

## **Situation and socio-economic development based on the exploitation of natural resources within the framework of the Nile Basin Initiative: The case of Burundi**

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### **ABSTRACT**

The aim of this presentation is to raise the real strengths on which Burundi can base to achieve its sustainable development. Our study is based on data from several studies, departmental reports, and various publications on the Web, which have guided our thinking on possible ways of fostering sustainable development in Burundi.

Burundi is one of the poorest countries in the world. Indeed, with a HDI of 0,313 well below the average index of human development (0448), it occupies the 169<sup>th</sup> place out of 173 countries and 70% of its population lives below the poverty line. Nowadays, life expectancy is 44 years and tends to decrease. The GDP per capita is 96 U.S. dollars while it was at 159 U.S. dollars ten years ago. This figure is now four times lower compared to other sub-Saharan countries.

To address all these socio-economical problems of Burundi, the solutions are based on the following:

The exploitation of the hydroelectric energy potentials and fossil energy (peat) should be enhanced which can enable the development of the industry sector, and the education system has to be strengthened for a sustainable development; In the agricultural and drinking water supply sectors, the use and reuse of water and the use of irrigation as well as utilization groundwater are also good alternatives. Reafforestation and erosion control can protect the water sources and the ecology. Measures have to be taken regarding climate change for a sustainable development. It is also necessary to develop the mining sector which is neglected, by conducting feasibility studies which take into account the preservation of nature. The total and viable integration of Burundi in the NBI community supposes also a good transport and telecommunication network.

In conclusion, while we look at a comparative analysis of economic indicators of the countries of the Nile Basin such as: HDI, Education, population served in telecommunication, water supply, irrigated land, road and railways infrastructure, etc.... our goal is to establish exactly the position of Burundi over the whole economic development spectrum, but more importantly, humbly suggest some solution to policy-makers and development planners in order to achieve a harmonious development, in an environment of peace and cooperation between the Nile Basin countries.

***Key words:*** *Socio-economic potential; development; Burundi; Nile Basin countries*

## INTRODUCTION

Burundi is a country that recently emerged from a civil war that has affected national life in all its socio-economic components. Generally speaking, it is a country that has known, since independence, recurrent crises which not only led to deep divisions of the Society, formerly cohesive, but also affected most the sense of belonging to a secular nation, with the same history.

The recent history has built ethnic walls, psychological ghettos and lack of confidence among Burundian brothers and sisters. The war has also affected the economic life to such an extent that approximately 70% of the population lives below the poverty line. Today, Burundi is ranked 169th country out of 173, therefore, it is among the poorest countries in the world. It relies and lives under the infusion of aid from the international community and is threatened with a danger of social disintegration because of its endemic poverty.

However, despite this gloomy picture, Burundi has alternatives. Today as a member of the East African Community and more broadly as a member of the Nile Basin Initiative, Burundi has opportunities to break this cycle by using its bad experience for a more conscientious and comprehensive development. To attain this, Burundians have to reconcile with the past, inventory the existing problems and know that Burundians have a common past, and recognize the importance of rebuilding confidence among all Burundians and to start again the process of development.

After describing Burundi's physiographic and hydrological aspects, socio-economic situation and its position in the context of the Nile Basin, analysis and proposals are developed in order to make a contribution on how Burundi can move ahead and change its economically bad position.

In the development of this paper, we will focus on the existing potential resources in terms of energy, agriculture, mines and environmental management. Our discussions will take into account the broader space offered by the Nile Basin Initiative in which Burundi is affiliated.

## HYDROLOGICAL AND GEOGRAPHICAL CONTEXT OF BURUNDI

The Republic of Burundi is located in Central Africa, east of the Democratic Republic of Congo, south of Rwanda, and south and west of the United Republic of Tanzania. It covers an area of 27834 km<sup>2</sup> and has a population around 7 million inhabitants. Burundi is entirely a landlocked country between 29° and 30° 54' East longitude and between 4°28' and 2° 20' South latitude.

As far as the water system is concerned, there is a clear linkage between the topography and drainage network. Indeed, there are two river systems separated by a watershed: the Congo-Nile crest. The latter divides water which flows into the Congo Basin from those flowing into the Nile Basin. It is from this Congo-Nile ridge that the sources of rivers flowing into the Nile are found. These are the Ruvubu River and its tributaries Ruvyironza and the Kanyaru, flowing at the border between Rwanda and Burundi, which are the real sources of greatest southern Nile. Thus, the southernmost source of the Nile is Rutovu, located in Bururi province. The latter is indicated by a pyramid built in 1938 by Dr. Burkhardt Waldecker, referring to the pyramids of the Nile valley in Egypt.<sup>63</sup>

<sup>63</sup> <http://musemakweli.ifrance.com/musemakweli/touribu.html> 2007.

Each of these two hydrological systems is in turn divided into sub-basins. The hydrological system of the Congo is divided into the following sub-basins: Rusizi, Tanganyika and Malagarazi while the Nile is formed by sub-basins: Kanyaru, Kagera and Ruvubu.<sup>64</sup> The Ruvubu River, which in itself is a portion of the Nile so named in Burundi and 480 km long, has in itself a catchment area of 12300 km<sup>2</sup>. It originates in the eastern part of Congo- Nile peak at 2500 m and sank to join the Kagera at 2 km from Rusumo Falls, with an average slope of 150 m / km.<sup>65</sup>

Its course is some times interrupted by cataracts. The total flow leaving Burundi into the Nile is estimated at 2.6 billion m<sup>3</sup>.

Burundi has also lakes. One of the lakes is located in the Congo basin namely Lake Tanganyika. It collects all the waters from rivers from the west of the Congo Nile crest and Lake Kivu through the Rusizi. With a maximum depth of 1433 m and an average of 700 m, it is the second deepest lake in the world after Lake Baikal. Its length is 677 km and its average width is 50 km. It is equally the largest reservoir of fresh water in Africa and the second in the world.

The other lakes are located in the northern Burundi and the most important are Cohoha and Rweru.

Burundi is a country with a significant rainfall with an average pluvial of 1274 mm / year of rain. There are 3 rainfall zones namely: the crest Congo-Nile (2600 m) with a rainfall of 1400 to 1600 mm / year, the central plateaus (1400-1750 m) with 1200 mm, depression of North East (Bugesera Natural region) and that of East (Kumoso natural region) located between 1000 and 1500 metres above sea level with a rainfall of less than 1000 mm / year.

The temperatures vary between 12 and 16<sup>o</sup> C for the peak Congo-Nile, 16 and 20<sup>o</sup> C for the central plateau, and between 20 and 24<sup>o</sup> C for the plains of Mosso, ( Imbo natural region), and the north-east depressions.

## SOCIO-ECONOMIC SITUATION OF BURUNDI

Burundi is one of the poorest countries in the world. Indeed, its Human Development Index (HDI) of 0313 is among the lowest in the world and far below the global average of HDI (0448). It ranks in relation to the latter as 171th out of 173 countries, followed by the Niger and Sierra Leone.

The HDI takes into account several factors contributing to the well being of people. It summarizes very well the level of poverty and reflects better the notion of "Human Development" in parallel with "Economic Development". It also considers that the "human well-being is not only due to economic development and income".<sup>66</sup> It brings the notion of "well being" and "happiness" and is based on the Universal Declaration of Human Rights of 1948.

However, GDP, which was often used before, is an index giving very little information about the individual or collective Well-Being.<sup>67</sup>

<sup>64</sup> Ministère de l'Energie et des Mines (1998). Plan Directeur National de l'Eau, Rapport de Base, Volet III: Ressources en eau. V. Planning the future, Gouvernement du Burundi: 99.

<sup>65</sup> Norconsult A.S. and Electrowatt (1975). Aménagement du Bassin de la Rivière Kagera, Phase II – Burundi, Rwanda, République Unie de la Tanzanie: Rapport Technique, Volume 7, Etude Sectorielle, Hydrologie.

<sup>66</sup> <http://fr.wikipedia.org/wiki/>

<sup>67</sup> idem

The HDI is a composite factor calculated on the basis of parameters such as: Longevity (life expectancy), education (literacy rates and school enrolment) and the standard of living (GDP in purchasing power parity).

To finally set ourselves on this human development index (HDI), we propose to review the various composites factors of the concept introduced by UNDP in 1990, applied on Burundi, namely education, life expectancy and GDP.

#### ***Status of education in Burundi***

According to statistics drawn up by UNESCO,<sup>68</sup> from 1999, only 2% of children are registered in pre-primary education.

In the primary, 58% of girls and 63% of boys were registered in 2005. Among these, only 36% completed the full course of primary education.

At the secondary level, the gross rate of schooling is 13% in 2005 while it is only 2% at the University or High School.

A budget of 17% is allocated for Education and is divided up as follows: 52% of the budget for primary, 33% for secondary and 15% for higher education.<sup>69</sup>

#### ***Life expectancy in Burundi***

Life expectancy is 44 years and the fertility rate is 6.8 children per women. It fell from 51 years in 1993 to 44 years in 2005. Longevity is therefore among the lowest in the world and it is linked to the war which lasted more than 14 years.

#### ***GDP in Burundi***

The GDP per capita is the equivalent of 96 U.S. dollars<sup>70</sup> in 2005 whereas 10 years before, it was 157 U.S. dollars. Burundi's GDP per capita is four times lower than the average of the entire sub-Saharan region. Rwanda is slightly better because its GDP represents 44.7% of sub-Saharan figure.<sup>71</sup>

Despite the gloomy picture described through the HDI with its composite factors, this situation could change. It could change rapidly if the public and national forces were capable of a burst of conscience to realize the opportunities for development. Indeed, Burundi has strengths that predestine it to be a country for the future. These are expressed mostly by natural and human resources available including a fertile land, rich in water resources (even if it is not efficiently exploited), a young and dynamic population.

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<sup>68</sup> <http://stat.unesco.org>

<sup>69</sup> Statistiques de l'Unesco (2005), <http://stats.unesco.org/unesco>

<sup>70</sup> [http://www.studentsoftheworld.info/informations\\_pays.php?Pays=BDI&Opt=economie](http://www.studentsoftheworld.info/informations_pays.php?Pays=BDI&Opt=economie)

<sup>71</sup> Les évolutions socio-économiques au Rwanda et au Burundi : Quelles perspectives pour le développement ? *An Ansoms, Amers, avril 2004.*

## SITUATION OF NATURAL RESOURCES OF BURUNDI

### *Water Resources in Burundi*

According to statistics published by FAO,<sup>72</sup> the average rainfall is 1274 mm / year. However, 68% constitute the evapotranspiration and only 31% constituting the internal resources available, divided into surface waters (8%) and groundwater (23%). They total an average flow of 319 m<sup>3</sup> / sec or 10.06 km<sup>3</sup>/year.

According to the "Plan Directeur National de l'Eau" (PDNE, 1998), the flow at the sources is approximately 6 600 litres / sec.<sup>73</sup> The groundwater reserves and its exact distribution in space are not yet determined. Nevertheless, the fact is that groundwater sources are not available except in areas concentrated in alluvial deposits of lowland valleys such as in the sediments of the Rusizi plain and Kumoso with respectively 71% and 35% of their areas (PDNE, 1998).

| Précipitations         | Evapotranspiration    | Débit de base         | Eau de ruissellement |
|------------------------|-----------------------|-----------------------|----------------------|
| 1274 mm/ an            | 872 mm/ an            | 299 mm/ an            | 103 mm/ an           |
| 1011 m <sup>3</sup> /s | 692 m <sup>3</sup> /s | 237 m <sup>3</sup> /s | 82 m <sup>3</sup> /s |
| 100 %                  | 68 %                  | 23 %                  | 9 %                  |

Tab.1: Bilan hydrologique d'une année moyenne. - Source: AQUASTAT, FAO INFO 2005

| Bassin | Surface (Km <sup>2</sup> ) | Débit moyen         |                   |                     | Débit de base       |                   |                     | Débit garanti à 95 % |                   |                     |
|--------|----------------------------|---------------------|-------------------|---------------------|---------------------|-------------------|---------------------|----------------------|-------------------|---------------------|
|        |                            | Km <sup>3</sup> /an | m <sup>3</sup> /s | l/s/km <sup>2</sup> | Km <sup>3</sup> /an | m <sup>3</sup> /s | l/s/km <sup>2</sup> | Km <sup>3</sup> /an  | m <sup>3</sup> /s | l/s/km <sup>2</sup> |
| Nile   | 13218                      | 4.32                | 137               | 10.4                | 3.09                | 98                | 7.4                 | 2.08                 | 66                | 5.0                 |
| Congo  | 11817                      | 5.74                | 182               | 15.4                | 4.38                | 139               | 11.8                | 2.87                 | 91                | 7.7                 |
| Total  | 25035                      | 10.06               | 319               | 12.7                | 7.47                | 237               | 9.5                 | 4.95                 | 157               | 6.3                 |

Tab.2: Ressources en eau renouvelables internes:- Source: AQUASTAT, FAO INFO 2005

Another significant resource is made up of a cross-border water supply of 336 m<sup>3</sup>/sec. It is worth mentioning Lake Tanganyika, the second deepest lake in the world after Lake Baikal and is the largest reserve of fresh water (20000 Km<sup>3</sup>) with an area of 32600 Km<sup>2</sup> of which 2600 Km<sup>2</sup> belong to Burundi.

Other lakes are located in north of which the most important are: Cohoha (59 km<sup>2</sup>) with a water volume of 530,106 m<sup>3</sup> and Lake Rweru (91 km<sup>2</sup>) and 370,106 m<sup>3</sup> volume. The latter is linked to Lake Victoria through the Akagera river.

### *hydroelectric potential*

<sup>72</sup> ([www.fao.org/ag/agi/aglw/aquastat/countries/burundi/printfr1.stm](http://www.fao.org/ag/agi/aglw/aquastat/countries/burundi/printfr1.stm); FAO 2005)

<sup>73</sup> Ministère de l'Energie et des Mines (1998). Plan Directeur National de l'Eau, Rapport de Base, Volet III: Ressources en eau. V. Planning the future, Gouvernement du Burundi: 99.

It is through the development of water and energy resources that development and higher standard of living of population can be achieved. Burundi has attained a very low growth related to energy issues in general and the development of hydroelectric energy in particular.

The first dam with a capacity of 8 MW was built by Chinese on the Mugere River, tributary of Lake Tanganyika in 1982.

Towards 1994, the hydropower potential of Burundi was estimated to be 1371 MW. In 1997, the installed capacity of electric energy was 43 MW of which 32 MW was from hydroelectric dams, the balance being from thermal energy.

To meet its electricity needs, Burundi imports energy from the hydroelectric power of the RUZIZI I / SNEL and from RUZIZI II / SINELAC respectively for about 4 and 8.3 MW available for that purpose, it means 30 to 40% of the total energy. Since 1997, hydroelectric projects with a capacity of 34 MW have been planned. There are dams on the Mpanda (10 MW) which could allow the irrigation of 5550 Ha in the Rusizi plain and dam on the Kaburantwa with a capacity of 20 MW. The implementation of these projects were planned for 2000 for Mpanda and 2002-2003 for Kaburantwa but the war didn't permit their execution up to now.

There are still 17 small units of hydroelectric dams of the capacity slightly higher than 1 MW that are operational and totalling 0.93 MW.

Since 2005, another series of hydroelectric projects on rivers Jiji and Mulembwe with respectively 15.5 MW and 16.5 MW of capacity were planned.

Other international projects such as Ruzizi III and Rusumo with respective 82 MW and 62 MW of capacity are also planned in the framework of NELSAP-Projects. Besides REGIDESO, the General Director for Energy and rural Hydraulics (DGER) is responsible for providing water and electricity in rural areas.

Briefly put, electricity production in Burundi is mainly from hydroelectric (95%) and consists of 27 hydropower schemas including two regional ones.

Despite heavy public investment made in this sub-sector, the electrification rate in the country (number of households electrified as compared to the total number) is very low.

### *Fossil energy*

The share of hydroelectric production to the total energy use in Burundi, represents only 0.6%. Indeed, 95 % of the total energy is based on traditional sources namely wood and charcoal. But the tragedy that is looming on the horizon is that consumption exceeds production of wood. More than 5.7 billion tones of wood are used each year. The rural areas consume 76% of the total consumption of wood or 2.9 Kg / household / day.

Peat, whose reserves are estimated at 100 million tones out of which 57 millions are exploitable, could possibly reduce the deforestation. However, the only company which operates in Peat production, ONATOUR (Office National de la Tourbe) has a very limited capacity. Only 12000 tones/year are produced which represents 0.04% of the energy consumed in Burundi.<sup>74</sup> The imported petroleum products represent 2.5% of the total consumed energy.

<sup>74</sup> MINEFI-DGTPE (2005). "L'Energie et l'Eau au Burundi, 8 mars 2005- Missions Economiques, Ambassade de France au Kenya."

### *Status of irrigation in Burundi*

Irrigation in Burundi occupies a very limited priority in the agricultural production system. Indeed, according to statistics (FAO 2005), the irrigated area is 21430 Ha and represents 1.6% of the total cultivated area. The average increase per year over the last 15 years (1985-2000) is 2.7%.

The topography of Burundi as described before can be subdivided into two major groups according to suitability for irrigation. It consists of the Western and South Western region and the central region from North, North East and East.

The irrigable area between 700 and 1000 metres above sea level, is the plain of the north Imbo in which Rusizi river flow as a tributary of Lake Tanganyika; the center Imbo, drained by the river Mpanda; the south Imbo region with palm oil trees and the Plain of Nyanz lac.<sup>75</sup> The total area is 95000 ha which are made up from Imbo plain ( 75000 ha) and 20000 ha from the Moso plain.

The other part consists of the central plateau, north and north-east, which are part of the Nile basin. It is a hilly region interrupted with marshes between 1100 and 1700 m above sea level. The marshes are 120000 ha or 4.3% of the total area of Burundi (without considering the lakes).<sup>76</sup> These are very important in the survival of populations during the dry season.

## MAJOR ENVIRONMENTAL CHALLENGES IN BURUNDI

### *Deforestation*

In Burundi, the degree of deforestation has reached alarming proportions ranging up to 47% of its coverage, or 137000 hectares of forests in the period between 1990 and 2005. Today, Burundi has only 152000 hectares of forest. The consequence is the negative impact on the ecological balance especially in terms of biodiversity. Indeed, these deforestation for heating and charcoal production, timber production and expansion of farmland, in the forest reserves of Burundi (2500 species)<sup>77</sup> lead to a reduction if not to a disappearance of some plants in which some are endemic. Similarly, wildlife is threatened by these acts caused by the population, the administration and during the civil war by security forces and rebels.

### *Loss of soils*

The ever increasing population leading to a high exploitation of arable land resulted in erosion and has become one of the major Burundian problem that threatens our once very fertile soils. This phenomenon is exacerbated by the rugged terrain whose bottomlands are made up of marshes, reservoirs of water during the dry season. The willingness to put in place mechanisms in order to fight against this phenomenon is still very low.

The consequences of the loss or erosion of soils include: reduced soil fertility, gullies that reduce farmland, silting marsh, siltation of rivers and lakes, etc....

<sup>75</sup> PDNE (1998). "Plan Directeur National, Rapport de Base, Volet III: Ressources en eau".

<sup>76</sup> idem 9

<sup>77</sup> Burundi. <http://rainforests.mongabay.com/deforestation/2000/Burundi.htm>

Another consequence is the drying up of water sources because of deforestation, which increases the amount of runoff and soil loss. Indeed, springs, fed by water infiltration, lose their flow.

### Climate Change

The global climatic changes do not spare Burundi as a result of which there is either flooding or long periods of unusual drought affecting farmers and sometimes destroying crops. Another consequence is the draining of lakes and the reduction of river flow which may even reduce performance of hydroelectric dams.

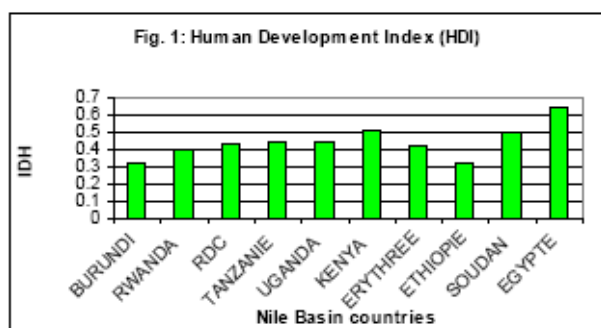
Another consequence is the spread of diseases like malaria in areas of high altitudes because of the increase in temperature and floods.

### COMPARATIVE ANALYSIS OF SOCIO-ECONOMIC PARAMETERS OF BURUNDI WITH REGARD TO OTHER NILE BASIN COUNTRIES

In order to appreciate the position of Burundi as compared to other Nile Basin countries, several socio-economic parameters have been analyzed on the basis of data published on the Web.<sup>78</sup> The statistics provide a basis for comparison of the following parameters: the people, areas, the human development index (HDI), the rate of growth, the occupation of populations per sector, GDP / sector, energy consumption in terms of barrels consumed/day, energy production (in MW), the number of people with phones and mobile phones, asphalt and paved roads, the areas of irrigated land as well as arable land compared to the total area.

### Human Development Index Analysis.<sup>79</sup>

Burundi has the lowest Human Development Index among the Nile Basin countries. It is followed by Ethiopia and Rwanda. However, the observation is that Nile Basin countries, with the exception of Egypt, Kenya and Sudan are all below the average HDI ( 0,448 ) and therefore very poor.



<sup>78</sup> <https://www.cia.gov/library/publications/the-world-factbook/geos/by.html>

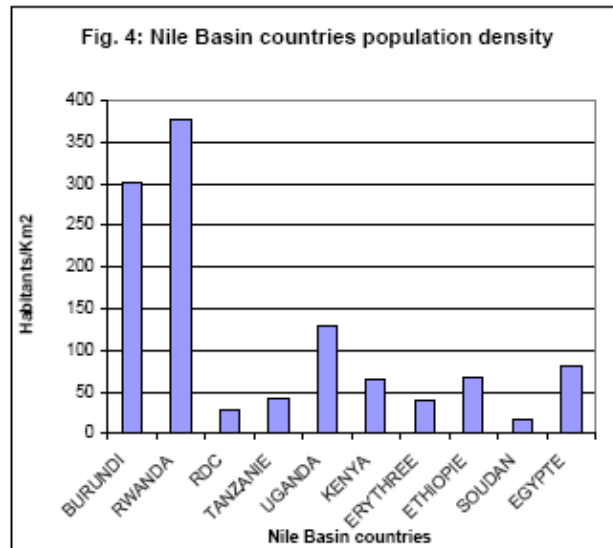
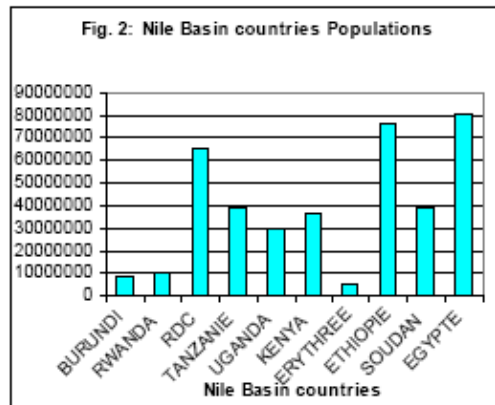
<sup>79</sup> see Fig. 1



***Populations of the Nile Basin countries.<sup>80</sup>***

Burundi, Rwanda and Eritrea have the lowest populations of the Nile Basin countries. However, with a very limited area, Burundi and Rwanda set the record in population density, which vary between 300 and 400 inhabitants per km<sup>2</sup>, and also throughout all Africa. Other countries such as: DRC, Tanzania, Eritrea and Sudan are below 50 inhabitants/Km<sup>2</sup>.

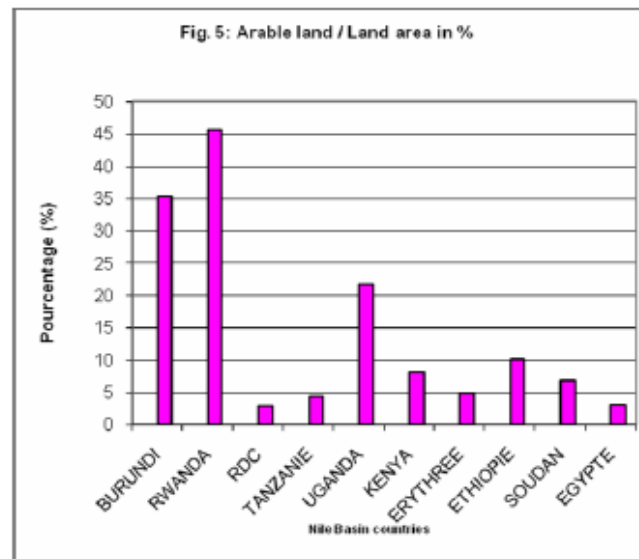
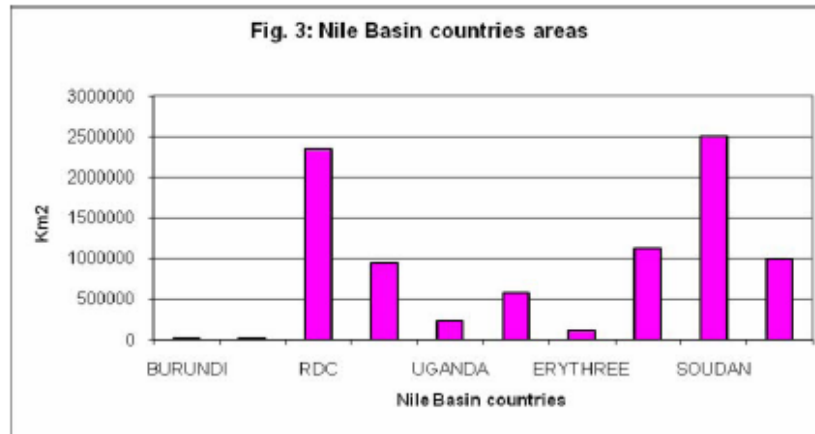
The rest, apart from Uganda which is slightly above 100 inhabitants per km<sup>2</sup>, are below 100 inhabitants/Km<sup>2</sup>.



<sup>80</sup> see Fig. 2 and 4

***The size of Arable land in Nile Basin countries.<sup>81</sup>***

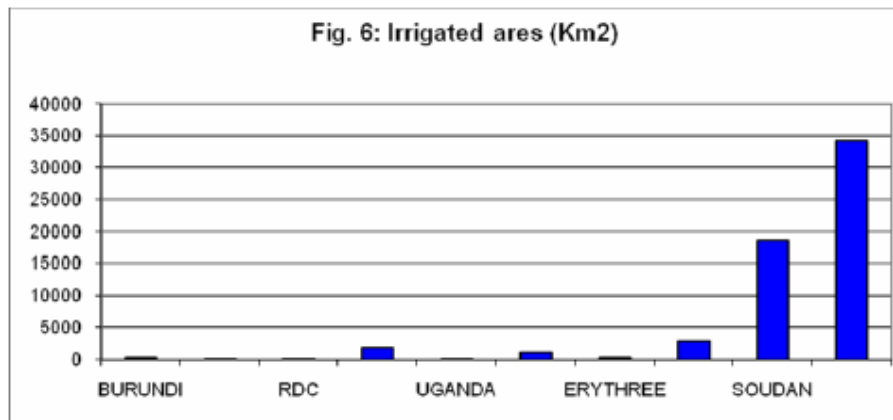
The proportion of arable land for Rwanda, Burundi, followed by Uganda is high. The other countries are well below 10%.



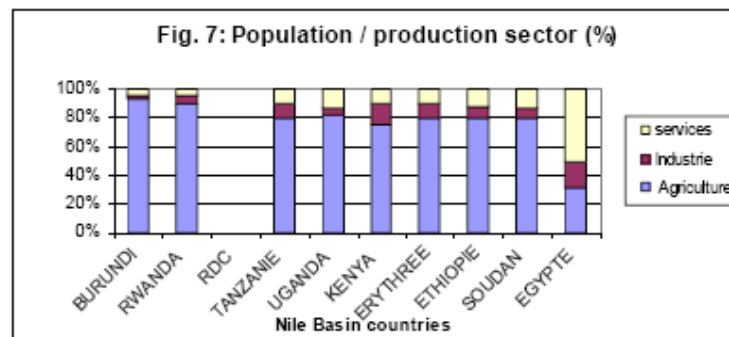
<sup>81</sup> see Fig. 5

***Irrigation in the Nile Basin countries.***<sup>82</sup>

Irrigation practice is almost non-existent in the Great Lakes African countries. It is more significant in Egypt followed by the Sudan. It is an important indicator of development. This factor is to correlate positively with the increase of agricultural production. Indeed, by irrigation, we can cultivate and produce throughout the year even in the dry seasons.

***Populations per production sectors in the Nile Basin.***<sup>83</sup>

Except Egypt, at least 80% of the population of all the Nile Basin countries is active in the agriculture sector. For Egypt, the majority of the population is employed in the secondary and tertiary sectors. This leads to conclude that Egypt can be classified among emerging countries.

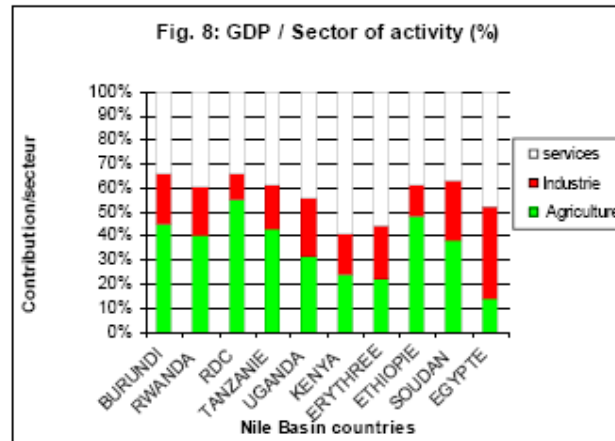


<sup>82</sup> see Fig. 6

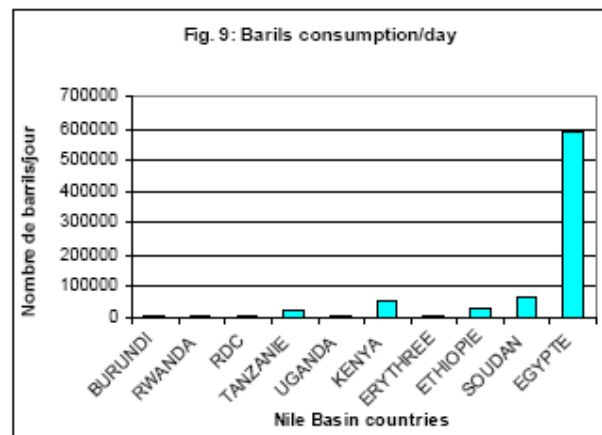
<sup>83</sup> see Fig. 7

***GDP Contribution per sector of activity.<sup>84</sup>***

Except Egypt, the contribution of the industry to the GDP in the Nile Basin countries is insignificant. It is the agriculture and services which form the bulk of GDP. This shows that agriculture plays a great role in the economic activities. Another problem is the very weak agricultural productivity capacity of those countries and also the low value of the products on the international market.

***Consumption of oil in the Nile Basin countries.<sup>85</sup>***

Oil consumption is also an index that assesses the degree of development of a country. Seen from this angle, Egypt emerges as the biggest consumer of oil and thus enjoys a more intensive economic activity than its partners. However, we have to add that Egypt produces itself oil and so has facilities as far as the consumption of this product is concerned.

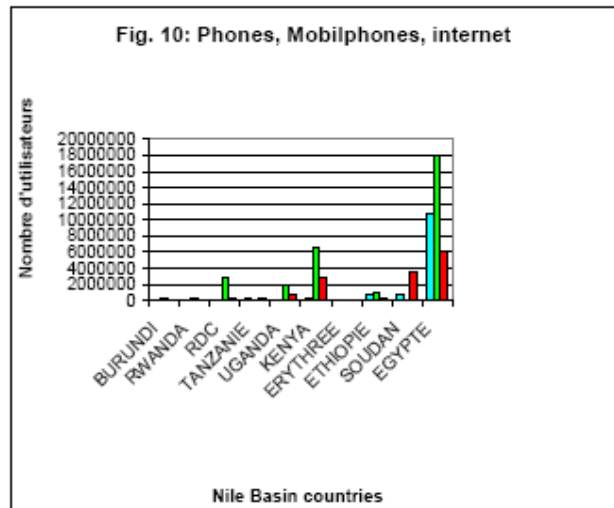


<sup>84</sup> see Fig. 8

<sup>85</sup> see Fig. 9

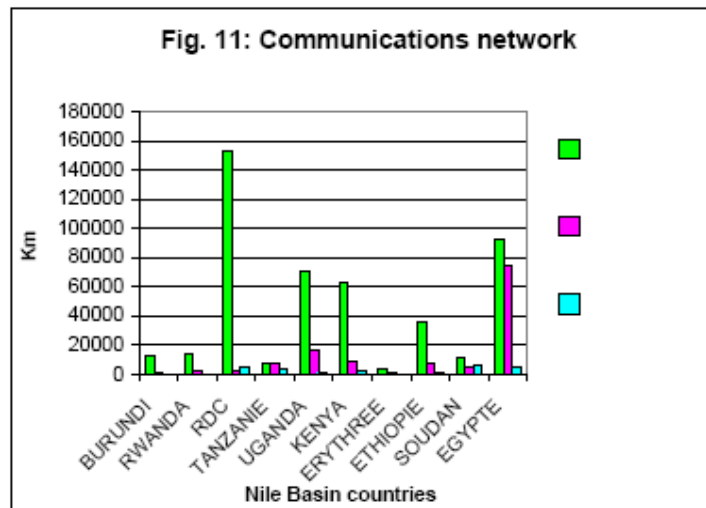
**Telephone communication, cellular and Internet**<sup>86</sup>

With regards to the communications system of the Nile Basin countries, it appears that Egypt and Kenya are the most developed countries as far as the communication is concerned. Other countries still have a long way to go.



**Road and railway network**<sup>87</sup>

Very few countries in the Nile basin have important railways. Burundi and Rwanda have no railways. However, most of the existing railways date from the colonial period and are sometimes faulty and poorly developed.



<sup>86</sup> see Fig. 10  
<sup>87</sup> see Fig. 11

Considering all these parameters, Burundi emerges as a very poor country, practically the last of the Nile Basin countries. We have already seen that in terms of hydropower, only 3% of the total capacity are exploited;

In terms of irrigation system, only less than 3% of the total is irrigated. The fossil energy, namely peat, is operated with a small percentage of 0.04%. Land management is almost non-existent and the rate of soil loss is very high. Industrialization is in an embryonic state and tends to fall back. In summary, Burundi HDI describes its level of poverty below the world average of 0,448 as already mentioned.

### **EXPLOITATION OF AVAILABLE RESOURCES FOR A BETTER DEVELOPMENT IN BURUNDI**

Our observation is that in order to develop, each country must take its human potentialities and available natural resources into account. Some countries are poor in natural resources (water, mineral resources, etc...) but they have successful development through exploitation of the genius of their human recourses.

Burundi has fertile land, sufficient water resources and some mineral resources that can be developed.

This means that Burundi is not devoid of natural resources but it lacks the necessary know-how for its own development and also lacks good political and social environment in order to reverse the situation of being the least developed country in the world.

Regarding human resources, considering its small size, the existing engineers, doctors, licensed and available technicians can contribute to the achievement of sustainable socio-economic development in relatively short time. But success is conditioned on political will and good governance.

#### ***The exploitation of the total hydropower potential***

The first pillar of development is the efficient use of the hydropower potential. Indeed, a population living in darkness can not be mobile and innovative. Light illuminates not only the environment in which we live but also our minds, our imagination and creativity. With electricity, drinking water supply by pumping systems is possible, opportunities will be available for learning at home for students and other people, and broadcasting which can bring new and modern thinking and new behaviors will also be possible. Use of the internet will also be popularized and the world becomes a small village etc...

The production of electricity brings about transformation, boost food production and transform our mining sector in order to give them added value, etc... Therefore, hydroelectric production is one of the priorities in improving the quality of life and production in all domains.

Let's also mention that the exploitation of fossil fuels such as peat and alternative energies are equally needed.

#### ***Public education***

The education of the population must also be a priority. A good education permits the population to use all opportunities for its development. Education must harmonize theory and practice for good results.



It is extremely important and urgent to strengthen technical training. Indeed, our population is composed of over 60% of youth, so, the government has to provide them with training that would allow them access to work and their attachment to their natural environment.

#### *Agriculture and irrigation*

The population of Burundi manages to survive thanks to an archaic agriculture practices. However, if this does not change in the short term, it may experience famine and severe malnutrition.

Thus, agriculture is a key domain in the development of our country. With a population of more than 7 million in 2007, Burundi's population will almost doubled in 2025. It will be necessary to triple food production on the same area. This cannot be achieved without a modern irrigation, conservation of rainwater, soil loss reduction, the application of lime to neutralize acidic soils which constitute the majority of Burundian soil, the use of organic fertilizers and chemicals, reforestation as well as the promotion of applied research in agro-livestock and forestry.

#### *Environment and tourism*

Good environmental management does not only restore the ecological balance but also increase food production, hydropower and the use of charcoal for the households remain nevertheless necessary.

A good environment also incites tourism. Indeed, Burundi has a relief of a particular beauty capable to draw the curiosity of tourists. The organization of this sector can generate significant revenue that can compete even with revenue from exports products. In the tourism sector, the exploitation of Lake Tanganyika must be taken into account because it is particularly rich in variety of fish and some of which are endemic. It is also one of the largest reserves of fresh water and the second deepest lake in the world after Lake Baikal.

#### *Fishing and fish farming*

Fishing and aquaculture are two areas which are still under-exploited. Lake Tanganyika is full of fish that can to some, because of their endemic nature, become delicacies sought in the world. It could not only use them as foodstuffs but also for export as part of aquatic collection (aquaculture).

Fish farming could easily be an element that can improve the nutritional quality of the population. Obviously, fishing has to be accorded particular attention in order to have a lasting exploitation.

#### *The mining sector*

The mining sector occupies till now a low priority, as far as its contribution to the economy of the country is concerned. In fact, much has not been done apart from the big Musongati nickel deposits, the explorations of which have been made up to now. The exploration results have not yet been conclusive. Moreover, in 1977, mining studies have been made with the aid of Germany, Belgium and the UNDP cooperation. However, the reserves have not been conclusive. Thus, the semi-industrial or cottage industry exploitation has been adopted.



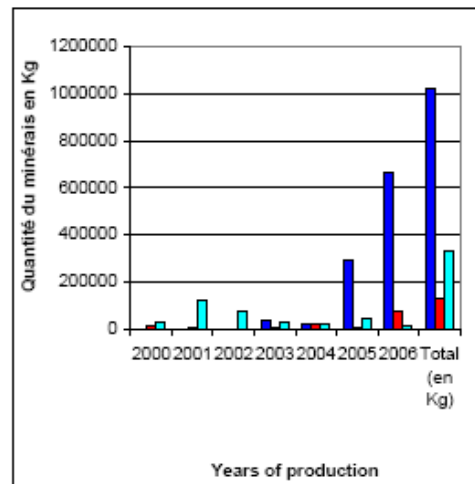


Fig. 12: Wolframite, Tin and Coltan production.

| Substance minérale | Production annuelle (kg) |        |       |       |       |        |        | Total (en Kg) |
|--------------------|--------------------------|--------|-------|-------|-------|--------|--------|---------------|
|                    | 2000                     | 2001   | 2002  | 2003  | 2004  | 2005   | 2006   |               |
| Wolframite         | 0                        | 0      | 0     | 32788 | 23857 | 294505 | 688184 | 1019334       |
| Cassitérite        | 9978                     | 5398   | 0     | 8767  | 18612 | 8100   | 78898  | 129753        |
| Coltan             | 31175                    | 122537 | 72441 | 24382 | 23356 | 42592  | 16177  | 332660        |

Tab. 2: Production of Wolframite, Tin and Coltan since Year 2000 until 2006.<sup>88</sup>

Nowadays, the cottage mining exploitation occupies around 40000 mining craftsmen spread all over the whole Burundian territory and support more than 200000 people.

The purchase and exports of minerals are carried out by Bujumbura and Ngozi legal trading posts.<sup>89</sup> Some of the ores exploited in Burundi are: Tin, Gold, Coltan and Wolframite.

Regarding the exploitation of gold, the production has increased from 415 Kg in 2001 to 4600 Kg in 2006. The related receipt in 2006 was 451.627.353 Burundian francs. This shows that it is possible to increase the production of this ore. At the moment, foreign companies are trying to make an exploration work in order to increase its exploitation. Concerning Tin, wolframite and Columbo-Tantalite, positive progress of their production can be realized, particularly with regards to Wolframite ( see Tab. 2 & Fig. 12).

The quantities are not high but the tendency for the exploitation of Wolframite, the most preferred metal all over the world, is encouraging (See Tab.2 & Fig.12). The best way should be to enrich these ores through metallurgical processing within Burundi. This allows getting ores with added value enabling to secure increased foreign exchange. However, feasibility study should follow this policy in order to determine the actual available quantities for building better infrastructures, and industrial setup.

<sup>88</sup> Note sur les minerais de cassitérite, wolframite et Coltan, 2006. Ministère de l'Energie et des Mines.

Another ore which is not yet exploited but with significant reserve is Nickel. This metal is equally preferred because of its various applications in strategic domains such as the production of steel. The exploitation of “ Nickel latéritifère” depends upon sulphuric acid import sufficient for the treatment of this ore. But its exploitation depends on the availability of adequate energy capacities. The reserves are subdivided at Musongati (180000000 tones ), Waga (35000000 tones) and Nyabikere (46000000 tonnes) with an average yield which is between 1.45 and 1.62 %.

Another ore is the Vanadium of Mukanda with 9700000 tones with an average yield of 0.63%.

## CONCLUSION

Although Burundi is endowed with considerable potential in terms of its natural resources, potential hydropower, fossil energy (Peat), mineral resources and a climate favorable to the use of alternative energy (solar, wind, biogas), it remains one of the poorest countries in the Nile Basin but also on the planet. This is due to a difficult socio-political environment, compounded by many ethnic problems and aggravated by the history of the recent past of physical violence, suffered by the population. However, awareness of this situation can change this grim picture to much more cheerful situation. Efforts should be made to avoid misunderstandings among the population and create a better situation to exploit our resources by setting appropriate priorities. The development of the energy sector, the driving force of any other development activities (processing industry of agricultural products and mining, drinking water, lighting public and private facilities, etc...), requires special attention. But, concomitantly, education is another cornerstone of development, as indeed, without it, nothing can reassure the sustainability of this development in time and space. Protecting the environment is the guarantor of sustainable development. Reforestation and introducing practices of anti-erosion are important steps so that we can sustain our water resources, our arable land, maintain the biological ecosystem, increase production and boost tourism.

Agriculture must rely on the development of new lands and integrate production with irrigation wherever possible (the Rusizi plain and the Kumoso).

Burundi is now a member country of the Nile Basin Initiative, and also the Economic Community of East Africa. As such, its development must reflect this environment in which it has much to gain in collaboration with these economic entities in which it is possible to open trade not only commercial but also a multifaceted cooperation and a positive and constructive competition.

### Acronyms:

|     |                         |
|-----|-------------------------|
| HDI | Human Development Index |
| GDP | Gross Domestic Product  |
| MW  | Kilogram                |
| Ha  | Hectare                 |