



ENVIRONMENTAL IMPLICATIONS OF CELL PHONES PENETRATION AND DISPOSAL IN KENYA

¹Dr. Franklin Wabwoba, ²Prof. Thomas Sakwa, ³Dr. Samuel Mbugua, ⁴Mr. Humphrey Juma
Kilwake

¹School of Computing and Informatics, Kibabii University College, Kenya
fwabwoba@gmail.com

²Department of Physics, Masinde Muliro University of Science and Technology, P.O. Box 190-50100
Kakamega, Kenya
tsakwa@mmust.ac.ke

³Department of Information Technology, Kibabii University College, P.O. Box 1699-50200, Bungoma,
Kenya
mbumu@yahoo.com

⁴Department of Computer Science, Masinde Muliro University of Science and Technology, P.O. Box 190-
50100 Kakamega, Kenya
jkilwake@mmust.ac.ke

ABSTRACT

Kenya has over six million active mobile subscribers who may at some point want to replace or get rid of old mobile phones. A big number of the mobile phones were recently switched off for not being genuine without a proper mechanism being put in place for the disposal. If every affected individual or otherwise disposed off phones by throwing it away then there could be a serious ecological disaster in waiting. Cell phones are hazardous materials because of electromagnetic radiation and electronic composition. They have substances such as antimony, arsenic, beryllium, cadmium, copper, lead, nickel and zinc which belong to a class of chemicals known as persistent toxins. These toxins pollute and remain in the environment for long periods. There are ill-effects of wireless and telecommunication devices on the environment are disastrous. The increased use of high resolution LCD screens leads to a potentially devastating environmental challenge. There is no clear policy framework on e-waste management with a special focus on used mobile phones in the country. A proper disposal mechanism of wireless and telecommunication devices is a necessity in Kenya.

Indexing terms/Keywords

Mobile phones penetration; E-waste; Disaster; Disposal; Kenya.

Academic Discipline And Sub-Disciplines

Information Technology and Computer science.

SUBJECT CLASSIFICATION

Information Technology.

TYPE (METHOD/APPROACH)

Literary Analysis; Interview.

Council for Innovative Research

Peer Review Research Publishing System

Journal: INTERNATIONAL JOURNAL OF COMPUTERS AND TECHNOLOGY

Vol. 13, No. 7

editorijctonline@gmail.com

www.ijctonline.com, www.cirworld.com



1.0 Introduction

Mobile phones penetration increased considerably in the last one decade because of the economic advantages Mobile phone technology has brought about. It has reduced communication costs in Kenya and caused a major transformation in situations where ramshackle networks of both fixed line communication and physical transportation infrastructure were, in the least, rundown, inadequate and unreliable. This successful uptake of the mobile phone throughout the developing economies has significantly influenced economic development initiatives. Governments, private corporations, educational institutions and non-profit organizations are all examining the possibilities for using this new means of communicating with learners and citizens. The Government of Kenya is keen to have every subscriber register his/her line for the same reasons. Short Message Service (SMS) is widely used to spread information from individual to individual. More so, especially in the developing world, organizations and governments are increasingly using SMS to reach out to rural populations that could not previously be contacted. SMS is a huge commercial industry worth over \$81 billion globally as of 2006 (ITU Internet Report 2006) and its worth now could easily have doubled.

2.0 Population Levels in Kenya

Mobile phones penetration is a function of the population in the country. It appears to increase with the population of the region. The population of Kenya according to 2009 census was recorded at 38.6 million people (see *Table 1* and *Figure 1*). The population growth rate is estimated at 2.69% per annum in Kenya. From that time to end of December 2012 of course some people died, while others were born, one can easily make a fare projection on the Kenyan population. Using the above figures, approximately the population of Kenya at the end of December 2010 was around 40 million and by end of December 2012 the Population could have overshoot 43 million assuming that the estimated growth rate is steady, for the time being as shown in *Figure 1*.

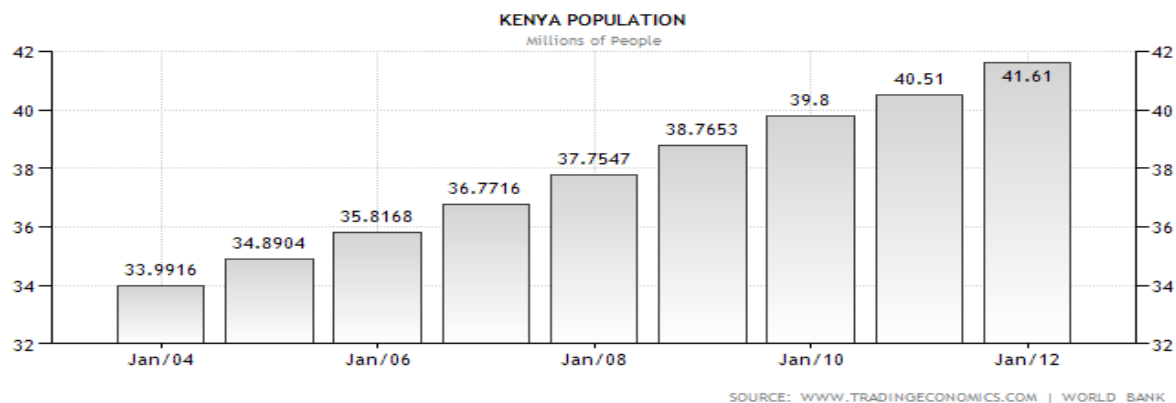
Table 1: Population Distribution by Sex and Number of Households in Kenya

	Male	Female	Total	Households	Area in Sq. Km.	Density
POPULATION	19,192,378	19,417,719	38,610,097	8,767,954	581,309.00	66.42

Source: Kenya Population and Housing Census

From Figure 1, the growth of the Kenyan Population is linear and one can easily give a fair projection based on these statistics.

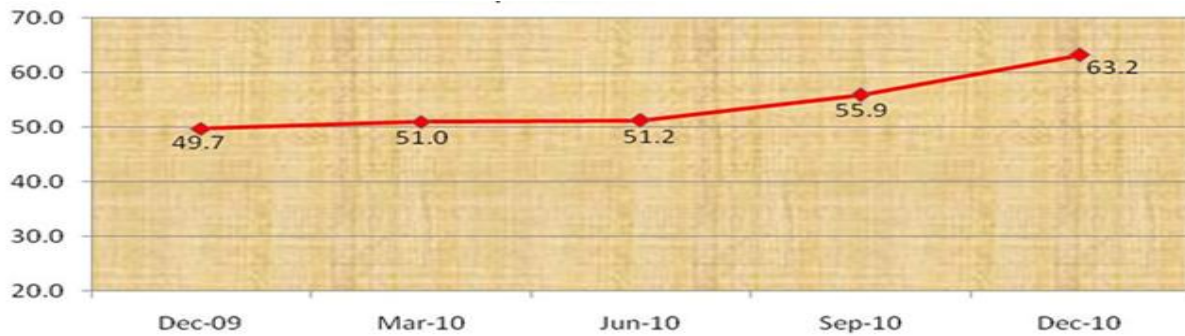
Figure 1: Population Growth in Kenya



3.0 Penetration of Mobile Service in Kenya

The penetration of mobile service in Kenya had reached 64.2 per 100 inhabitants as at 2011 (Communication Commission of Kenya 2011). A close study in terms of Kenyan mobile phone penetration gives interesting data with 24.96 million mobile phone subscribers of a population of 40 million people. As illustrated in *Figure 2*, mobile penetration grew steadily over the quarters. At the end of the quarter being reported, the penetration of mobile service reached 63.2 per 100 inhabitants from 55.9 per 100 inhabitants in the last quarter, 2011 (*Figure 2* below).

Figure 2: Penetration of Mobile Service in Kenya



Source: CCK, operators' compliance return forms

At the end of June 2011, Kenya had 25.27 million mobile subscribers (CCK 2011). Kenya's high mobile penetration rate and subscription number indicates that mobile technology is a promising business opportunity, and an indispensable tool for empowering the country's citizens, especially its rural poor. The majority of Kenyans (78.4 per cent) live in rural areas (Country STAT Kenya 2009).

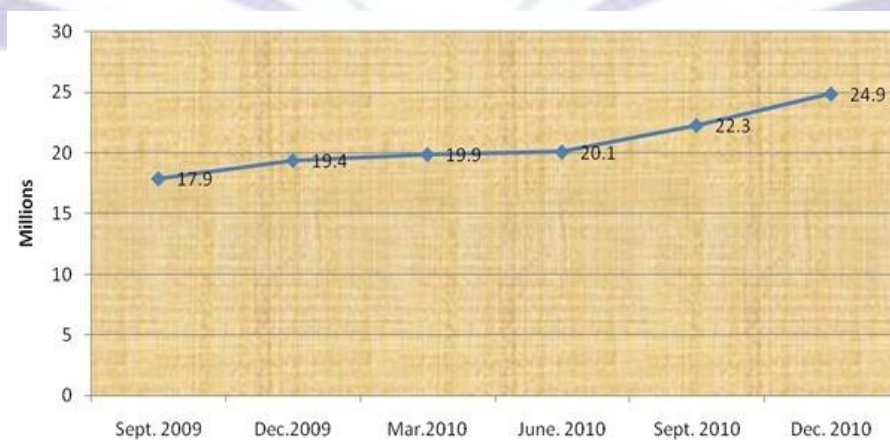
On the aspect of technological advancement, the last decade has seen a sharp increase in technology on the continent of Africa. The number of mobile phone users went up substantially and Africa is now the second largest market in the world with over 600 million subscribers. Kenya appears to be on the forefront of development and with a population of around 43 million, and a GDP Purchasing Power Parity of around US\$66.03 Billion (As of 2011), it remains a strong economic powerhouse on the face of Africa. During the last quarter of 2012, CCK (Communication Commission of Kenya) announced that the country's total number of mobile subscribers was an incredible 29.7mn. It is now strongly projected that Kenya has crossed the 30 million threshold of active cell phone numbers.

Table 2: Mobile subscription by operators

Service provider	Mobile Subscriber base					Market share (%) Q210/11
	Q2 10/11	Q1 10/11	Q4 09/10	Net additions	Growth rate (%)	
Safaricom	17,451,325	16,714,548	16,240,569	736,777	4.4	69.9
Airtel	3,792,404	2,977,696	1,834,343	814,708	27.4	15.2
Orange	2,133,462	1,160,534	552,294	972,928	83.8	8.5
Essar Telecom	1,591,700	1,465,832	1,492,098	125,868	8.6	6.4
Total	24,968,891	22,318,610	20,119,304	2,650,281	12.0	

Source: CCK, operators compliance return forms

Figure 3: Growth in Mobile Subscription 2009-2010



Source: CCK, Operators compliance return forms

Currently, this number firmly makes Kenya as one of the countries in Africa with the highest mobile penetration rates of 75.4 percent, signifying a growth of 17.5 percent from 25.2 million recorded in the 2010/2011 period. The Kenyan market



has accepted the mobile phone as a primary form of communication. This access to mobile phones has even surpassed access to banks which were present here long before the mobile phones. The banks may have no options other than to collaborate with Mobile phone service providers to boost the business. On the other hand, the country heavily relies on mobile phones for both personal and commercial use. Most of the people use their mobile phones for business transaction.

The rise in the number of mobile phones could also be attributed to an increase in the middle class population and also government policies that are giving rise to a healthy and competitive telecommunication industry. Some of the recent policies include connecting Kenya to the rest of the world using fiber optic cables. The undersea fiber optic cable has contributed to the increase of mobile phone penetration because the GSM networks use this as a medium to provide Internet services, through SIM cards. A majority of the Kenyan population access Internet through mobile phone devices.

Analyzing the Kenyan population data, about 42.5% of Kenyan population are under 15 years old (see *Table*). This may boldly imply that every living Kenyan adult now could have a mobile phone and the next growth is up to the under 15 years old. However, some people have more than two SIM cards and this may clearly come out when all lines are registered. The number of phones in one house might be as many as 10. And as you can see it is 63% of the total Kenyan households which is in line with recent statistics by CCK whereby the mobile subscribers passed 50% mark of the population.

Table 3: UN population projections of Kenya

Year	Total population (x 1000)	Population Aged 0–14 (%)	Population Aged 15–64 (%)	Population Aged 65+ (%)
1985	19 655	50.0	47.2	2.8
1990	23 447	49.0	48.3	2.7
1995	27 426	46.5	50.8	2.7
2000	31 254	44.3	52.9	2.8
2005	35 615	42.7	54.5	2.8
2010	40 513	42.5	54.9	2.7

Source: Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2010 Revision.

Going by what is happening to us an average Kenyan gets a new cell phone every 18 to 24 months. This makes cell phones to be among the fastest growing type of manufactured garbage in the nation. According to the U.S. Environmental Protection Agency (EPA), Americans discard 125 million phones each year, creating 65,000 tons of waste.

4.0 Implications of Mobile Phone Penetration and Population Growth in Kenya

The data in the previous section serves to inform us that mobile services in Kenya is doing well since nearly every adult has a mobile phone and many have more than one handsets. Consequently, the rate of acquisition and disposal of mobile phones could be fairly high. The increased mobile phone acquisition leads likewise to increased energy use that impacts on non-renewable resources and release of carbon dioxide and other green house gases into the environment that contributes to global warming. The challenge is that the mechanism of disposal is not well known to Kenyans. Given the exploding population of Kenyans with mobile phones, their used mobile phone translates into a huge e-waste that could be a disaster in waiting. We have not traced a policy guideline on the disposal of used phones.

As cell phones proliferate they are giving computers and monitors some competition for the dubious distinction as the largest contributor to the world's growing e-waste problem. Indeed, toxin-laden electronics are clogging landfills and polluting air and groundwater supplies from coast to coast. According to the U.S. Environmental Protection Agency (EPA), Americans discard 125 million phones each year, creating 65,000 tons of waste. In most cases these phones are refurbished and sold to developing countries, providing affordable communications to poorer citizens while helping to "bridge the digital divide." However, this is a disposal mechanism to the third world countries that seem not to know the dangers of these electronic gadgets. Also most of the cheap phone batteries are recycled and sold cheaply to developing countries. While this option might provide a technological advantage to the population in question, it isn't perfect since there is insufficient information as to how a mobile phone in such an environment should be correctly disposed

The switch-off for fake mobile handsets in Kenya within the year 2013 was partially successful and electronics manufacturers Nokia and Samsung knowing the risks in improper disposal of handsets, set up separate collection points for fake phones, which were to be recycled. However, consumers are unaware of the environmental benefits of recycling

their broken or unwanted mobile phones. Nokia set up over a 100 collection points for fake phones, and has partnered with mobile service providers Safaricom, Zain, Nakumatt, Naivas, Phonselink, and Tusksys to drive their campaign. By giving users access to collection point, it will make it easier for users to dispose of their models.



The reality is that mobile phones contain many valuable and useful materials that can be recycled, including precious metals and plastics. In fact, for every one million phones recycled, it is possible to recover nearly 35kg of gold and 350kg of silver, which can be re-used in the production of future electronic goods. On the other hand, Cell phones have been classified as hazardous material because of electromagnetic radiation and electronic composition. Cell phones contain substances such as antimony, arsenic, beryllium, cadmium, copper, lead, nickel and zinc which belong to a class of chemicals known as persistent toxins. These toxins have the ability of entering the soil and groundwater from points where the disposed phones are thrown (landfills) and remain in the environment for long periods. Such toxins then find their way to the food life cycle and are very toxic to human and animals. End life disposal of some components of the phones and batteries contain heavy metals which can contaminate groundwater. This calls for dispose off of cell phones in the proper way to maintain clean environment. Notably there is no policy in existence to provide guidance on the disposal off of cell phones and their accessories. While there are many ways to make money online, taking advantage of mobile phone recycling services also gives the advantage of making some extra cash in ones pocket to put towards the next mobile purchase.

The importance of disposing of mobile phones in the right way has become an increasingly popular and important part of the life-cycle of any purchase. In line with this, within the packaging of new mobile phones one will find a recycle bag for one to safely send the old phone away to be responsibly broken down. Throwing away old mobile phones poses an ecological disaster. Batteries left in the disposed handsets will react with gases and other matter in the landfills. Similarly, the increasingly common use of high resolution LCD screens can, if not treated in the right way, lead to a potentially devastating environmental challenge.

Your mobile device probably holds sensitive information like addresses and phone numbers, passwords, account numbers, email, voicemail, and text message logs. When getting rid of your old device, it's important to take steps to help ensure this information doesn't fall into the wrong hands. Otherwise, you stand to experience another knowledge edge disaster by being exposed beyond limits with probably all your confidential information to wrong hands.

5.0 Conclusion

Already quite a huge amount of mobile phone e-waste materials may not have been properly disposed. The government may need to address this issue with the thrust it deserves. Meanwhile information should be widely and readily be made about the collection points of used mobile phones. Perhaps consumers should be given incentives for returning phones and batteries such as a deposit refund systems or discounts on new phones when returning old ones. Mobile service providers (e.g. Safaricom, Zain) should increase awareness among their subscribers about their recycling information via SMS. They may also create a help desk unit where one may call the service provider to inquire on how to dispose off of old cell phone. They need to emulate some service providers that have programs on safe disposal of cell phones such as the website www.charitablerecycling.com. By clicking on 'Wireless Waste' link on this website one can learn a lot about the ill-effects of wireless and telecommunication devices on the environment. It's important to delete any personal information you stored on the device before disposal of the same and dispose it a proper manner.

Acknowledgments

We acknowledge the support from Kibabii University College towards the preliminary study out of which the findings are herein published.

REFERENCES

- 1) Communications Commission of Kenya (CCK) (2011). Quarterly Sector Statistics Report April-June 2010/2011. URL (accessed November 2011):http://www.cck.go.ke/resc/downloads/SECTOR_STATISTICS_REPORT_Q4_2010-11.pdf
- 2) CountrySTAT Kenya (2009). Key Indicators. URL (accessed November 2011):
<http://www.countrystat.org/KEN/cont/pages/page/indicators/en>.
- 3) Hellstrom, J. (2010). The Innovative Use of Mobile Applications in East Africa. SIDA Review 2010:12, SIDA, Stockholm, Sweden. URL (accessed November 2011): <http://www.sida.se/publications>
- 4) International Telecommunication Union (ITU) (2011). ICT Statistics Database. URL (accessed July 2011):
<http://www.itu.int/ict/statistics>.
- 5) ITU Internet Report - Digital Life (2006). Business Digital. Chapter 3. Pg. 69-89. URL (accessed July 2011):
www.itu.int/osg/spu/publications/digitalife/.../digital.life-chapter3.pdf
- 6) IndexMundi (2011). Kenya Literacy. URL (accessed November 2011):
<http://www.indexmundi.com/kenya/literacy.html>.
- 7) Angela CRANDALL Fulbright Research Program, Kenya.
www.research.ihub.co.ke/uploads/2012/.../1337774145_819_425.pd...
- 8) Mas and Morawczynski (2009): "Designing Mobile Money Services: Lessons from M-PESA," Innovations, 4(2), 77-92, MIT Press.
- 9) Mas, Ignacio and Kabir Kumar (2008): "Banking on Mobiles: Why, How, for Whom?," Consultative Group to Assist the Poor, Focus Note No. 48, Washington DC.



- 10) Romer, Paul (1986): "Increasing Returns and Long-Run Growth," *Journal of Political Economy*, October, 94:5, 1002-37.
- 11) Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision*.

