -)	06	07	08	10	06	07	08	10	06	07	08	10
Europe	11	3	6	8	17	24	24	36	45	34	35	45
Asia	0	1	1	2	24	19	19	22	34	14	14	19
Latin America	11	2	4	31	5	10	10	12	9	5	5	8
Africa	0	0	0	1	1	1	1	2	3	2	2	5
Middle East	0	0	0	8	1	1	1	4	2	2	2	3
North America	0	0	1	0	0	1	1	2	3	4	4	1

This table lists the number of FOSS initiatives made by governments at the national level. The initiatives can be multiple, even for a single government.

B. An Overview Of The Global Status Of Foss Policy

Under ideal circumstances, a specific policy favouring FOSS is not required [8]. However, FOSS policies may be used to solve specific problems within different countries. Thus governments in various countries have different motives for their FOSS initiatives. In the recent times Governments globally have begun considering the promotion of FOSS via legislative, policy or government procurement methods particularly when FOSS provides a viable substitute to proprietary software.

Governments have two implementation options of FOSS policy to choose from [9] these are:

- Formal vs. informal approaches: Formal approaches prescribed via legislation or a government strategic plan may be considered against more informal, flexible approaches that let FOSS use evolve without normative patronage.
- Strategy and level of involvement: Strategy initiatives may be carried out at sub-national, national or regional levels, and they may also entail different degrees of involvement, from awareness building to procurement to funding of R&D

FOSS policy surveys conducted by the centre for strategic and international studies (CSIS) between the year 2000 and 2010 shows that activity in FOSS related policy began in year 2001 as depicted by figure 2

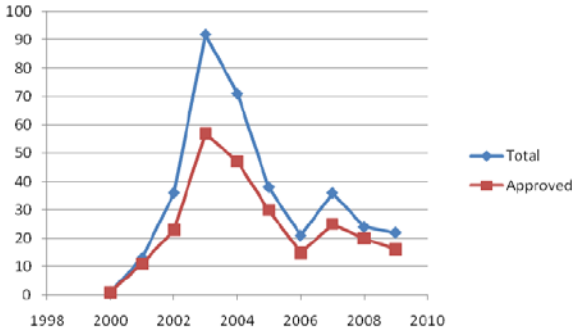

Fig 2: Number of FOSS Initiatives between the years 2001 And 2010 [10]

A remarkable increase in FOSS policy activities was noted in 2002 followed by an extraordinary jump in 2003. This is attributed to various factors including [10]:

- Increased lobbying efforts by large multinational firms
- Growth of anti-Americanism and the desire to be less reliant on American brands
- Development of strong viable open-source alternatives.

This year also marked the formation of the Free Software and Open Source Foundation for Africa (FOSSFA). The second peak observed in 2007 is attributed to a reaction to the global release of a major closed-source software package, to avoid vendor lock-in. This reaction was likely driven in part by the desire of governments to avoid costly software renewal as well as unfavorable reception of the closed-source software package.

Table II summarizes the total number of FOSS initiatives globally as presented by Lewis (2006 [6], 2007[11], 2008[12], and 2010[10]). The totals include proposed and approved initiatives

TABLE II: SUMMARY OF TOTAL NUMBER OF FOSS INITIATIVES GLOBALLY

year	Total initiatives	Approved initiatives
2006	265	166
2007	268	123
2008	275	130
2010	364	208

Figures from this table show an increasing global trend in FOSS initiatives pointing to an increased momentum in FOSS movement. The variation between total initiatives and approved initiatives insinuate that the will to implement FOSS does not necessarily translate into full implementation [13]. A regional breakdown of these figures by continent is presented in table III as extracted from the centre for strategic and international studies (CSIS) working papers of 2006, 2007, 2008, and 2010 authored by Lewis. The policies are categorized as research, mandatory (where the use of open source software is required), preferences (where the use of open source software is given preference, but not mandated), and advisory (where the use of open source software is permitted).

TABLE III: SUMMARY OF THE CONTINENTAL DISTRIBUTION OF POLICY INITIATIVES

	National initiatives	Mandatory	Preference	R&D/ Advisory
Europe	73	11(15%)	17(23%)	45(61%)
Asia	58	0 (0%)	24 (42%)	34(58%)
Latin America	25	11(44%)	5 (20%)	9 (36%)
Africa	4	0 (0%)	1 (25%)	3 (75%)
Middle east	3	0 (0%)	1(33%)	2 (66%)
North America	3	0 (0%)	0(0%)	3 (100%)

Europe has the bulk of the FOSS policy initiatives and this is in agreement with the correlation data of figure 1 where countries in the continent have a remarkable FOSS development and adoption index. The number of initiatives in North America is less while its adoption index is the highest in figure 1. This can be attributed to the fact that such initiatives may not be necessary for a region that hosts the most prominent FOSS distribution companies (Sun Microsystems, Red Hat, Novell, etc.), and whose universities have made an indisputable contribution to the creation and development of FOSS. Africa trails in both FOSS adoption index and policy initiatives. Middle East took a drastic action in 2010 by adopting eight mandatory FOSS policy initiatives and this is likely to raise its adoption index in future above Africa.

4. ADOPTION AND USE OF FOSS IN AFRICA

This section explores the factors affecting adoption and use of FOSS in Africa and attempts to assess the status of the same by tracking FOSS activities in the region.

A. Factors affecting adoption of FOSS

The logistics guiding the adoption and use of FOSS in developed and developing countries are different [13]. While issues like voluntarism feature in developed world where developers are not money constrained, it does not apply to Africa since developers are not financially independent and hence want to be compensated for their work. A survey of open source software users conducted in 2009[14] revealed that cost is the primary driver for the initial adoption of open source. 44% of the respondents as indicated in figure 3.

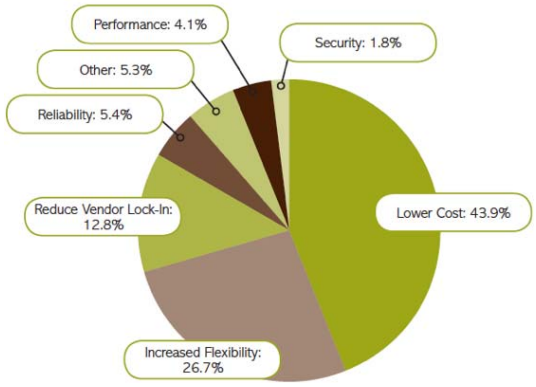

Fig 3: primary reasons for organization deciding to use open source software [16]

In the context of constrained economy in Africa, ICT development is not a priority for many countries in comparison to the population's basic needs[15]. Hence the cost driver is justified since FOSS can be obtained at low or no cost; no royalties or license fees apply.

Connectivity is another major factor affecting adoption of FOSS in Africa. Since FOSS is distributed via internet there is need for good connectivity for it to be accessed. Without an efficient connectivity the dream of FOSS adoption in Africa will remain unrealized. As noted by Coetzee (2002) South Africa is the most well connected in Africa [16]] and registers the highest FOSS adoption index as shown in figure 1. As it was earlier noted it is the only African country whose FOSS index is near the worldwide average.

Copyright is another major driving force. High rate of illegitimate software in Africa is one reason why Africa lags behind in FOSS adoption index [6]. The piracy study of 2010 by business software alliance shown in figure 4 places Africa among the continents with the highest piracy rates. FOSS is a good option to avoid flouting international copyright laws.

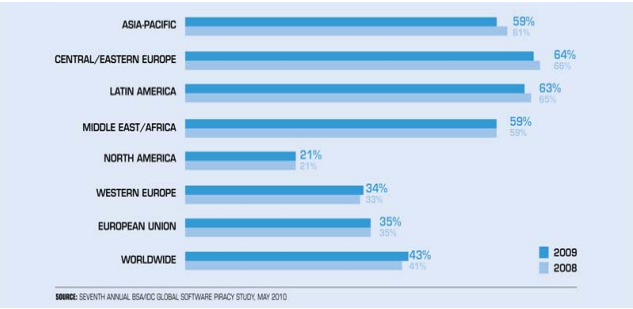

Fig 4: Seventh Annual BSA/IDC Global Software Piracy Study, May 2010 [17]

Other drivers FOSS drivers relevant to Africa as identified by Bruggink [18] include:

- The need to promote local technological skills through access to source code: Since the source code is accessible and the software is usually based on public standards, technically inclined users can see how the software works, and develop transferable ICT skills.
- The need to reduce vendor lock-in: This factor entail avoiding being hostage to proprietary software
- collaboration and knowledge sharing: The global open source community provides opportunities for South-North and South-South collaboration and knowledge sharing

B. Focus on Africa foss activities and the trends observed

The fragmented and scattered nature of FOSS communities in Africa poses a major challenge to advancement of FOSS activities. The Free Software and Open Source Foundation for Africa (FOSSFA) was set up in 2003 with the purpose of organizing and leading the FOSS movement in Africa. However FOSS adoption in Africa is facing barriers such as lack of advocacy, poor internet connectivity and aggressive marketing by proprietary software companies [19]. Despite this, Africa is making commendable efforts as hinted by the continental distribution of FOSS policy initiatives summarized in table III. From the table the initiatives may be summarized further as shown in table IV.

TABLE IV: SUMMARY OF FOSS POLICY INITIATIVES IN AFRICA FROM THE YEAR 2006 TO 2010

2006	2007	2008	2010
4	3	3	8

From this table it can be noted that the number of initiatives increased considerably in the year 2010. This can be attributed to more intensified advocacy activities by FOSSFA and implies that African governments are becoming more aware of the need to adopt FOSS. As noted by the Collaboration on International ICT Policy for East and Southern Africa (CIPESA) [20], by the year 2005, 15 countries in Africa had initiated some FOSS policy activities. With eight of this being approved by 2010, it shows that Africa governments are getting more involved in steering FOSS adoption and we expect to see increased adoption in the coming years as more governments step in the campaign.

Although from global data Africa lags behind, observed trend is in proportion to world forward momentum. From figure 2 on the number of FOSS initiatives globally, an extraordinary increase was observed in the year 2003. This is also the year that FOSSFA was formed to coordinate FOSS activities in Africa and serve as a place to share all the initiatives across the continent. FOSSFA began work by focusing on three thematic areas: (1) Open Source in Government, (2) Open Source in Health (3) Open Source in Education.

With these thematic areas in mind, FOSSFA supports the integration of OSS into national politics. This is why since its formation an increase in FOSS policy initiatives in Africa was observed culminating in 8 approved policy initiatives in 2010. FOSSFA also coordinates and promotes OSS initiatives and the local software industry. The main OSS projects focus on local adaptation. One of the initiatives has been the creation of a project database. FOSSFA also adopted a FOSS a capacity building strategy resulting to training projects such as Free and Open Source Software Resource Center (FOSSREC) whose role is to offer a process by which individuals, groups, institutions, organizations and societies in Africa enhance their abilities in FOSS and meet development challenges in a sustainable manner [21]. Another capacity building initiatives ict@innovation is a partnership between FOSSFA and 'Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)', Germany. Its role is to build capacities in African small and medium ICT enterprises and supports Free and Open Source Software (FOSS) powered business. It also aims at encouraging the growth of African ICT industries, particularly in Southern and East Africa, through three main actions: (a) spreading FOSS business models for enterprises in Africa, (b) fostering FOSS certification and (c) Supporting innovative local FOSS applications for social and economic development. According to the executive Chairperson of FOSSFA, by 2010 ict@innovation project had conducted FOSS Business trainings for more than 15 countries and increased its business directory to more than 300 [22]. ict@innovation is sharing its wealth of expertise with the Europe-wide 'Free Technology Academy' (FTA) community in areas such as the economic aspects of FOSS and capacity building material on African business models [23]. This form of knowledge exportation reported in January, 2011 is an indicator of how well FOSSFA capacity building strategy has worked.

Recent involvement of multinational organizations like UNESCO in open source projects in Africa is also a good indicator of increased FOSS activities in Africa. For instance MIFTAAH memory stick created by UNESCO in co-operation with UNDP/ ICTDAR has been implemented in Algeria, Libya, Morocco and Tunisia [15]. Notable FOSS projects from Africa in the recent times include: The African Virtual Open Initiatives and Resources (AVOIR) project whose core activity of capacity building is undertaken through software design, development, deployment and support. The core product of the project is the Chisimba PHP5 application development framework and suite of applications. Cybera an Internet cafe administration system from Burkina Faso started in 2004. Student Academic Registration Information System (SARIS) provided by Zalongwa Technologies Limited company (www.zalongwa.com) Tanzania. Ushahidi from Kenya, a web based reporting system that utilizes crowd

sourced data to formulate visual map information of a crisis on a real-time basis.

5. FOCUS INTO THE FUTURE

As noted by UNTCAD (2004) [24] internet presence of developing economies have continued to grow over time as shown in table V. Between the years 2000 and 2003 the growth for Africa has almost tripled. This growth concurs with the observed increase in FOSS activities in Africa in 2003. It also concurs with the observed global peak in the same year as shown on figure 2.

TABLE V: INTERNET USERS, 2000–2003 (THOUSANDS)
SOURCE: ITU (2004) DATA [25] AND UNCTAD CALCULATIONS.

	2003	%Growth	2002	%Growth	2001	%Growth	2000
Developing Nations	246290	17.53%	209556	50%	139317	48%	94352
Africa	12123	21.23%	9988	63%	6119	34%	109257

This insinuates that Africa's contribution to the 2003 global peak was fairly significant. It is also a clear indication that despite being at the tail of FOSS adoption queue globally there is a forward move. It is expected that emergence of optical fibre will provide Africa with Improved and affordable regional and international connectivity. Thus with improved connectivity the momentum for FOSS adoption is expected to increase

6. CONCLUSION

Despite the fact that from a global perspective Africa lags behind in FOSS adoption index, a closer look at FOSS activities in the continent give a more encouraging scenario. The triple growth in internet usage between the years 2000 to 2003 is a good indication of a continent that is ready to achieve parity with the rest of the world technologically. The number of FOSS projects resulting to world class software is testimony enough that the continent is making commendable efforts in adoption of FOSS. Internet usage is expected to skyrocket with improved broadband connectivity via undersea cables. This will definitely encourage FOSS adoption which is highly dependent on internet. The 62% FOSS policy initiatives increase in 2008 is a good indication of African governments' willingness to support the FOSS adoption agenda. By incorporating the best tenets of FOSS, increased collaboration and innovation, governments working together can create meaningful value for their citizens and for each other. FOSS is an essential tool to leapfrog development in Africa.

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