

# Case Study

## WEEE

# Burundi

IWWG TG WEEE  
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### **ABSTRACT**

Burundi is currently facing delicate decisions in planning the next steps for development. Although being one of the poorest countries in the world, Burundians still maintain a genuine lifestyle. Pollution is very low since there are few motor powered vehicles, industry is virtually nonexistent and animals are raised in freedom and to a sustainable extent. The lush nature, however, is radically influenced by human activities, Information and Communication Technology represent significantly powerful tools for exchanging information and good practices towards sustainable development. Nevertheless, development will necessarily involve waste, and in the case of Burundi this could be mainly WEEE in the near future. In this beautiful still uncontaminated country, where the rural unexpectedly mixes with the latest technologies, from the hoe to satellite internet connection, the very outcomes of technological development are still uncertain. What will the future be for this wonderful land?

It is practically impossible to evaluate the quantity of Waste electronics in Burundi mainly due to two factors:

1. There is no national program for the collection of waste of any kind. Hence when electronics are exhausted, prior to being dismissed, they are dismantled and all reusable parts are refurbished and used to repair other electronics, while all the other materials that cannot be recuperated are burned or buried without any regard to toxic elements they may contain.
2. The country is totally disorganized and it is virtually impossible to acquire reliable or precise data.

Therefore, in order to approximately evaluate the quantity of waste technologies, which is virtually impossible to estimate, it is easier to investigate the volumes of imported goods. Considering that the average life of technological products can vary greatly, it is hard to precisely estimate when and how these sorts of products will be disposed of. However, it can be said with certainty that sooner or later, at a certain point, all technological products will break or become obsolete and will end up being e-waste. Understanding the nature and flow of such materials may help in evaluating the average market trends, and foresee to some extent the quantity and quality of trash there currently is and will be produced in the near future.

This report will describe the current situation of infrastructure (pages 3-7), analyze the plans and projects of the government and international community (pages 7-10), specifically focusing on how Information and Communication Technologies (ICT) can be a powerful tool for sustainable development. A following section will study the trade flows of Electronic and Electric Equipment (EEE) to Burundi (pages 10-15) and what are the most desirable household appliances and consumed technological goods (pages 15-16). Finally there is a section dedicated to interviews and personal experience (pages 16-21) and a conclusive comment on future perspectives for Burundi (pages 19-23).

the final scenarios of bridging the digital divide in technological development, accompanied by responsible management of the WEEE generated, could open towards innovative solutions and promising outputs.

When carefully managed, this model in which the preservation of natural resources intertwines with latest information technologies, Burundi could actually become trendsetter, a sustainable example for other developing countries and the entire world. Finally through research and technological innovation Burundi could be the cradle of a modern, sustainable system able to combine tradition and respect for nature with the latest communication technologies.

## **COUNTRY BACKGROUND**

Burundi is a densely populated country in the heart of Africa on the north eastern coast of the Tanganyika lake. It is the 47<sup>th</sup> most populated country in the world, based on the 2012 estimates provided by the Population Division of the United Nations Department of Economic and Social Affairs. 289 inhabitants per Km<sup>2</sup> for a total of 8,035,000 people, according to the 2008 survey. However, the high levels of fecundity (average 6 children per woman) will increase the population drastically as the annual growth is estimated to be around 2.4% for the period 2010 - 2020.

90% of the population lives in rural areas and self-sustains on agriculture. Varying between 166<sup>th</sup> and 169<sup>th</sup> position according to the human development indicators, it's placed among the poorest countries in the world.

Since independence in 1962, Burundi has known increasingly violent cyclic ethnic/political crisis. The crisis has brought hardly definable direct and indirect consequences, counting hundreds of thousands of causalities and refugees, whereas administrative and productive disorganization has tossed the whole country into a profound state of poverty. Since 2003, conflict has officially ceased allowing International Organizations to provide aid for the country's reconstruction and development. Nevertheless, the long lasting civil strife has torn the very fiber of society, resulting in a highly dysfunctional government system.

Since 2005 there have been some signs of development. Democratic elections were held in 2010. The country's economics have grown at an average 4% rate between 2006 and 2009, featuring remarkable statistics in elementary education, which is granted free for all. Yet the country still largely depends on foreign investments representing 57% of the government's budget and is far from being autonomous.

Burundi is currently facing delicate decisions in planning the next steps for development. The country is very poor, however it is very fertile, unpolluted and has a lot of water. This report will describe the current situation of infrastructure (pages 3-7), analyze the plans and projects of the government and international community (pages 7-10), specifically focusing on how Information and Communication Technologies (ICT) can be a powerful tool for sustainable development. A following section will study the trade flows of Electronic and Electric Equipment (EEE) to Burundi (pages 10-15) and what are the most desirable household appliances and consumed technological goods (pages 15-16). Finally there is a section dedicated to interviews (pages 16-21) and personal experience and a conclusive comment on future perspectives for Burundi (pages 21-23).

## **INFRASTRUCTURE**

This section specifically describes the state of the art of civil infrastructure in Burundi. There are projects to improve public services throughout the country, however such intentions have not yet been implemented. The current situation is as follows:

In general there is a total lack of infrastructure within the country. There are only a few main asphalt roads connecting cities and lager settlements, where also other public commodities such as electricity and running water are scarce and inconstant.

### **Water**

Although Burundi has plenty of precipitation and spring water, collection and distribution of drinking water is limited. Many villages and remote locations, for instance, rely on communal founts and wells, which fortunately are abundant and of good quality. In larger settlements and cities piping is capillary,

however there are often closures in the supply that can range from a few hours to a few days, or even several weeks, therefore people are used to collecting rain water for washing and cooking. Due to these frequent shortcomings in the availability of clean uncontaminated water, there is a general lack of hygiene and a high risk of disease. Most common are Cholera and Typhus but there are many other minor endemic parasites thriving in such a favorable environment such as bed bugs, amoebas, scabies and so forth. The mismanagement of water also causes many areas to swamp, favoring the development of malaria bearing mosquitoes, which represent a great health hazard within the country and a lot of people, including many children, die from it each year. In fact there is a certain strain of this disease that hits the brain and can lead to death within 8 days.

Thanks to the spongy quality of the soil and abundant precipitation during the rainy seasons water filtrates creating copious underground waters that spill out from many minor sources of spring water randomly scattered all over the territory. This abundance allows luxuriant and lush vegetation and favors the thriving of agriculture. In fact local farmers can yield up to three cycles per year. This is due to the fact that during the rainy season torrential rivers fill the geographic depressions, allowing water to swamp in the valleys where a third harvest is possible during the dry season. Unfortunately during the last few years foreign investors have been eyeballing sources around the country trying to acquire the supplies to produce bottled water. Fortunately no sale has yet been accepted.

Today Burundi is still an uncontaminated territory in the deep heart of Africa. The question that arises naturally is: for how much longer will this paradise remain so? How long will it take before human activities and industry influence and pollute such natural richness?

### **Electricity**

Similarly to the water piping, also electric lines are scarce and concentrated in urban or semi-urban areas. Most of the electricity in Burundi is provided by small sized hydroelectric plants. The power plants usually consist in a sort of small dam that channels a stream. Exploiting the conformation of the territory which is characterized by high hills peaking over 2000 meters, water is left to fall through a massive pipeline where it hits a turbine once it reaches the bottom of the chute. However due to the density of population and increasing demand, the small power plants are not able to provide enough energy alone, hence blackouts are a daily phenomenon and can last from a few minutes to several hours.

There are many rivers and water streams in the country, yet only a few have a appreciable and constant flow throughout the year, whereas many water streams depend on precipitation and offer quite different carrying capacity according to seasons. There are no large artificial basins or large dams both because they require massive investments and because the geological formations and soil compound result brittle and spongy, thus they cannot provide reliable anchorage for the construction of a big reservoir. Another construction problem in Burundi is the general lack of cement and quality construction material available. Nevertheless in the next few years a Government project will see the construction of a big hydroelectric power plant in the Mubuka area, which will be supplying the Nickel mines in the eastern part of the country.

In addition, even with an adequate energy supply, the distribution system, mostly availing on air cables hung between wood poles, is highly dispersive. Hence home power outlet voltage can easily

vary between 180 and 270 Volts. Thus any kind of electric appliance may often suffer from overcharge and undercharge and this has detrimental effects on the life span of electronic equipment, which may result much shorter than it would be, if powered by a steady energy supply. The immediate solution is to use continuity groups, a sort of battery pack that comes into action when there is a blackout. Nonetheless these Nickel-Cadmium batteries burn out or polarize fairly quickly, adding to the variety of e-waste.

Solar systems are being implemented throughout the entire country to contribute to a steady energy supply based on renewable energy. Yet Burundi is characterized by a particularly rainy climate, featuring 3 to 4 months per year of dry sunny weather, during which there is a lot of dust that may decrease the efficiency of solar power absorption, followed by 8 to 9 months of rain and clouds. Although many resort to simple home panels for lighting, radios, phone chargers and hair shavers, solar panels cannot answer alone to the growing demand for electricity of the 9 million Burundians scattered more or less evenly throughout the territory. Nonetheless solar technology can provide electricity in remote areas where there would be no access at all to electric power otherwise. In 2012, for instance, the Italian cooperation built a hospital on a remote hill, nearly 15 Km away from the closest city. The building, a maternity hospital featuring state of the art ultrasound equipment, is completely powered by solar panels. In Bujumbura, the capital, a solar field the size of a football ground, was built in 2012. Many private houses have solar hot water heaters and new roads are lined with solar powered light poles.

Solar panels require specialized training for installation and maintenance, and this could provide opportunities for new jobs. Unfortunately photovoltaic technology is very expensive, has a rather short life span (average 15 years), and requires an accumulation system and batteries, which can result rather pollutant and dangerous due to the acid and heavy metals they contain. In fact the average life of a truck battery mounted on a solar panel is 5 years...hence batteries usually must be replaced up to 3 times during the life span of a solar panel system.

In conclusion, based on the infrastructure currently available in Burundi, solar energy is apparently providing a new resource for sustainable development, however in the near future the use and implementation of last generation technologies will eventually create a massive and increasing amount of latest generation WEEE, which will have to be dealt with.

## **Roads**

Burundi shares borders with Congo, Rwanda and Tanzania and represents a strategic spot in the middle of the East African Community, still communication is hindered by the poor state of roads. In order to improve communications and trade, the World Bank has financed a project to build a freeway from Uganda to Tanzania, passing through Burundi and possibly it will be using similar technology.

## **Telecommunications**

One of the greatest businesses in Burundi is mobile communication, mainly cellular phones. The infrastructure required is rather cheap and easy to install and able to cover most of the territory allowing easy communication despite the conformation of the terrain, characterized by very high and steep hills (over 2600 hills) most of which peak over 2000 meters above sea level. Coverage is unexpectedly capillary and there are chances of receiving a call also in remote and uninhabited areas. There are 4 different service providers Leo, Onamob, Tempo and U-com, however not all companies have coverage on the entire territory and most people have more than one mobile phone to use

according to the area and price of calls. Land line communication is available only in urban areas and it's usually scarce, expensive and inefficient. Thus GSM technology offers a highly efficient and inexpensive solution in telecommunications and avails mainly on old American and European infrastructure imported during the last decade. Satellite dishes are slowly catching on for TV signal reception and more rarely for internet. Yet in many place satellite is the only source available for world signal reception although far too expensive for local incomes.

In conclusion Burundi, although being one of the poorest countries in the world, still maintains a genuine lifestyle. Pollution is very low since there are few motor powered vehicles, industry is virtually nonexistent and animals are raised in freedom and to a sustainable extent. The lush nature, however, is radically influenced by human activities and Information and Communication Technology represent a significantly powerful tools for exchanging information and good practices towards sustainable development. Nevertheless, development will necessarily involve waste, and in the case of Burundi this could be mainly WEEE in the near future. In this beautiful, still uncontaminated country, where the very rural unexpectedly mixes with the latest technologies, from the hoe to satellite internet connection, the very outcomes of technological development are still uncertain. What will the future be for this wonderful land?

## **LAWS, REGULATIONS AND INTERNATIONAL COOPERATION**

This section is dedicated to the comprehension of the political interests of the country and to better understand the direction Burundi will be moving towards in the near future.

Approximately from the cease fire in 2003 and the reestablishment of a yet wobbly economical and political system growth, the request for new technologies throughout the county has risen enormously. Many International Organizations work and cooperate with the government to establish development plans. Burundi is very poor and the average population income is estimated to be 180 USD/year per person, hence expensive new technologies are inaccessible to most of the population. This has attracted several semi-government and Non-Government Organizations to participate in the development of the country, where health and ICT projects are needed most.

This part of the research investigates the political trend and some of the projects that are being implemented both for the development of ICTs and their integration in a responsible and sustainable manner.

There are no specific State laws regarding waste management in Burundi, although there are several regulations on a larger scale.

According to the National Environmental Code *"Code de l'environnement Loi n° 1/010 du 30 juin 2000 portant Code de l'environnement de la République du Burundi."* the government is particularly attentive to the environment and, although there are not many specific laws, the National Law states that any industry or human activity must be done in full respect of the environment, avoiding waste as much as possible and all waste produced is the responsibility of the producer to dispose of in an environmentally responsible way.

In June 2011 the Ministry of Planning and Communal Development of Burundi, along with the Forecasting Unit of the United Nations Development Programme in Burundi have delivered *"Vision Burundi 2025"*. This document states: "Burundi is aware that the attainment of strong and competitive

growth of its economy depends on the use of new innovative technologies and on ensuring the capacity to gain access to, and absorb these resources. Vision Burundi 2025 intends to make promotion of new technologies one of its priorities. This effort will focus on reforming education at all levels. Pride of place will be given to science and technology in education curricula, by in particular stressing research and information and communications technologies which are generally used as major catalysts for acquiring and adopting new advanced technologies.." - concluding briefly chapter 6.4 *Science and Technology*, with: "Collaboration with other countries of the sub-region will be required in order to facilitate access to certain technologies, to the training of experts and professionals, and to applied research."

The implementation of this vision involves many actors and the efforts of many countries around Africa and in the world to pool their energies to find sustainable opportunities for development.

The IST Initiative action plan, for instance, presented at EuroAfrica ICT Forum, Cape Town, 15 Nov '11, reveals the intentions to develop the Great Lakes Inter-University Network (RIGIL). The main topics of discussion for future research and development cooperation were on ICT, Information Society and Space. The goal is to create a multinational network between Africa and the EU for the development of an academic knowledge base between universities for the creation of new solutions and specialized experts.

In particular the project involves empowering education in state and private schools from high school to university. The implementation of these programs also includes supplying ICT labs and training technicians for maintenance as well as trained teachers as indicated in the PARES inter-university project, which has already installed 20 computers for the Faculties of Literature and Human Science, Economy and Law, 20 computers for the FSA/ITS as well as another 12 computers in the Faculty of Medicine for professors and researchers, where a lab with 20 computers had already been constituted in 2004 and has now been upgraded. In addition specialized technicians are being trained for maintenance and development.

Nevertheless, Burundi is subject to general disorganization within the system and this often impedes accomplishing the desired results. Still in January 2013, in fact, there are only a few schools which can vaunt an ICT lab and trained personnel. More frequently schools have overcrowded classrooms, teachers (who on the other hand earn an average 60 to 70 euro/month) and personnel are insufficient. Furthermore, school desks and stools are old and worn out and often two students must share the same notebook. In schools where there are ICT labs, instead, computers are usually old and due to the electric instability they break down fairly easily. Moreover there are not many people who can use a computer and many less able to teach.

Also the political organization is realizing that ICT can be a powerful tool for managing archives and sharing information. The goal is to implement ICT registration in schools, public offices, police stations and prisons. This certainly is a rather ambitious plan in a country where still many people are not registered in any office. Nevertheless this is the direction Burundi is moving in. The PAFE (*Police Aérienne des Frontières et des Etrangers*), for instance, can vaunt offices supplied with modern computers, cameras and networking systems.

Likewise, in 2012, *Progetto Amahoro* began training the local Clerk & Recorder's office staff on the use of ICT technologies. The project in fact consists in the implementation of computers in the office with a database program in which the paper files will be copied. Although the software still needs to be updated to meet the requirements of the Burundian recording system, the possible outcomes of

implementation of a digital recording procedure are yet to be fully understood.

Similarly In 2011, the International Records Management Trust reports that Burundi is still in a fragile and uncertain political and economical situation. Enduring stability is necessary for development. Thus the International Record Management Trust highly recommends that Burundi should work on developing a reliable and organized record system, by also implementing Information and Communication Technology as well as upgrading record and document filing systems. Whereas nowadays record offices are still disorganized and the archive system relies on paper documents and old-fashioned book keeping. Therefore international cooperation and universities are invited to increasingly address their interventions on ICT subjects, and the government should work towards the adoption of ICT to establish a network and improve office organization.

To sustain ICT development many experts and trained personnel will be needed. A study conducted by the Institut International des Technologies del'Information (INIIT) in Decembre 2010, shows a steady annual increase in demand of specialized technicians from 1624 experts in 2011 to 2437 by 2015.

The government, in cooperation with different stakeholders, has approved and financed the ambitious project to wire the entire country with fiber optics, envisioning the future of Burundi as a country where speed internet is available in its most remote areas.

This increasing demand for technological products throughout Africa unfortunately also produces many undesirable effects as proven in many other counties in Africa. Burundi fortunately is yet to begin a radical turnover to modern technology. Thus, also because of the fear of what has happened in other countries, Burundi and many neighboring countries are already seeking to protect the environment without denying opportunities for development. In particular waste management in the East African Community is becoming an increasing issue and many establishments around the world are investigating future outcomes of such rapid technological development.

In 2012, for instance, Örebro University in Sweden, released a publication on E-Waste Management in East African Community pointing out how local governments conceive e-waste to be an increasingly concerning issue and investigates in depth laws and regulations and further plans to deliver environmentally sustainable solutions throughout the EAC.

Furthermore the EANECE was established in May, 2010 at a regional conference held at the United Nations Gigiri Complex, Nairobi, Kenya. At said conference, the five East African nations through their respective national environmental management agencies agreed upon and signed a Charter establishing the Network. The East African Network for Environmental Compliance and Enforcement (EANECE) is a regional network of governmental agencies which have in their mandate environmental management, compliance and enforcement responsibilities in the East African nations of Kenya, Uganda, Tanzania, Rwanda and Burundi. The EANECE Executive Committee has recently approved the entry of Ethiopia and Zanzibar into the Network and steps are being taken to actualize the entry of the two nations.

Finally International Organizations have stepped in to support the governments of the East African Community countries in outlining a plan of action for sound e-waste management. In particular "The Pan-African Forum on E-waste held at the United Nations Environment Programme Headquarters in

Nairobi, Kenya, during 14-16 March 2012, calls for action outlining a set of priorities to support development of a regional approach for the legal transboundary movements and the environmentally sound e-waste management throughout the African continent, aiming to protect human health and the environment as well as to promote opportunities for social and economic development."

To support transboundary movements and environmentally sound management (ESM) of e-waste, the following priority areas were identified as summarized below:

Area 1: Baseline Assessment of e-waste problems

Area 2: Principles for environmentally sound management of e-waste

in which the accent is put on promoting green design and transparency, encouraging reuse and refurbishing along with promoting environmentally sound recycling according to international criteria.

Area 3: Legal, policy and regulatory frameworks, endorsing all African countries to ratify the Basel and Bamako conventions enforcing law to their provision, while facilitating the development of sound recycling strategies.

Area 4: Enforcing international, regional and national law concerning imports and exports of used electronic and electrical equipment and e-waste, in particular by establishing a control system on the quality of importation.

Area 5: Financing environmentally sound management of e-waste.

Area 6: Environmental, health and social-economic aspects of e-waste management.

In conclusion Burundi has the great opportunity today, to develop in a sustainable way and this can be done also through ICT, which is one of the main goals of current government and international plans. However caution must be taken in planning future moves in order to guarantee the protection of the environment in one of the few still uncontaminated areas of the world.

The quantities and volumes of trade involved in ICT development of Burundi will be described in the next section.

## **DATA RETRIEVAL, PROBLEMS AND METHODOLOGY**

This section is dedicated to the theoretical study conducted to evaluate the volume of Electronic material flowing into the country, however, it does not consider quality. Data are often scarce and only related to the last 6 or 7 years, however it can be useful to evaluate at large the incidence of technological development in Burundi.

It is practically impossible to evaluate the quantity of Waste electronics in Burundi mainly due to two factors:

3. There is no national program for the collection of waste of any kind. Hence when electronics are exhausted, prior to being dismissed they are dismantled and all reusable parts are refurbished and used to repair other electronics, while all the other materials that cannot be recuperated are burned or buried without any regard to toxic elements they may contain.
4. The country is totally disorganized and it is virtually impossible to acquire reliable or precise data.

Hence in order to approximately evaluate the quantity of waste technologies, which is virtually impossible to estimate, it is easier to investigate the volumes of imported goods. Considering that the average life of technological products can vary greatly, it is hard to estimate precisely when and how

these sorts of products will be disposed of. However, it can be said with certainty that sooner or later, at a certain point, all technological products will break or become obsolete and will end up being e-waste. Understanding the nature and flow of such materials may help in evaluating the average market trends, and foresee to some extent the quantity and quality of trash there currently is and will be produced in the near future.

It is very difficult to retrieve precise data on the volumes and quality of imported goods, in particular when considering technological items. In this case-study the volumes and value of the various imports from all over the world to Burundi have been taken from the UN website [www.uncomtrade.un.org](http://www.uncomtrade.un.org). Although the site is up to date and can be considered a powerful tool to analyze trade flows throughout the world, in terms of technological products, data can be rather difficult to retrieve and values can vary considerably depending on the reporting country. In addition, due to the long period of instability, which has thrown the country into a civil war for more than 20 years, many foreign investments have escaped the country and only in recent years, since the end of hostilities in 2003, have boundaries been reopened to global trade and foreign investments, allowing at last to record trade flows. Nonetheless, data is scarce and often incomplete or controversial.

In general most of the data retrieved on the UNComtrade site is fairly recent and sometimes evaluations must be made on data which dates to only the past few years or on a 5-year basis at maximum.

Data were studied in order to acquire the greatest number of entries possible. A cross study between the different reporters was conducted and the highest values reported were taken into consideration. This choice was made because there are considerable discrepancies between the data regarding volume and monetary value.

Studying the charts, it is peculiar to notice that generally when the reporting country is Burundi, values are considerably higher than what is reported by the exporting country. The difference in reported data can amount to several thousands of dollars, namely hundreds of kilograms. In addition it must be considered that Burundi lacks IT registration systems, infrastructure and general government organization, hence data may not be completely reliable. On the other hand the exporting countries might tend to lower the numbers reported especially on the weight declared because of international regulation and taxes applicable on the exportation of technological goods.

For this study technological products were divided into three main areas of study and named after the UNComtrade code of identification as follows:

**8471** Automatic data processing machines (computers).

**8517** Electric apparatus for line telephony, telegraphy (including phones for cellular networks base stations and other wireless networks).

**8525** Radio and TV transmitters television cameras.

**8527** Radio, Radio-Telephony receivers.

For each of the study areas, data was collected regarding volumes and value as reported. In order to achieve a global view on the subject Import values have been divided into 3 main areas of interest as below:

**Global Vision:** Including the world values as reported and a selection of relatively influential countries and sub regions on the global markets. Australia, Canada, China, EU 27, Hong Kong, India, Israel, Japan, Russia, United Arab Emirates and USA.

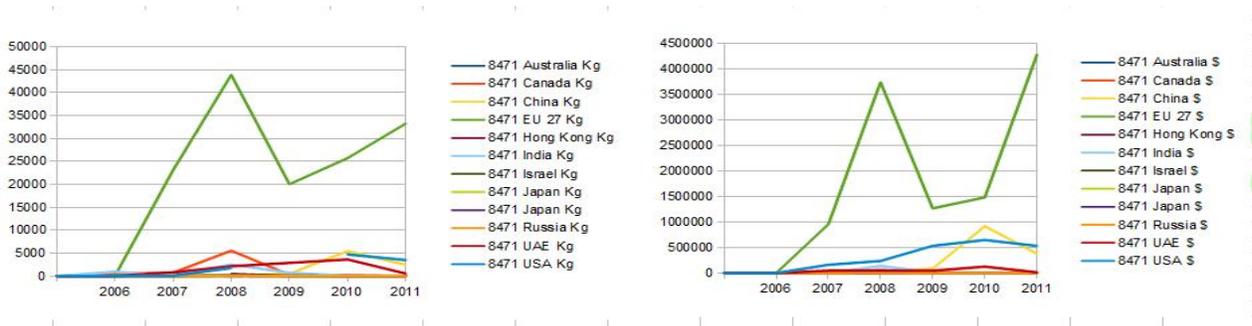
The global vision was then divided into sub regions aiming to analyze the flow of technological equipment from the different countries in sub-regions and by typology of product. Hence the study has analyzed in detail trade flux originating from:

**EU 27:** European Trade Countries Including other neighboring countries when presenting relevant data.

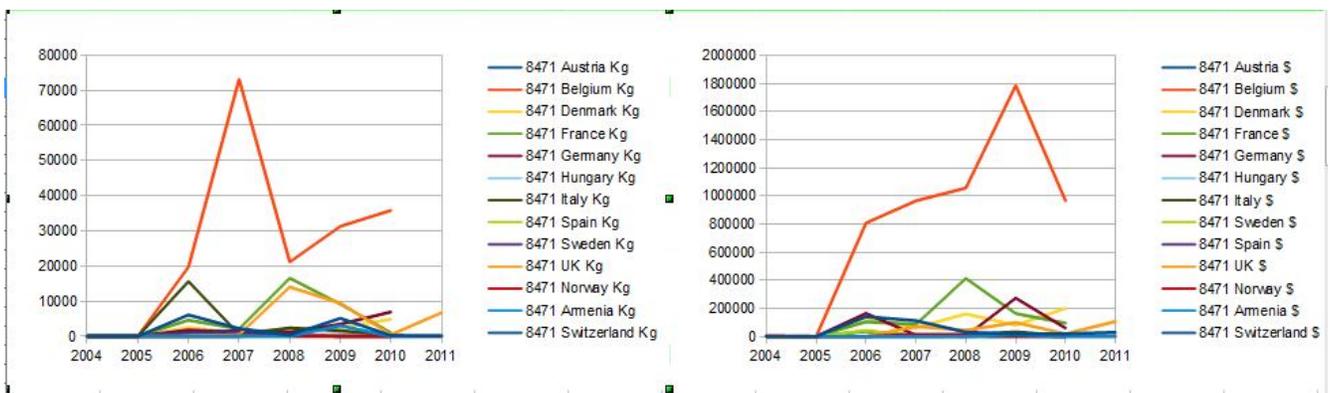
**Africa** (East and Southern Africa Preferential Trade Area) and other African countries when presenting relevant data.

### Charts

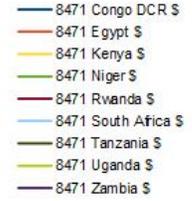
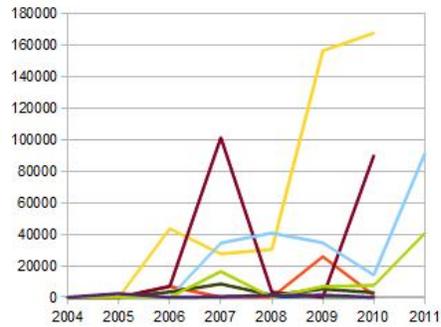
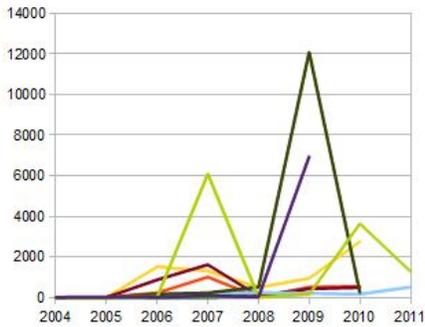
This series of charts below will help analyze what kind of EEE is being imported to Burundi and who are the main partners for the different types of goods. This is important also to understand the nature of future WEEE, therefore it can be useful for planning future strategies for responsible waste management. The charts are the results of an accurate transcription of the data retrieved and selected from the UNComtrade as explained above onto a Calculus page. Herein are the graphics generated by the program.



gr.1) 8471 Automatic data processing machines (Computers) – Global vision. The figures clearly demonstrate there is an undoubted involvement of Europe in ICT development in Burundi, followed by US and China.

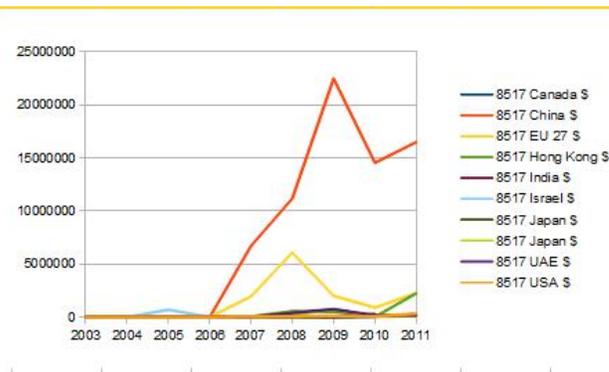
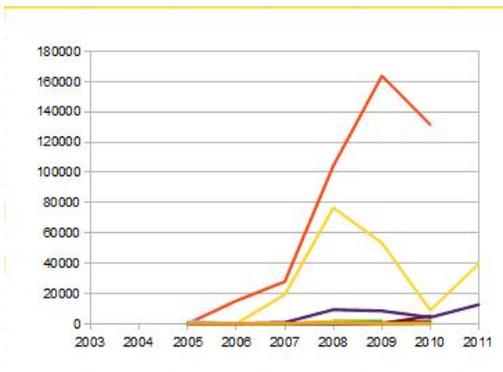


gr.2) 8471 Automatic data processing machines (Computers) – EU 27. Analyzing the figures regarding the European trade statistics Belgium represents the most influential actor, followed distantly by France UK and Italy.

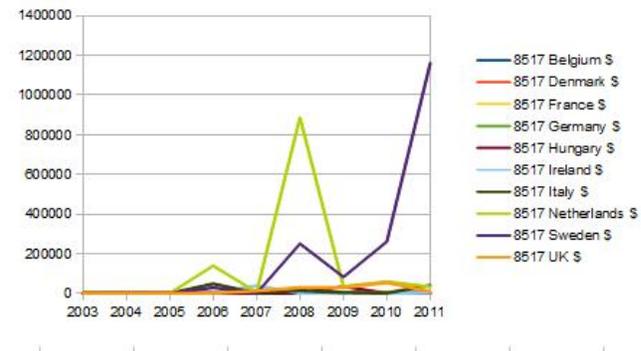
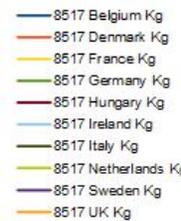
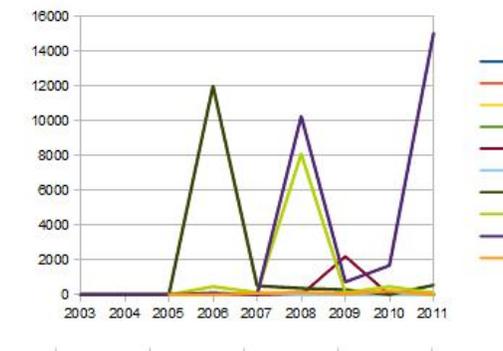


gr.3) 8471 Automatic data processing machines (Computers) – Africa. Although importations from African countries to Burundi is irrelevant compared to the volumes of trade offered by the EU, these figures show how ICT is becoming a profitable business within Africa itself. Not surprisingly the graphs show considerable volumes flowing from Kenya, Uganda, Rwanda and South Africa.

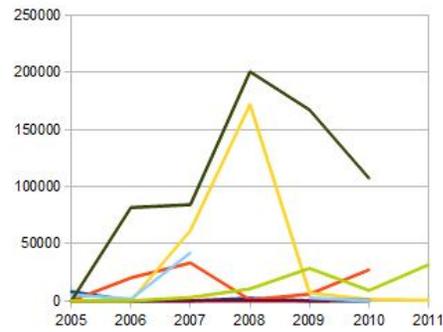
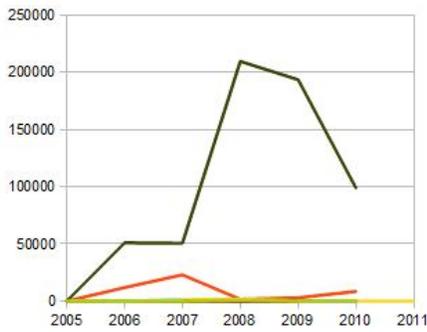
The following charts instead describe the situation regarding telephone lines, infrastructure and wireless networks:



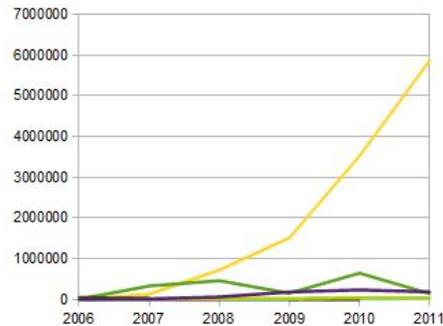
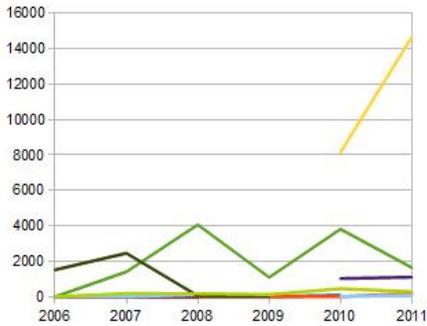
gr.4) 8517 Electric apparatus for line telephony, telegraphy (including phones for cellular networks base stations and other wireless networks) – Global vision. This figure shows a powerful and increasing influence from China in the telephone industry, noticeable is the reduction of trades from Europe where Chinese business increases.



gr.5) 8517 Electric apparatus for line telephony, telegraphy (including phones for cellular networks base stations and other wireless networks) – EU 27. The chart clearly shows the main actors of trade from Europe towards Burundi, where Sweden and Netherlands represent the European market in Burundi. While it appears that Italy has withdrawn after an initial interest in 2006.

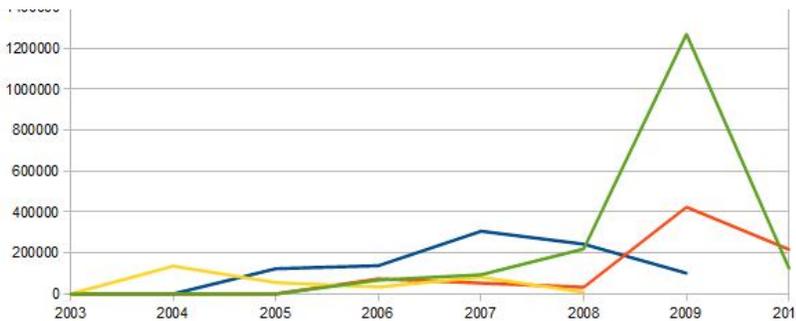
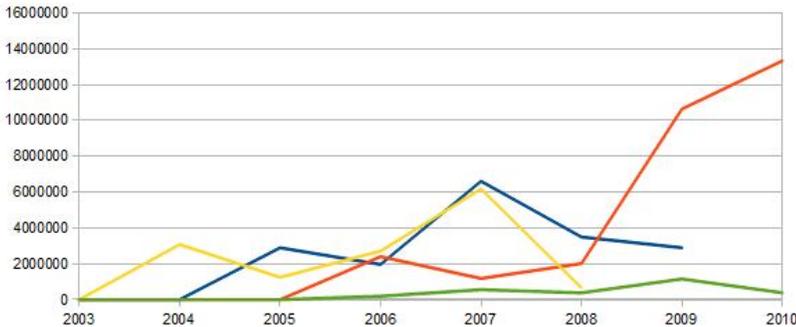


gr.6) 8527 Radio, radio telephony receivers – Global vision. This image clearly shows the United Arab Emirates and Europe struggling over the radio-telephony market and apparently Dubai has established it's predominance, although many of the products sold by UAE originate from China, India and Europe.



gr.7) 8525 Radio and TV transmitters television cameras - Global vision. The figure shows a constant involvement of Europe whereas in the last years China has entered the trade achieving exponential growth in this sector as well.

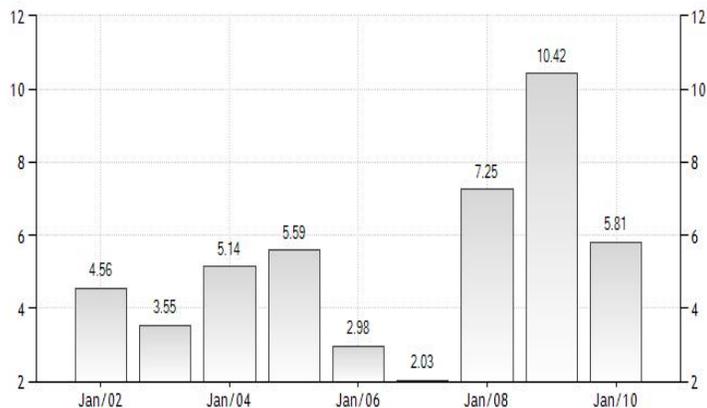
The charts below compare the different areas of study and the involvement of trade during the last decade:



gr.8-9) Global EEE trade in Burundi. Not surprisingly the figure clearly shows a great market in telephony that, as we have seen, is mainly Chinese. The second business are computers, however due to the price of machines and the country's

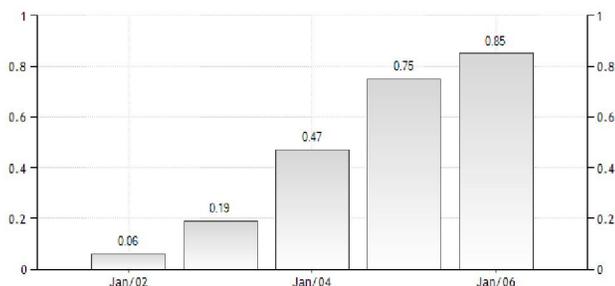
economic situation the market still hesitates to launch. Television instead, after an initial interest between 2003 and 2007 has dropped during the last few years in favor of computers and telephones, while radios offer a steady business although they involve less monetary volumes compared to the volumes traded, peaking over 1200 tons in 2009.

Another reliable monitoring study is that of the World Bank, where the results are in line with the discussion above, as described in the charts below.

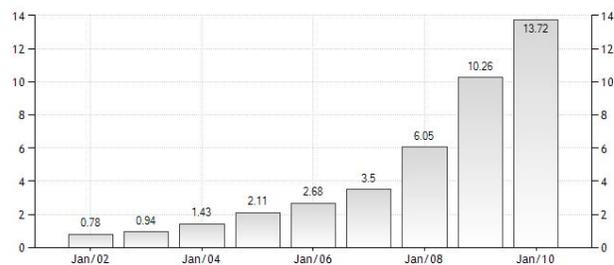


gr.10) World Bank - Burundi ICT goods imports percent of total goods imports. Also this graph shows how ICT has covered over 10% of the total volume of imports in 2009.

It is curious to notice how import rates seem to follow cyclic growth patterns and pass from massive peaks in 2005 and 2009, alternated with deep lows, whereas use of technology has been growing exponentially in the past decade as shown in the graphs below.



gr.11) Burundi personal computers per 100 people.



gr.12) Burundi mobile cellular subscriptions per 100 people.

The figures reveal that the use of technology is booming and can only be expected to grow during the next years, as from January 2002 to January 2006 the number of computers has risen to almost one per every 100 inhabitants. Mobile phone subscribers, instead, have tripled in the biennium between 2008 and 2010 and it is estimated that in January 2010 almost 14 people out of 100 had a mobile phone subscription. Following the trend in the graph it is possible that in the last three years subscribers could have easily increased to up to 20%, namely 1/5 of the almost 9.000.000 inhabitants.

In conclusion the results of this study fully describe a society in which interpersonal communication is one of the priority values and, despite poverty, mobile communication is a booming business. There is also a rising interest for computers and internet technology, however, the high prices of computing machines is significantly offsetting for the consumer.

The results of this study will be investigated in more detail in the following sections.

## **HOME APPLIANCES and GENERAL CONSUMPTION OF TECHNOLOGICAL PRODUCTS**

This section investigates the distribution of household appliances and the most common technologies available. Throughout the country, household consumption of electronics is scarce. The majority of the population lives in rural areas and doesn't have access to electricity and in some cases not even to water. Nonetheless almost every person over 18 years of age has one or more mobile phones. In fact, as discussed above, World Bank estimates set the figure at 14% of the population in January 2010. Nonetheless there are also smaller devices commonly used in households.

### **Lamps**

Most dwellings usually have at least one lamp which uses a modern low consumption bulb. The instability of the electric power supply causes the bulbs to pop fairly often, up to 5-6 times per year. Unfortunately there is no awareness whatsoever regarding the contents of this kind of bulbs, hence they are freely disposed of in the wilderness. In addition, in remote areas, many households use car and truck batteries to power lamps for evening lighting or other low consuming appliances. There are shops everywhere offering battery charge services for 1000 to 3000 FBU (0,50 – 1,50 euro) per charge, yet car batteries have a short life span and contain sulfuric acid and heavy metals, and generally are disposed of in a hole in the ground when exhausted.

### **Generators**

Larger activities such as hospitals, schools, offices and bars often have fuel-powered generators for back up in case of a prolonged blackout. Still, gasoline is expensive (about 1 euro per liter) and, often enough, there are shortcomings in the supply and gas stations may run out of fuel. Sometimes there isn't any fuel for weeks, and this also encourages black markets to thrive.

### **Television and other household appliances**

In urban areas there is a moderate increase in the availability of fridges, televisions, washing machines, computers and other electric appliances, most of which are used or refurbished. However due to the high instability in the electric supply, fridges cannot be a reliable mean for food conservation.

Old fashioned cathodic tubes are frequently used in cities and in most medium sized settlements, although modern flat screen output systems are increasingly common. Bars, schools, youth centers and other public areas usually have a television and a DVD player. And a couple of channels can be watched without the need for a satellite dish.

As with all other electronic devices also multimedia players are preferred if cheap and versatile, capable of reading the greatest number of formats, file extensions and codecs; as well as possibly accepting USB devices and SD cards, whereas output quality is not a priority.

### **Telephones**

The demand for low cost phones has induced a parallel pirate market. Pirate models are very similar to originals and the impression is that they may be refurbished. At the central market in Bujumbura mobile phones are available for 10 euros, however, these products are of the lowest quality. For instance a NOKIA 1100 bought in May 2012, subject to normal daily use became nearly useless by December of the same year. The cover cracked, the battery would last only a few hours and the software bugged. The cover had Arab characters on the dials, the inside was marked "made in Sweden" and the battery was undoubtedly low quality made in China.

On the other hand it is possible to buy originals for reasonable prices directly from the providers as



42.000 computers and more than 421.000 mobile phones were collected in Europe, of which respectively 36% and 45% were re-useable. Some of the re-usable computers and mobile phones were and are currently sent to Africa through the *Clic Vert* program.

*Clic Vert*, in fact, is a program totally focused on fostering the digital inclusion of Africa, while contributing to the responsible management of exhausted computers and mobile phones. Since 2005, more than 17.000 computers and mobiles phones have been sent to Africa (Burkina Faso, Benin, Burundi, Cameroon, Madagascar and Niger), enabling schools, small enterprises, NGOs and others to gain access to ICTs. *Clic Vert* has already implemented refurbishing and collection facilities in Burkina Faso, Cameroon and Burundi. Unfortunately, they are not yet fully operating due to the reluctance of companies to pay for their computers to be collected and dismantled.

## **GLICE**

This is the report on the interview with Mr. Roger Ouedraogo, project coordinator at GLICE Bujumbura. The project started in March 2010 and is now in its 3<sup>rd</sup> year. Mr. Ouedraogo reveals an overview on the subject and related problems regarding WEEE in Burundi and in the Northern Tanganyika basin in general.

GLICE provides a program in collaboration with *Les Ateliers du Bocage*, a French NGO based in Le Pin. The project is to create a flow of technologies through different channels, yet granting a safe handling of the end-of-life cycle of these technologies. The *Les Ateliers du Bocage* provide part of the computers while additional machines are bought by GLICE itself mainly through Computer AID.

For instance GLICE Bujumbura has three sites.

GLICE 1 is a central dismantlement facility where computers are collected and dismantled by trained personnel. The workers in fact, are recruited among local technical degree students and, working in the refurbishment shop where they can earn enough to afford university, while acquiring practical knowledge on the subjects studied. Refurbished computers are then used to implement ICT labs in universities and schools. School, in fact, might be the only chance for most people to ever use a computer. GLICE 1 provides maintenance for the whole life of the machines and when at end-of-life, it must be returned to GLICE. GLICE 1 also seeks out contracts with local refurbishers around the country and offers to swap trash collection for refurbished items (ex. N°Kgs of trash for a battery charger).

The exhaust material is then separated and plastics and base metals are sold to companies in Burundi. Plastic is generally recycled for the production of large tanks for water conservation, whilst metal is recycled in the production of construction rods. The rest is tested and working parts are recuperated and refurbished, while all undesirable WEEE is safely stocked. When a noticeable amount of waste electronics will be collected the *Les Ateliers du Bocage* will have them shipped to France in a container for precious and other metal recovery.

GLICE 2 is an internet cafe and shop where anyone can access the internet for 15 FBU/minute (about 50 euro-cents/hour). The shop also sells refurbished computers and components along with food and drinks. The opportunity to have affordable internet access points is vital for information retrieval in such a disorganized country where means are scarce and books are rare.

GLICE 3 is a private school in the north of the capital in a new rising estate. The objective is to provide

courses and internet for local kids and young adults. GLICE 3 also is the administrative headquarters of the enterprise.

GLICE's future projects also include opening labs in Gitega and Ngozi and is trying to expand and provide collection systems throughout the entire country. There are also another two GLICE points in Congo and Rwanda all pooling energies together to create sustainable opportunities for ITC development in the Great Lakes Area.

Focusing deeper on the flow of the refurbished and new technologies entering the country, Mr. Ouedraogo reveals that technology implemented at various levels within the country mostly comes from International Cooperation and NGOs operating in the territory. Most of the Cooperation comes from Belgium, Italy and the UK. However – he remarks - there are substantial differences in the quality of goods depending on the country of origin. In fact, the obsolescence of certain products makes them nothing more than trash. Most of the new products instead are mainly telephony and radio communication devices and usually come from China, Arab Emirates and Sweden.

Mr. Roger Ouedraogo finishes expressing his concern for the increasing amount of technology. Although ICT might actually be at the base of the country's development, there is a lack of government policy for treating the issue of e-waste and toxic waste. In fact he points out that a national program on waste education and responsible management should be a priority for the protection of the environment for future generations.

This pleasant encounter with Mr. Ouedraogo opened a whole new window on the opportunities for sustainable development in Burundi, where, through international cooperation, there are concrete opportunities to bridge the digital divide while preserving the environment. GLICE Burundi is just one example of the involvement of the *Clic Vert* program, which will eventually achieve the results obtained in other countries (Burkina Faso, Benin, Madagascar and Niger), where over a total of 79,7 tons of wastes, the equivalent of 531.000 mobile phones, have been collected since March 2010. 40 out of these 79,7 tons, have already been shipped to France for recycling.

### **Local retailer**

There are three electronic shops in Bururi, a medium sized community in the heart of the country. Interviews conducted with local retailers revealed that each shop sells an average of 500 mobile phones per year for a total of 1500. The majority of models sold are small, inexpensive, but versatile like NOKIA 1100 or HUAWEI G2800 and other base models of the kind. Double SIM card, a memory card slot, radio player and a flashlight, very important because of the scarce public lighting and the frequent blackouts, are the type of features consumers desire.

Mr. Galaxy, who is owner of one of the shops and is also the town DJ, is confident that the sales in larger settlements increase exponentially and can be estimated to be in the order of 1500 mobile phones per year in each shop and there are approximately 50 – 100 shops in every city Bujumbura, Rumonge, Gitega and Ngozi (1500.000 to 700.000) are considered big cities, while Bururi, Makamba, Ruygi, Musinga and Bubanza (10.000 to 150.000 are medium sized human settlements. Smaller communities (< 10.000) might not have a local retailer.

The popularity of mobile communication and the demand for low cost technologies induces network

providers to sell telephones for less than their market value just to gain clients, whom will be spending on phone calls. Hence the phone company purchases the telephone for 40 euro and sells it for 7 -10 euros, thus providing low cost means for a long term revenue in call credit. Since an average client might purchase 2 to 3 euro of credit per week, during the life of the device a lot more money will be spent on phone credits, compared to the full price of the phone. Moreover the consumer will prefer an original upon a pirate.

Mr. Galaxy concludes stating that telephony is a profitable business at the moment and is expected to increase in time. In addition, also music is very important for people and other technological objects are largely appreciated and sold in his shop such as MP3 players, headphones, flash disks, memory cards and CDs. As with phones all other electronic gadgets are desirable when small, inexpensive and versatile. Computers would be appreciated, however the high cost of the machines makes them far from being affordable for the average person.

### **Batwa village**

Burundi's population namely presents three ethnicities, if they can so be called. This is a very delicate issue since the country recently emerges from 20 years of ethnic war. However, history describes the population of Burundi to be composed by Utu, Tuzi and Batwa tribes, the latter of which is the only native inhabitant of the forest. In fact, in the past, Burundi was covered in rainforest and was inhabited by Pigmy (Batwa) tribes, living in the jungle in total harmony with the surrounding nature. Thanks to the abundance of water and the hospitable climate other tribes from the north and the west gained interest in this rich land. Tutzis, who were mainly shepherds and cattle raisers, coming from the north, cut down forests for pasture land, while the Utus from the west would deforest the hills in favor of crops. Then came the Europeans, the Germans first and then the Belgians, who kept on cutting down the natural forest to plant tea and coffee crops. When the country had finally gained its independence in 1962 the natural forest had already been largely depleted and reduced to a mere percentage of its original size. Finally during the war, groups of rebels would hide in the wilderness, hence many forests were burnt down to chase out the dissidents. Unfortunately, not only the rebels failed to be hunted down, but many hectares of forest had been destroyed and most of the wild animals chased away.

Today Burundi presents bare hills, many of which are cultivated exploiting the land to its extreme. Some farmers, for instance, plant manioc almost vertically for how steep the hillsides are. Other parts are preserved as natural parks, even though the original natural forest remaining is nearly extinct. Reforesting projects have seen the implementation of eucalyptus and pine forests, while fast growing, this sort of woods have detrimental effects on the soil.

In some of the natural reserves left, there are still Batwa tribes. One in particular has been included in a project for touristic development. Houses, toilets and even an elementary school were built to improve living conditions and provide primary education. Yet the village has no access to running water or electricity whatsoever and the only connection to the rest of the world is a challenging dirt road winding through the forest. Batwas are artists by tradition and still produce pottery, wood and metal work, using ancient techniques and still sell their products at the markets. Other occupations are agriculture and raising food for self consumption. The life style is in complete harmony with the elements, yet in this small slice of ancient vibrations, GSM network is available and a group of children was playing with a printed circuit board. It might have been from a TV or more probably from an old radio.

Finding a piece of WEEE in the middle of a native community in the heart of the woods in Burundi shows the contradictions of such fast technological development. This image becomes a reason for questioning the sustainability of ICT development and the need for responsible solutions in WEEE management in developing countries.

Moving out of urban areas, internet is increasingly rare, however there still is the possibility to have GPRS internet connection and in some cases UMTS using a small USB device. The connection is very slow, yet sufficient to read emails and search on Google, whereas it's virtually impossible to download videos or attachments. Nevertheless computers are becoming common, more than television, washing machines or fridges.

All cities and towns have several internet points. Some are simple huts or shops where a dozen computers serve for internet access. Internet connection is available for reasonable prices (10 – 15 FBU/minute), still it isn't very fast and can be compared to first generation ADSL available in Europe 10 years ago. In the capital as well as in Gitega and Ngozi there are also other connections available for whoever may have a laptop, in fact there are several bars around town offering wireless along with a drink.

### **Youth Centers**

Another common spot where to find technology and internet are Youth Centers. There are several youth centers around the country, usually financed by international cooperation. Below there is a description of two of these initiatives one in a small village in the interior of the land and the other in the capital. Two different realities, still the needs for ICT development are similar.

### **Centre Jeunes Amahoro**

In Bururi the Italian cooperation has implemented a youth center with connected cyber cafe.

The cyber cafe in Bururi, which is also a youth center where children can meet and learn by following the several activities offered. It is located in a one story building down town between the market and the hospital and is easily accessible to most of the population. All the activities proposed in the center are free and can be followed by any young person, while professionals and grown ups must contribute in order to access ICT training.

The space is divided into three locals: an entrance, a big room 8 x 20 meters, and a back room, also accessible from the entrance. The larger room is supplied with 5 computers used for internet connection and guests customers charging 15 FBU/minute (7 euro-cents) and also has 10 computers used for ITC courses. The 5 computers for internet are modern *HP* models dating only a couple years, fast and efficient. The other computers instead are quite old *HP vectra* models able to support only *Windows XP* or former operative systems. All the computers have been upgraded several times expanding RAM and ROM up to respectively 564 Mb and 80 Gb. Spare hard drives and RAM cards are stored in the stock room along with other 8 *HP vectras* and 10 cathodic monitors, of which only a few are still working. In the rear there are also the satellite internet router, the local wireless router and the distribution switch.

The entire building is powered by a 2,8 Kw solar panel system mounted on the roof. Nevertheless the 10 solar panels cannot alone provide enough energy for the entire day and a few hours after the sun has set, the system blocks due battery under-voltage. The panels in fact are connected to 8 copper/lead truck batteries filled manually with diluted sulfuric acid. In summer 2012 one of the batteries was replaced and another drained and refilled. The battery was refilled and given to a person

living in the hills who could still use it for home lighting. The remaining 70 liters of exhaust acid filled with heavy metals instead are yet pending.

### **Centre Jeunes Kamenge**

The northern quarters of the capital are called Kamenge. This is one of the poorest corners of the city, where over 200.000 people live in very difficult conditions. Due to the multiplicity of people living there it was one of the most struck by the violence of the war. Placed right in the middle of the hottest area of town where the two factions would arise in the crudest guerrilla, the *Centre Jeunes Kamenge*, Founded in 1991 Claudio Marano, provided a small corner of paradise. The center would welcome people of any ethnicity, belief or social extraction, however, it would not allow weapons to be carried inside. This corner of hope gave a place for young people to resist and learn to love one another and live together in peace. Today, after the end of conflict, Kamenge is still a difficult place where the hard conditions of life often can stumble into violent acts. Don Claudio, the Italian missionary priest, who is currently the director of the center, still brings hope to the future of Burundians through his patient and dedicated work. The center's membership is free and allows access to the library, which is one of the largest in the country, and to all the other activities proposed. There is a ping pong and kicker room, a cinema, an internet point with 8 modern computers, where each associate has free access to the web 1 hour per week. Another room is supplied with 16 other machines for ICT courses. The lessons are free and at the end of the course each participant receives a certificate.

### **Scrap metal and WEEE**

Every human settlement has at least one scrap metal collector, who purchases scrap cans, bottle caps, steel sheet and all other kinds of ferrous metal by the kilo. The average deal for one kilo of metal is around 250 - 300 FBU, namely 10 – 15 euro cents. The scrap is then convoyed and resold by the collector to the foundry in Bujumbura.

Also refurbishing shops are very common and local knowledge provides cheap solutions to fix any kind of electric or electronic apparatus. The reparations are done using components taken from other exhaust equipment. Hence all scrap is usually stored for working parts and electronic components: cables are frequently reused and when completely exhaust are stripped for copper, transistors and other working components are reused to fix other items and the trash is stocked or burnt. A local dealer is confident that a ton of electronic scrap can be collected for 100 euro, however, he does point out there are not many tons to collect in the whole country.

Finally the entirety of the current situation of ICT development in Burundi has been outlined. The next section will briefly summarize the study, including comments and ideas for future paths for sustainable development within the country and the EAC in general.

### **Illegal mining and transboundary movements in East Africa**

Since the neighboring RDC Congo has fallen back into a violent political economical crisis, illegal operations in East Africa have noticeably increased. Obviously this is objectionable information since the newly fired war is being currently scenario of the latest genocide carefully hidden by International press. As usual during violent crisis many refugees are leaving the country to find peace and viable conditions in neighboring countries. One of the host countries for instance, is Burundi, a fairly easy to trespass where every day hundreds of refugees pass the border to escape the violence of the guerrilla. Many of the refugees find some way to survive on the other side of the border and it is not unusual to encounter Congolese fugitives offering access to raw materials. For instance it is relatively easy to

receive offers for kilos and tons of Coltan, Copper, Silver and gems. Prices are yet to be discussed however big quantities of various types of precious ore are fairly accessible.

## **CONCLUSIONS AND FUTURE SCENARIOS**

Burundi is a poor country just recovering from 20 years of civil war. Means are scarce, however, signs of development are outstanding. The main interest in future development is technology and fortunately Burundi, compared to other countries in Africa, has not been, and hopefully will never be, a massive dump for first world WEEE. The demand for technology is increasing, yet the population is very practical and demands quality products in favor of cheaper pirate versions or imitations.

The research has clearly described the current involvement of ICT in the development of Burundi. Interviews with local actors along with the study of international markets has confirmed the desire of Burundians for communication. Hence markets have seen the peaking of telephony in the last few years, mainly imported from China and the EU. Computers are less frequent and most are second hand, however government plans and international cooperation clearly foster ICT systems in the implementation of future development projects. Thus many more machines are expected to be entering the country in the near future.

On the other hand there is of global interest, also on behalf of International Organizations, to maintain ICT development environmentally responsible. The United Nations have filed a Call for Action in August 2012 and local NGOs have begun organizing WEEE collection. Currently, a lot of the waste technology is reused locally to fix other items. In offices and in urban areas the consumption of technology is increasing exponentially, however, ICT knowledge and awareness on end-of-life cycle of machines is yet to be widely spread.

This scenario of bridging the digital divide in technological development, accompanied by responsible management of the WEEE generated, could open towards innovative solutions and promising outputs. When carefully managed, this model in which the preservation of natural resources intertwines with latest information technologies, Burundi could actually become trendsetter, a sustainable example for other developing countries and the entire world. Finally through research and technological innovation Burundi could be the cradle of a modern, sustainable system able to combine tradition and respect for nature with the latest communication technology.

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Batwa village

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