Strengthening Higher and Technical Education in DRC

REPORT SUBMITTED TO RUFORUM

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EXECUTIVE SUMMARY

It is recognized that sustainable economic development is positively and strongly correlated with the quality of education and training delivered in a country. Education contributes to build the workforce for achieving the sustainable development agendas. It contributes to the development of competitive, integrated and knowledge based progressive societies, production of competent civil servants for effective running of the different sectors of life including government responsibility, business management, providing law and justice, banking etc. The higher education enrolment growth has however been phenomenal across the continent. Very few public universities have been created; but a proliferation of private (totally or partially) universities have been observed in several SSA countries. Three types of private universities have been operating across the SSA region. These include the state supported universities that receive some form of support from the state and regulated by state authorities. The non-profit private universities operated by trusts and relying on the students' fees is the second category of private universities. The last category are the universities which were established for profit. These universities have proliferated from the beginning of 1990s and are outnumbering the public universities in several countries. The quality of the private universities is variable across the continent and dependent on the existence and level of implementation of the legislative requirements, the quality of governance at the university, quality of the infrastructure and student recruitment.

The democratic Republic of Congo is a signatory of the Southern African Development Community (SADC) Protocol on Higher Education and Training, and has acknowledged the role of higher education in national and regional development and the importance of a regional higher education system. The country has experienced two decades of instability which has impacted several sectors of its economy and include its education sector. For the last two decades limited statistics has been published concerning the status, investment and challenges facing the sector. This information is important in designing appropriate strategies of enhancing the impact of this sector to the national and regional economy. The objectives of this study were to i) review the current statistics (including investment) available on Higher and Technical Education in the country with a focus on those relating to Science, Technology and Innovation; ii) establish key issues, gaps and challenges for Higher Education and ii) make recommendations for strengthening the sector and to inform future initiatives in higher education to be considered by RUFORUM and DR Congo Government in engaging with partners at national, regional and international levels.

It was found out that DRC has large and growing higher education system, which includes public institutions and private largely dependent on family funding. Due to demographic pressure the enrolment is rapidly increasing in both public and private HEIs, reducing significantly the government resources allocated to train a student. This is likely to overwhelm the entire HEIs if preventive measures are not taken considering the socio-economic environment of the student families. Despite recent efforts to improve budget allocation to education, public education has remained underfunded compared to most other countries in the region, with only 10.9% of the government budget allocated to education and implementation budget of 1.8% of GDP in the sector. In addition, the sector is facing various challenges including, limited academic autonomy in selecting leaders and designing the curricula, proliferation of HEIs, and a plethora of administrative staff both in the ministry and in the HEIs. Congolese women and girls do not

benefit from equitable representation in the HEIs in the DRC at all levels. There is inequality in access to higher education, academic careers and managerial functions as a pyramid that tapers from the bottom to the top. R&D and Science, technology and Innovation has been marginalized for the last two decades.

Based on the above results and conclusions, there is need to:

- Ensure adequate funding of the education system and its future expansion. This funding should aim at increasing in the unit cost of operations and equipment in order to make viable the higher education system. This will also require diversification of funding sources.
- Develop medium to long term plans to resolve the HEIs structural and governance challenges that threaten to compromise the quality of the training provided by the HEIs. The quality of HEIs students not only depends on the quality of the HEIs academic staffs, the quality of the learning conditions at HEIs but also the quality of the pre-university training. There is therefore need to enhance the learning conditions in the pre-university schools, standardize the training at these levels, promote more practicals than theories and thinking than memorizing.
- Build capacity of HEIs academic and administrative staff, through south-south and north –south partnerships. However, taking into consideration the current quasi isolation of the country at international level, there is a need to push for more south-south collaborations. There are various HEIs in the different regions of the continent which could offer adequate training to human resources in DRC. To this effect, RUFORUM as a network of universities for capacity building offer multiple opportunities for the country.
- Strengthen the capacity of the "Commission Permanente des Etudes" of the Ministry of Higher Education, to be able to perform its tasks, and regularly evaluate programmes and accredit them.
- Create a credible quality assurance system, which would have authority over both public and private HEIs.
- the use of innovation systems approach to strengthen the technological capabilities of the country
- Evaluate the scientific and technical potential of R&D institutions;
- Institutionalize the collection and management of HEIs, R&D, and Science, Technology and Innovation (STI) statistics with a view to producing indicators for Experimental Research and Development (R&D) and Innovation;
- Create and strengthen partnerships between major stakeholders in the national innovations systems for enhanced R&D and STI within the country.

1. Background

It is currently recognized that sustainable economic development is positively and strongly correlated to the quality of education and training delivered in a country (UNESCO, 2006; Bloom et al., 2014). Education help to build societies and build the workforce that will contribute to sustainability agendas (Martin & Jucker, 2005). According to Saint (2009), education institutions serve as power houses for the production of progressive work force in a country, hence prepare citizens to participate in all walks of life. According to Salazar-Xirinachs et al. (2014) "Learning builds up dynamic capabilities which are key drivers of catching up and economic development". Education, also contributes to the development of competitive, integrated and knowledge based progressive societies (Von Tunzelmann and Wang, 2007), production of competent civil servants for effective running of the different sectors of life including government responsibility, business management, providing law and justice, banking etc. Education has been useful in creating awareness on the concept of sustainability (Rowe, 2010; Weissman, 2012). In so doing, their role in shaping the way in which future generations will cope with the complexities of economic growth is not disputable. Higher education institutions also contribute in providing the knowledge required for development. It essential for design and productive use of new technologies, and providing foundations for a nation's innovative capacity (Carnoy et al. 1993; Serageldin 2000; Pillay, 2010). However, their participation rates in developing countries has remained very low, particularly in sub Saharan Africa, where the rate of participation was estimated to be less than 5% (Bloom et al. 2006).

The higher education enrolment growth has however been phenomenal, with some national systems in Africa expanding more than ten-fold since 2000 (Kruss et al., 2015). Very few public universities have been created; but a proliferation of private (totally or partially) universities have been observed in several SSA countries. Three types of private universities have been operating across the SSA region. These include the state supported universities that receive some form of support from the state and regulated by state authorities. The non-profit private universities operated by trusts and relying on the students' fees is the second category of private universities. The last category are the universities which were established for profit. These universities have proliferated from the beginning of 1990s (Varghese, 2004) and are outnumbering the public universities in several countries. The quality of the private universities is variable across the continent and dependent on the existence and level of implementation of the legislative requirements, the quality of governance at the university, quality of the infrastructure and student recruitment.

Any SSA nation that aspires to develop and improve the well-being of its citizens must therefore take its human capital investment seriously (Oketch, 2016), and support learning processes to develop dynamic technological capabilities at all levels (SalazarXirinachs et al., 2014) for their economic development. Science and technology links and knowledge exchange with universities, research organisations and other organisations are critical for technological capability building, but equally so are linkages to those organisations or actors that build the skills required at all occupational levels of the firm. In this regards, institutions organizing Science, technology,

engineering, and mathematics (STEM) programmes and/or Technical and Vocational Education and Training (TVET) are important in impacting the required scientific and technical skills. Universities involved in STEM training have remained very few in SSA, exposing the region to the dual challenge of recruiting and retaining diverse talents and ensuring that trainees receive the necessary STEM skills and resources to effectively compete and interact with their peers worldwide (Okeke et *al.*, 2017). Also, despite the tremendous success registered in TVET training across the region, several transverse challenges affect the TVET training in SSA, including the quality of the teacher training, the curriculum of TVET schools and the adequacy of the infrastructure.

Moreover, the enrollment rates for higher education in Sub-Saharan Africa, though still the lowest in the world, have tremendously increased over the year, putting enormous pressure on public university which in most cases were created during the colonial period (Bloom, 2005). The low enrollment in the region was attributed to the fact the international development community had encouraged the African governments' to put more emphasis on the lower level, as they believed that tertiary education was less important for poverty reduction (Bloom 2005). The emergence of a highly competitive, globally integrated, knowledge-driven world economy has played a key role in reshaped this conventional belief and boosting the enrolment in higher education across the region.

Financial investment to education in Africa, however, has remained very low. For example, between 1995 and 2005 only about 0.78% of the continental gross domestic product was invested in education, despite the fact that the enrolment had tripled (World Bank, 2010). Only about a fifth of its current public expenditure on education is dedicated to post-school education (World Bank, 2010). The mismatch between annual rate of enrolments and the public resources expenditure leads to a rapid decline in public expenditure per student. The situation is very alarming in the poorest and countries emerging or still in conflicts. Fewer funds are allocated per student and more resources are allocated to more compelling sectors including national security and military expenditure.

The democratic Republic of Congo is a signatory of the Southern African Development Community (SADC) Protocol on Higher Education and Training, and has acknowledged the role of higher education in national and regional development and the importance of a regional higher education system. The country has developed a draft policy on Science, Technology and Innovation. The country has experienced two decades of instability which has impacted several sectors of its economy and includes its education, Science, technology and Innovation sectors. For the last two decades limited statistics has been published concerning the status, investment and challenges facing both sectors. This information is important in designing appropriate strategies of enhancing the impact of these sectors to the national and regional economy. The objectives of this study were to i) review the current statistics (including investment) available on Higher Education, and particularly on Science-Technology and Innovation (STI) in the country, ii) identify the key challenges facing the HEIs and STI sector in DRC and iii) propose specific recommendations for strengthening these sectors and to inform future initiatives in higher

education to be considered by RUFORUM and DR Congo Government in engaging with partners at national, regional and international levels.

2. Objectives of this assignment

The objectives of this study were:
- A review of the current statistics (including investment) available on Higher and Technical Education in the country with a focus on those relating to Science, Technology and Innovation;
- A comprehensive review of the literature to establish key issues, gaps and challenges for Higher Education
- Detailed recommendations for strengthening the sector and to inform future initiatives in higher education to be considered by RUFORUM and DR Congo Government in engaging with partners at national, regional and international levels.

3. Country context

With its area coverage of 2.345 million sqkm, The DRC is geographically the second largest country in Africa and the largest Sub-Saharan African (SSA). It has an estimated population of 85 million, the third largest SSA population behind Nigeria and Ethiopia. The country is has been subdivided into 26 administrative provinces in 2006. About forty percent of the country population is located in three provinces namely Katanga, Kinshasa and Bandundu. The most populated provinces include Katanga, Kinshasa and Bandundu. The major cities include the capital Kinshasa, Lubumbashi, Mbuji-Mayi and Kisangani. Kinshasa is among the highest populated urban conglomeration in the world.

a. Demographic context

The population of the DRC is dominantly young, with about 45 percent of the population below the age of 15. The cohort of school age children (6-17yrs) is expected to increase to 24.7 million by 2020. About 50 percent of the population is female. The fertility rate is at 6.04 births per woman, one of the highest in the world. The large youth composition of the country renders the education sector a key focus area for the development agenda of the country and in ensuring young Congolese are able to fully participate in the economy. The changing demographics of the DRC is an important component in understanding the stock, evolution and possible trends in the human capital accumulation of the country.

b. Humanitarian context

The country has experienced several years of armed conflicts, particularly in both Kivu provinces (South and Nord), inter-ethnical clashes in Ituri and Mitumba regions, the Kamunia Nsapu clashes in the Kasai region and the conflict in Mai-Ndombe. Millions of people have been internally displaced creating more pressure on existing infrastructure (schools and health related) in the hosts' localities. In addition, the country has also faced several episodes of Ebola virus outbreak in North western and Eastern party of the country. According to the Humanitarian Response Plan (HRP) of 2017 – 2019, about 15% of the population of DRC need humanitarian assistance, and about 60% of them are children. The situation has been aggravated by the current pandemic of COVID-19 which has affected activities in most of the major cities of the country.

c. Socio-economical

DRC natural, mineral and energy resources potentials contrasts with the scale of poverty of the majority of its population (16 million people are in food insecurity) and the low level of Human Development (Human Development Index (HDI) 2017 of 0.457) (UNDP, 2018). In 2017, the per capita income average US $ 458 and with a GDP growth rate of about 3.7% (Central Bank of Congo, 2016). More than 70 per cent of the population lives below the poverty line, which can be multifaceted (low income, lack of food, difficulties in access to health care, schooling, decent housing, etc.).

The multidimensional poverty indices that measure the intensity of household deprivation in the areas of education, health and standard of living, show that more than 50.8 per cent of the Congolese population would still live in multidimensional poverty, nearly 36.7 per cent would be in severe multidimensional poverty and about 18.5 per cent in a situation close to multidimensional poverty (UNDP, 2016). This shows that poverty reduction requires a strong growth-oriented economic policy (at least 10-12 per cent per year for ten years), coupled with a satisfactory distributive policy, in order to hope to halve poverty by 2030. Since 2000, the government has been committed to the implementation of the Millennium Development Goals (MDGs), with a view to addressing poverty, improving the living conditions of the population and rebuilding social cohesion in places affected by the multiple movements of the population. It has thus established a set of action programmes to act effectively and promote social well-being. The courageous reforms carried out during the decade 2000 have allowed the country to stabilize its macroeconomic framework, revive and consolidate growth, reverse the pace of growth of its HDI and improve the standard of living of the population. Moreover, these advances position the DRC among the most dynamic economies in sub-Saharan Africa in the last fifteen years.

d. Structure of pre-university education

Since 1990, all DRC citizen have the right to equal access to education and vocational training. Public education is "free and basic education is compulsory". The right to establish private schools is subject to the approval by the line Ministries; namely le ministère de l'Enseignement primaire, secondaire et technique (MEPST), le ministère de l'Enseignement supérieur et universitaire (MESU) et le ministère des Affaires sociales, action humanitaire et solidarité nationale (MAS). The pre-university education include nursery (maternelle), primary school (Ecole Primaire), and secondary school (Ecole secondaire). Nursery school is generally for 2-3 years, starting when the child is generally 3 to 4 years. Nursery school is not generally compulsory, as it is for primary education. The latter start at the age of 6 and formally end at the age of 12. A certificate of completion of the secondary school is awarded after passing the final exam of the six-year programme. This exam is organized generally by the provincial Inspection system. This is the pre-requisite to proceed on to secondary education. Generally, several students from rural areas, from poor families in the suburbs of the major cities drop after this level. According to the World Bank, the primary school completion rate stood at 72.8% in 2012 (World Bank, 2014). This was an improvement compared to the previous years of conflict.

The secondary school consists of two tracks: the long cycle and the short cycle. The long cycle, which is also referred to as formal secondary education, and the short cycle is the technical vocational education/training (TVET). The formal secondary education (FSE) lasts 6 years and lead to higher education after the final state exam. This is only common national exam to which pupils are subjected during the 13 years of pre-university training. FSE start with 2 years of common training (tronc commun) before the pupils are split into three major streams general, teacher education, and technical of four years (Bashir, 2009; World Bank, 2005). There are several options within each

stream; the four-year program is divided into scientific (biology, Chemistry and mathematics-physics), pedagogical (psychology and pedagogy), literature (Latin, grecs, mathematics), technical (general mechanics, electronics, electricity, and arts). TVET duration varies from a few months to 4 years. There are those which start just the orientation period, immediately after primary school certificate and for manual unskilled occupations. Upon completion, the trainees earn a vocational aptitude certificate or the *Brevet* (in area of specialization) after successfully passing the exams.

About 80% of the pupils are enrolled in formal education, 18.4% VE leading to 6 years of secondary school (Level A2), and 1.6% leading to S4 (Level A3). The completion rate for secondary school is of about 25.3% in general and 15.9% for girls.

   e.   *School enrolment in pre-University education system*

Generally, the school enrollment rate has declining in the country for all education levels. For example, between 1972 and 2002, the gross enrollment ratio in primary school has declined by 28% from its original value of 92%. Since 2007, the enrolment reached 61% and has gradually increased since. Between 2006 and 2012 the enrolment increased by 47% was observed (MEPSINC/METP/MESU, 2015). In the year 2013/2014 the enrolment reached 80.4% (Annuaire statistique scolaire, 2008; UNICEF, 2017). In 2014, the number of pupils in technical and vocational school the number has reduced by 8 and 24% (MEPSINC/METP/MESU, 2015).
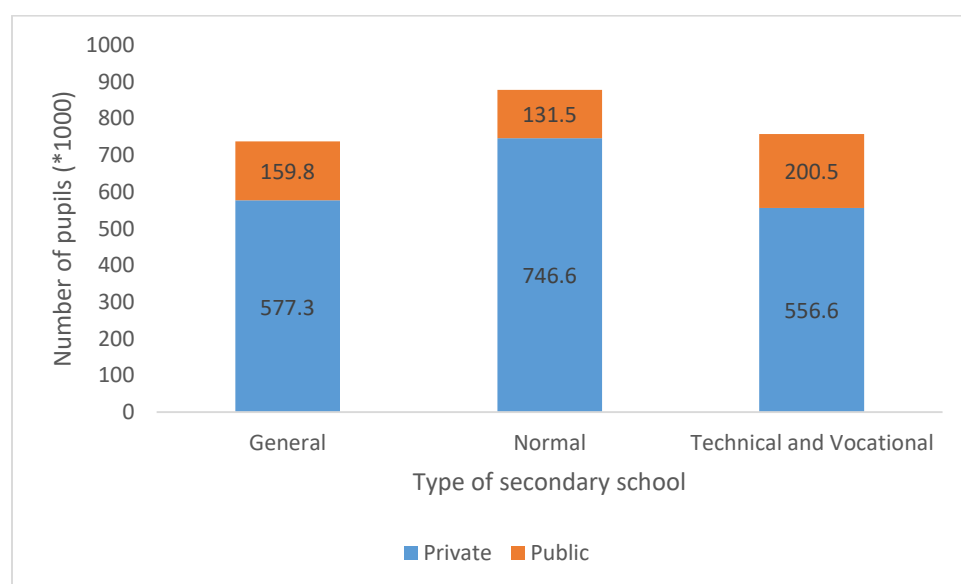

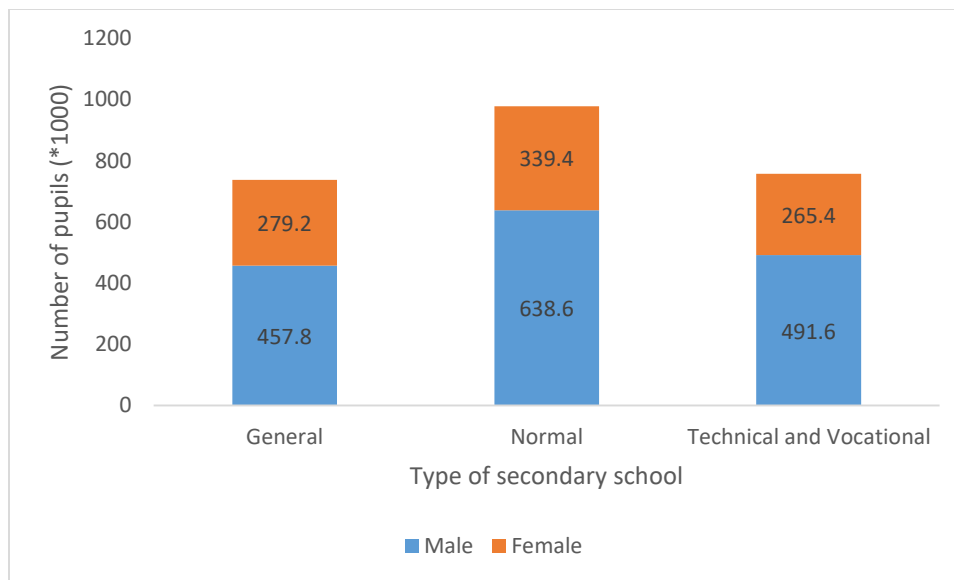*Figure 1: Pupil's number per school category*

Figure 2: Number of pupils per category of school and by sex

f. *Structure of higher education system*

The higher education sector, was designed by the Belgians as a copy of their system. Despite the fact that the Belgian system has been modified to suit the EU agreed system, the DRC higher education system has remained almost as designed by the Belgian. French is language used for instruction and the academic year runs from September to June. Higher education system in the DRC is run by the "Ministere de l' Enseignement Superieur et Universitaire (MESU). Private higher education in the DRC was first established in the early 1990s, when the government authorized private institutions to operate. The number of private institutions has risen significantly over the years and the proportion of students' enrollment in an institution of higher education, growing from over the years. Traditionally, the non-university HEIs were supposed to train in a specific domains, however, recently, several of them have started adding new courses on their curriculum, and even starting to that their status be raised to the rank of Universities.

Most of HEIs offer two cycles of training, the first cycle is of two 3 years and sanctioned by "a diplome de graduat". The second cycle is generally for 2 years honored by a "diplome de licence". The third cycle leads to "a *diplôme d'études approfondies"*, which duration varies between 2 and 3 years. In principle, the third cycle is organized in the three major universities of DRC. Other Universities create linkages, in form of doctoral schools, with these major universities to be able to train their staff for the third cycle.
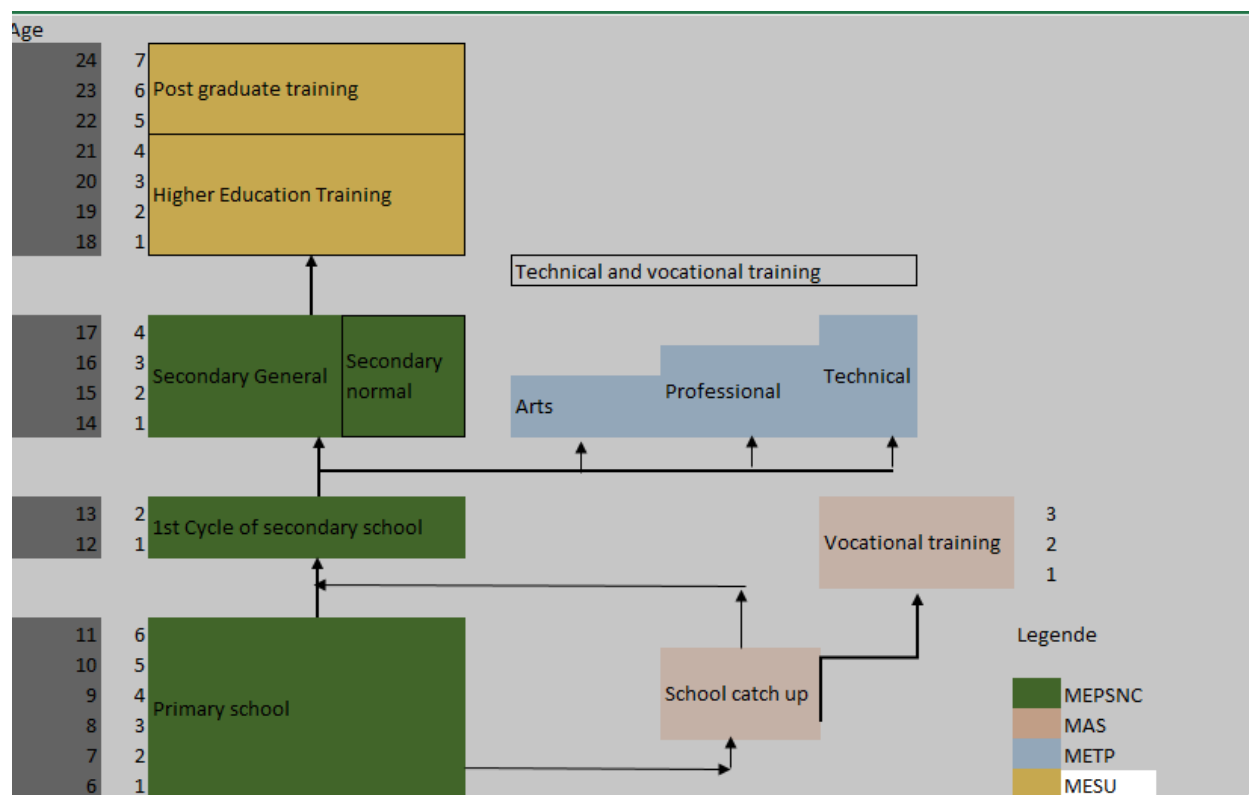
Figure 3: Structure of Education system in DRC

It is important to note that under the 2016-2025 strategy on education, there is a revised structure of education system which is supposed to be implemented. The structure align the DRC education system to the LMD system. This system is implemented with all the precaution, a 7 year primary school programme is underway.

g. Job market

According to recent data from the Ministry of Labour, the underemployment rate exceeds 50 per cent and the youth unemployment rate (15-24 years) exceeds 35 per cent. The employment structure remains dominated by informal jobs, which accounts for almost 88.6 per cent of employments, of which 59.7 per cent are in agricultural activities. The formal sector employs a maximum of 11.4 per cent of the total, distributed unevenly between public administration (5.7 %), parastatals (2.9 per cent) and formal private (2.8 per cent). The labour force is estimated at 65 per cent (52.7 per cent men and 47.7 per cent women), of which 58 per cent represent the 15-34-year age group susceptible to migration. This trend is the same in urban as well as in rural areas. The unemployment rate (in the sense of the International Labour Office – ILO) is 3.7 per cent, while in the broad sense it is 11.38 per cent. It affects 52 per cent of men compared with 48 per cent of women, 41.7 per cent of 25-34 year olds and 34.5 per cent of 15-24 year olds, of whom 62 per cent have reached secondary level, 29 per cent have reached higher level and 9 per cent have reached primary level.

Since 2001, despite the beginning of a period of economic recovery through a revival of bi-and multilateral cooperation and the implementation of macroeconomic programmes, satisfactory economic results have not helped to reduce poverty and unemployment. The growth rate of 8.9 per cent was ultimately insufficient to reduce poverty (71.3 per cent) and to fill jobs whose level of

creation is lagging behind the growth of the national economy and becomes a major challenge for the authorities since it does not translate into impact on the daily lives of populations.

According to the National Action Plan for youth employment, the incidence of poverty is estimated at 71.34 per cent for the country as a whole and therefore remains very high compared to other Central African countries. The national Report on Human Development in Africa indicates an overall unemployment rate of the working population of the order of 54.0 per cent, and 24.7 per cent for young people aged 15-24 in urban areas. The situation of young people on the labour market in the DRC is extremely precarious, while they represent an asset to the job market and a huge potential for the development of the country.

h. Enabling environment

The Development Strategy for Primary, Secondary and Vocational Education for the five-year period 2010 - 2016 is in line with the guidelines of the World Education Forum held in Dakar in April 2000. It emphasizes equity, efficiency, dialogue, partnership, participation and learning. This strategy incorporates both the formal and the technical and vocational education and aims at strengthening the technical and vocational education. The government of DRC planned to improve PSVE and particularly promote technical and vocational education by: (i) rehabilitating infrastructure, (ii) modernizing equipment, and (iii) updating the training programmes to better match with the national needs and the local labor market. The government is planning for initial and in-service teacher training. The government had planned to build one Technical and vocational schools per educational province.

This strategy was supposed to be operationalize for the period from 2012 to 2014, in order to: a) move faster, especially towards the primary education of all - boys and girls, b) attract and absorb the additional funds available, including from the "Global Partnership for Education". The PIE aims at strengthening TVE, and improve the governance of the education sector. It was also committed to clarifying the institutional mechanisms of the Ministries in charge of education and gradually increasing the share of the education budget with a view to reaching 25% of the national budget by the year 2016. The 2016-2025 strategy main objectives include improving student flows (MEPSINC/METP/MESU, 2015). This strategy envisages that among others i) 40% of 2nd cycle students are in technical, vocational or teacher training courses ii) the enrollment rate of 18-22 year-olds in higher education will improve but remain below 10% by 2025, iii) the changes projected for the flow of students in the system will result in a consequent improvement in enrollment rates and access to the different levels of the education system. These changes triggered by the policy to extend basic education to eight years will continue to produce effects after the period of the strategy.

The country has developed a Science, Technology and Innovations and requested UNESCO to support the implementation of the strategy in 2010. Consultations were organized in 2014 with restricted of participation of Kinshasa officials only. The process of finalization of the STI policy and strategy drafts are still ongoing with support from UNESCO.

4. Methodology used to achieve the objective of this assignment

This study was restricted to only electronically available literature, the books available at the DRC Embassy in Kampala, the websites of the line ministries and those which were obtained through google search. Both English and French documents were searched and selected from google engine. The key words used were, education in DRC, investment in Education, Science, Technology and Innovations, challenges facing education sector and especially STI in DRC. The findings from the selected literatures were supplemented with data from the World Bank and UNICEF. STI innovation information were mainly derived from the http://uis.unesco.org/en/news/rd-data-release.

5. Key findings

5.1 Distribution of HEIs in DRC

5.1.1 Distribution of HEIs
Figure 4 shows the distribution of HEI across the different provinces of DRC. A total of 236 HEIs were identified, but only 120 were found on the website of the line Ministry (Ministere de l' Enseignement Superieur et Universitaire -MESU). This number is below the 326 HEIs reported by World Bank (2005). In the later document the World Bank reported 114 public HEIs and 212 private HEIs. All the provinces have at least an HEI, though there is a wide variation of the number of HEIs across provinces. Kinshasa, South-Kivu, North-Kivu and Katanga are well endowed in terms of number of HEIs. Kinshasa, South-Kivu and North-Kivu, have more than 25 HEIs each, and Katanga falls in the category of 16-25 HEIs. This is followed by Kongo Central which is in the category of 11-15 HEIs. The provinces of Haut Lomami, Kisangani and Equateur belong to the category of (5-10 HEIs). All other remaining provinces have less than 5 HEIs per province.

Higher education in the DRC is a mix of public and private provision (Figure 5). The majority of private HEIs are run by religious/churches, a few are associated with provincial governments or are run by private individuals, trusts, or societies. The highest number of public HEIs are found in Kinshasa (>25), followed by North Kivu, South Kivu and Mongala (16-25). Haut Katanga falls in the category 10-15. The rest of the provinces have less than 10 HEIs each. For private HEIs, Kinshasa still had the highest number (>25), followed by South Kivu (16-25), and then North-Kivu and Mongala with (10-15). Haut Katanga and Kongo Central followed with the category 5-10. The rest of the provinces had less than 5 HEIs each. Three major HEIs (University of Kinshasa, University of Kisangani and University of Lubumbashi) have the highest enrollment rates; and the three provinces have remained the pole of HEI training in the country.
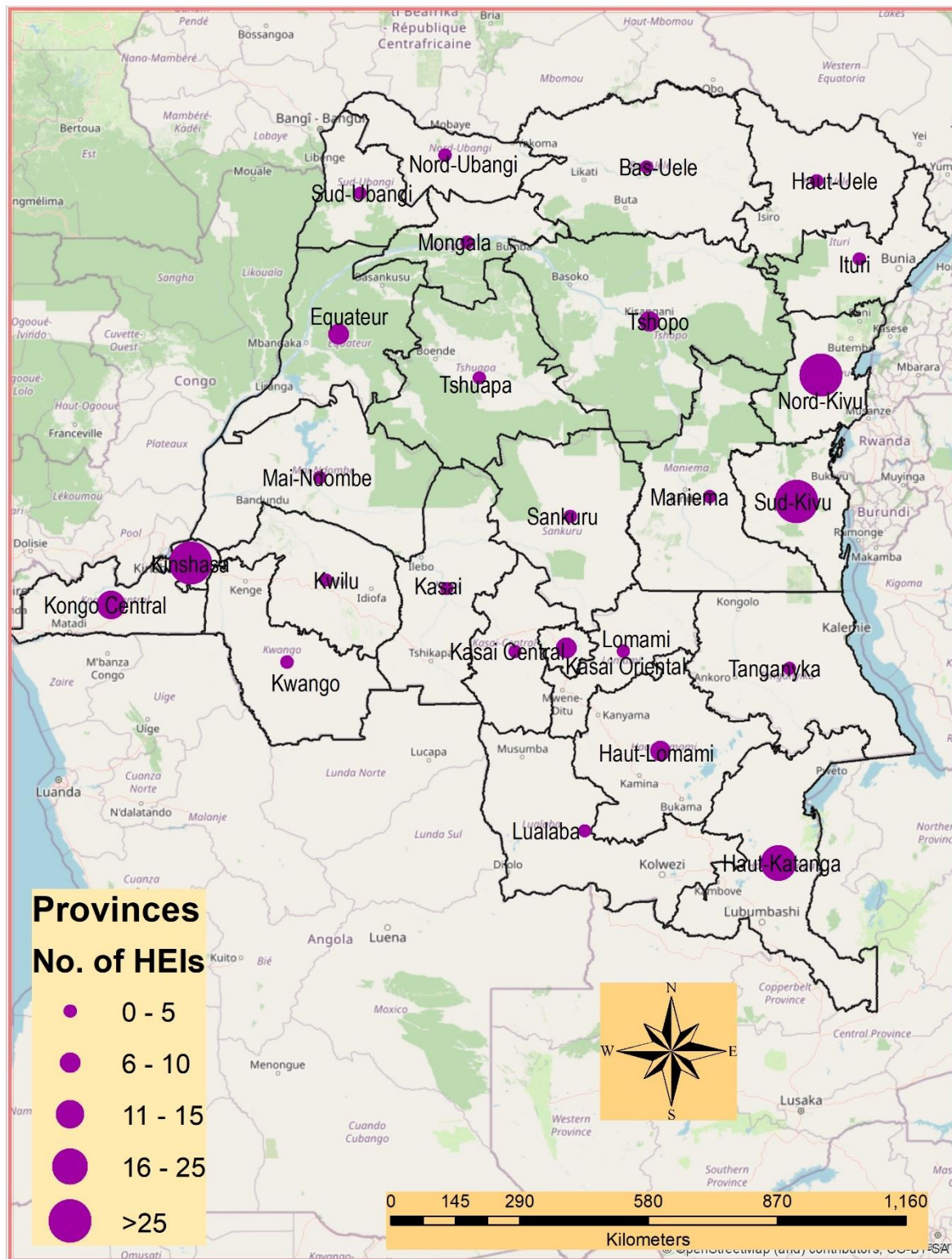
Figure 4: Distribution of HEIs across the provinces

HEIs include among others Universities and non-university institutions. The non-university Institutions are generally professional institutions with a wide range of training disciplines including

Pedagogical, business, medical, and Rural Development Institutions. None university institutions have a quasi-equal enrollment rates. Figure 5 shows the distribution of private and public HEIs across provinces and Figure 6 shows the percentage of the different categories of HEIs per type (private or public) and type of training offered. The majority of the HEIs are offering Technical training (IST) (52.1%), followed by Universities (31%), Pedagogical training (ISP) HEIs only represents 16.9% of the HEIs. There are more public ISP and IST compared to the private ones, but more private universities than public ones.
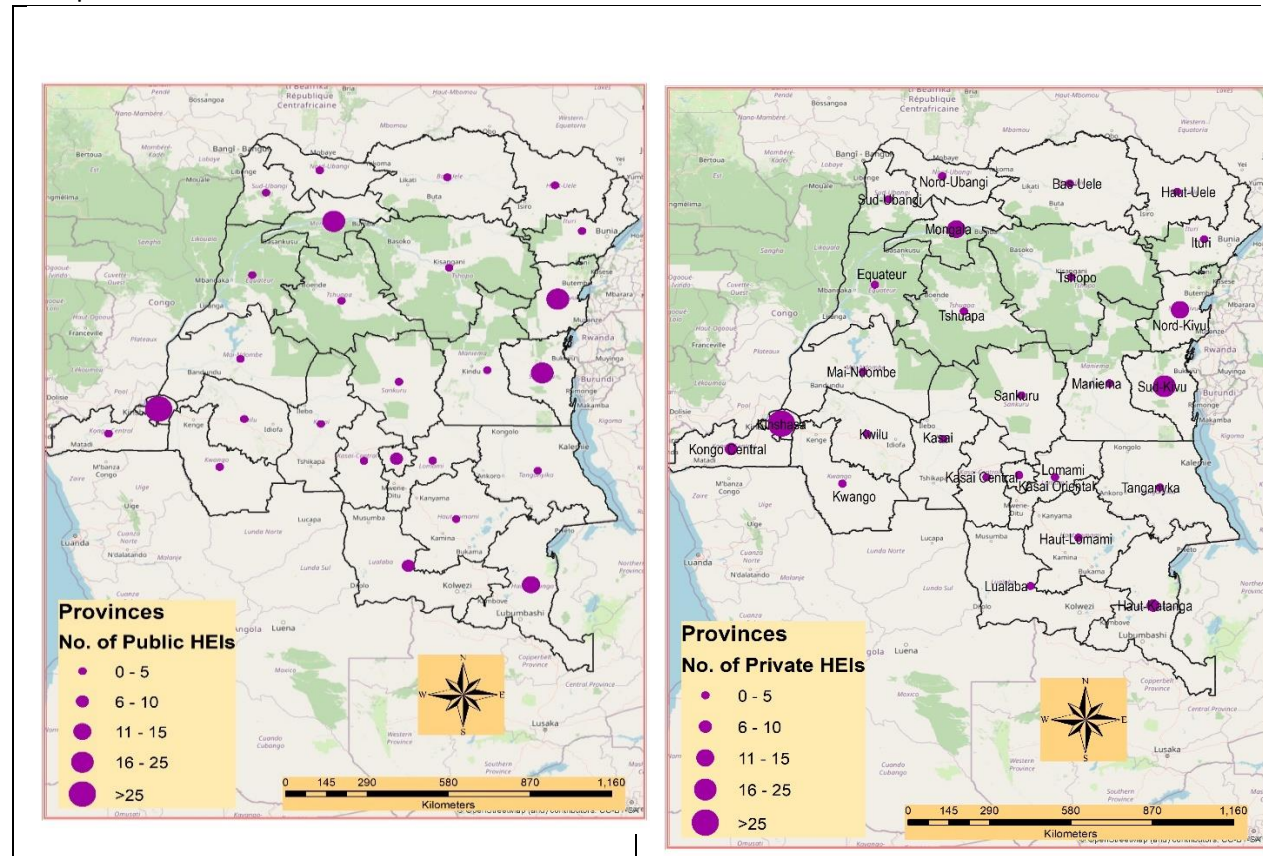

Figure 5: Distribution of Private and Public HEIs in DRC.
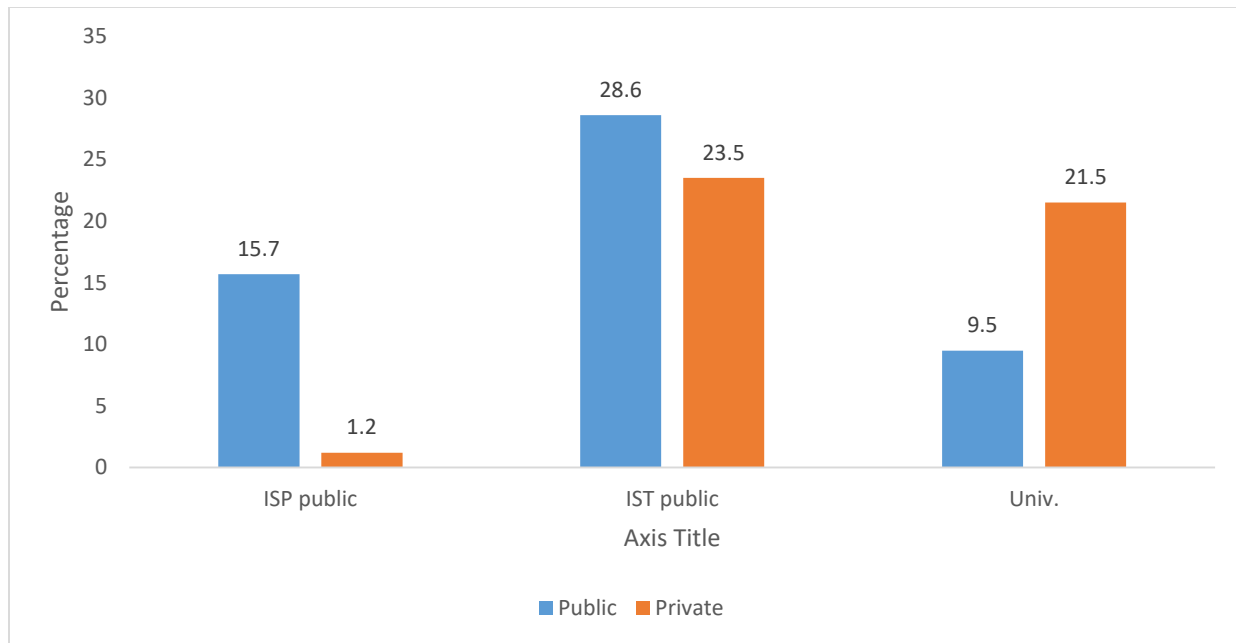
Figure 6: Percentage of private and public per type of HEIs

5.1.2 Number of students in the HEIs

The total number of students in the year 2014 is summarized on the Figure 7. The biggest proportion of students are in public HEIs. A total of 470000 students have been recorded across HEIs in DRC in 2004; only 30.4% of them were from private HEIs. The size of public establishments is larger than private establishments. 841 students per public institution against 323 students per private establishment. Since 2007, the total number of students have been growing gradually (gradient=31297 students/year, R^2=0.81, p=0.01). On average 12083 students have been enrolled every year in private HEIs (R^2=0.87, p<0.01), and 19214 students were registered every year from public HEIs (R^2= 0.54, p=0.04). This represents an average annual student enrolment of 31294 for the entire country (R^2=0.7; p=0.01). This represent about 13% of the student population in 2007.
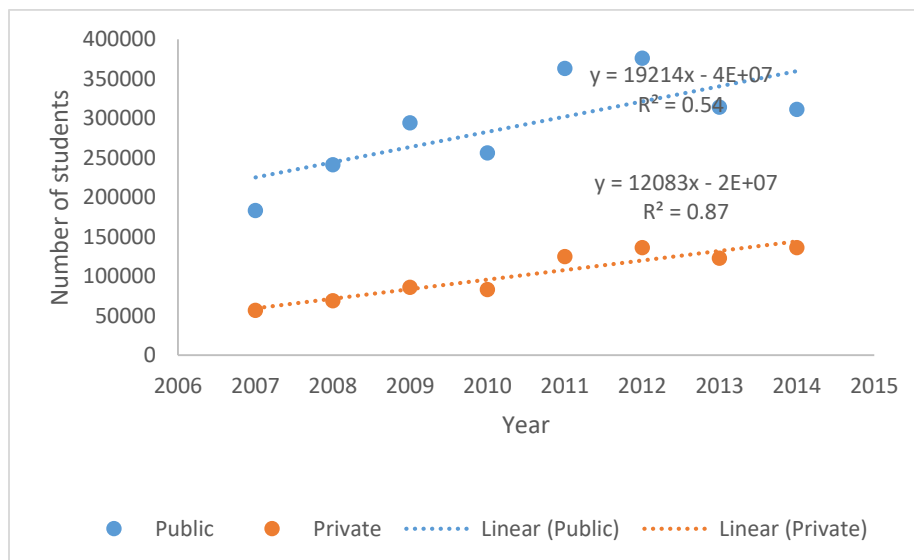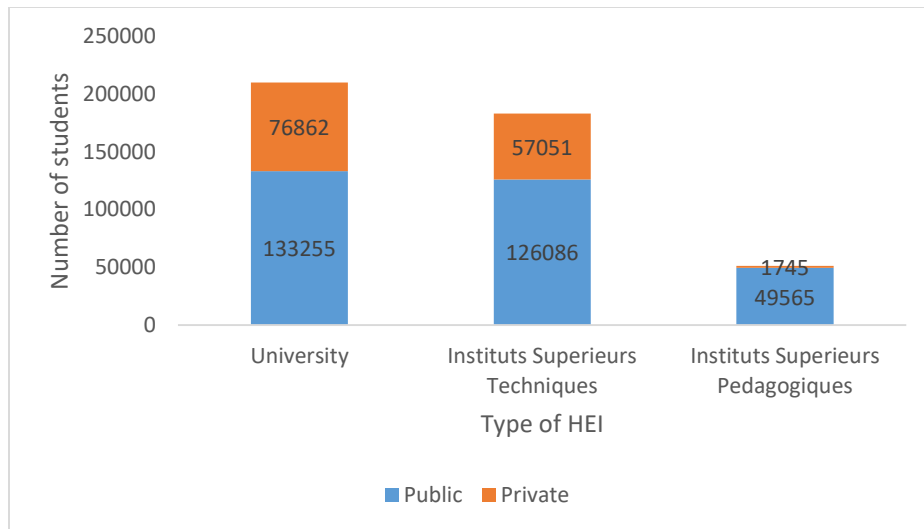
Figure 7: Trends in student enrolment for both public and private HEIs

The number of students vary with provinces. Kinshasa has the biggest number of students followed by Haut Katanga. The province of Maniema has the least number of students.

5.1.3 Number of academic and administrative staffs in the HEIs

The student-teacher ratios are generally relatively low in most of the HEIs. The average pupil-teacher ratio for the country as a whole is about 1:34, using an enrollment estimate of about 470,000 in public institutions. The total number of teaching staff in the public HEIs was 13680 in 2010. Among them only 4.1% of them were Professors, and 3.5% are associate professors. About a quarter of them are lecturers or senior lecturer. The bulk of the staff are teaching assistant. Generally lecturer (Chef de Travaux) and the teaching assistants have a "Licence" or are "graduat". A greater proportion of the highly qualified academic staff is located in the public HEIs

and particularly in the three main universities of Kinshasa, Lubumbashi and Kisangani. The majority of professors are old or close to retirement age (World Bank, 2005).
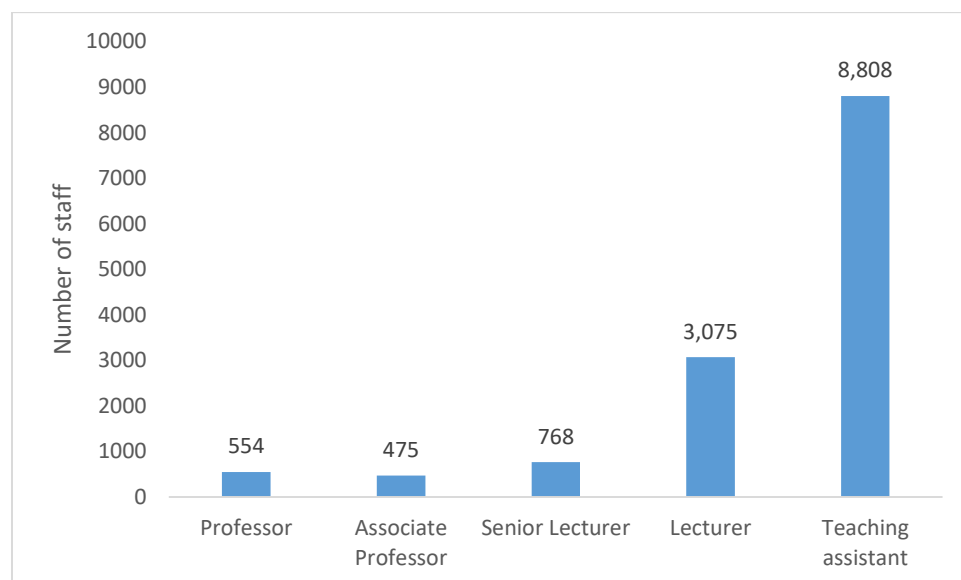
Figure 8: Academic staff of both public and private HEIs

5.1.4 Governance of HEI

a. At the level of HEIs

The total number of administrative staff in the different HEIs was estimated to be 12 144 (Figure 9) in the public HEIs and 2767 for the central administrative unit at the line Ministry (Figure 10) (World Bank, 2005). This make the administration almost double the size academic staffs in the public HEIs. The total number of Directors was estimated to be 910 and 1232 Head of Divisions. This number of directors and head of divisions is almost the doubles of all the academic staff beyond the rank of senior lecturer in the public HEIs; and relatively higher than the same group in all the HEIs. The majority of the academic staff are men, only 899 staff were female in 2010, representing 6.5% of the academic staff in all the HEIs.

Figure 9: Administrative staff in public HEIs

The administrative bodies of all the HEIs is dominantly in the hands of the men. Women are also very much in the minority within the Faculty / Section Councils and their Faculty Offices and among the positions of responsibility at this level (Deans of faculties/head of sections, Vice-deans of faculties/deputy head of sections, academic secretary faculties or section, administrative and financial secretary of faculties or sections). The same goes for Department Councils and the positions of Head and Department Secretary.
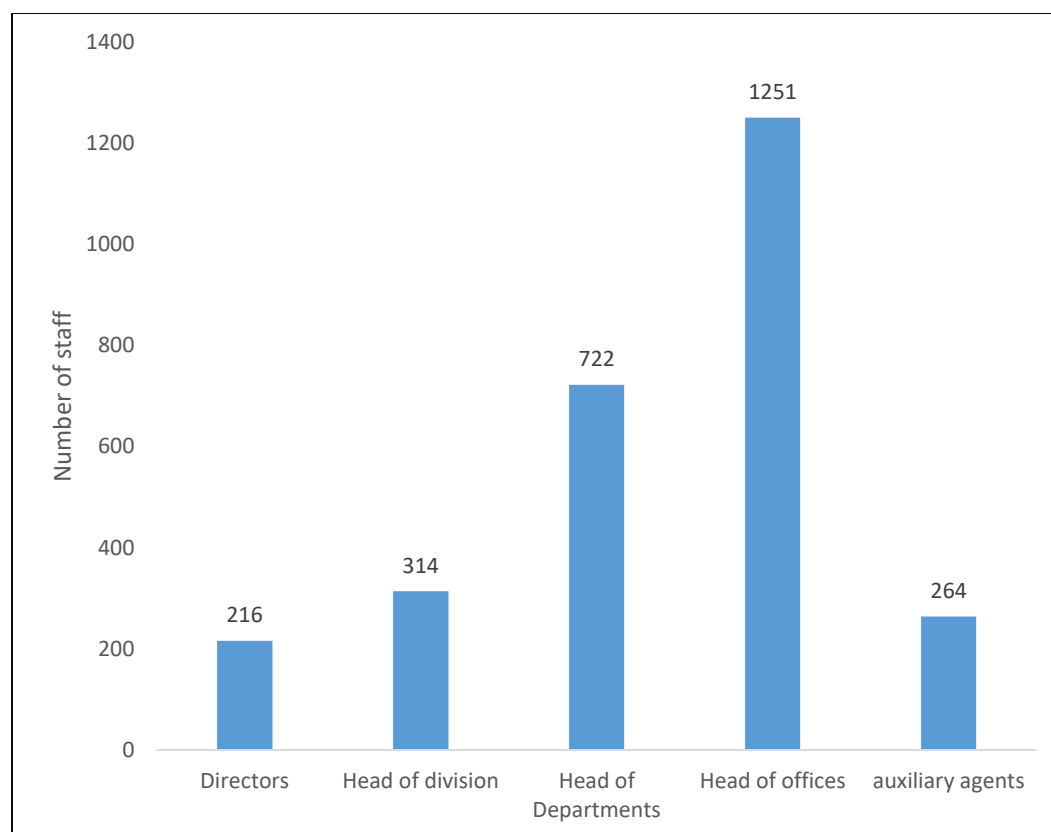
b. Governance at the Ministry level

The Line ministry with the mandate of steering the governance of the HEIs in DRC, had had period of fusion and fission with the Ministry of primary, secondary and professional education (Figure 10). The period of fission between the two Ministries include the period of 1960-1980, 1992/93 and 1997-2000. The splits and fusions aimed at improving the efficiency of the Ministry (ies) to make education accessible and deliver quality education to all DRC students. The tenants of the split of Ministries believe that they represent two different realities and that need different approaches in terms of management. While those who believe in unicity of administration of education ministries, believe that integration of these ministries provide more benefits in streamlining regulations and reducing operation costs. In fact, it was observed that fusion of Ministries of education always happened during financial constraints periods. The fusion of the two line ministries coincides with the drastically decline in the country economy in the 1980s (CENADEP, 2009). This is attributed to various reasons external and internal. From 1965 to the mid-1970s the country was political stable, with low monetization of the deficit and lower inflation (Nachega, 2005). The brutal slowdown in economic activities and the soaring of inflation in developed countries in 1973-1974, associated with the

increased fuel price affected drastically the exportation of raw materials from developing countries including DRC which economy was heavily dependent on mineral exports. This was aggravated by the "Zairianisation" process in 1974, 1979 fuel crisis and the closure of the Benguela runway because of the war in Angola (Nachega, 2005). The country then only relied on debts as the only way to obtaining supplies of goods and services and fresh capital from abroad. The overdependence on a few commodities for its foreign exchange earnings, namely copper, cobalt, diamonds and coffee; economic difficulties of the state-owned company Gécamines associated with lack of maintenance of its equipment (Maton, 1991), and the internal political instability pushed the country economy to its lower limits in the period 1993-1994. DRC pursued a structural adjustment programme since 1983, but this program has been interrupted several times. The period 1997/2000 coincides with war of liberation of DRC and the Presidency of Laurent Kabila under difficult conditions.
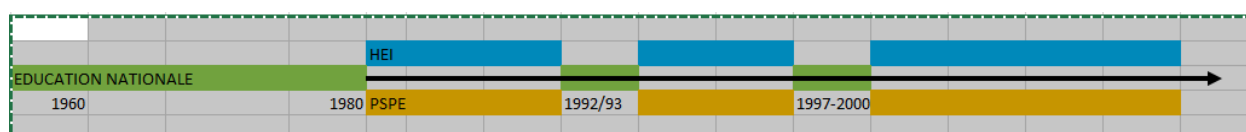

Figure 10: Periods of fission and fusion between the Ministry of MPSPE and MESU (green Fusion, bleu, white and orange Fission of ministries)

5.2 Science, Technology and Innovations in DRC

5.2.1 Existing Human capacity

Science, Technology and Innovations are increasingly recognized by DRC leaders and scientists as critical for the transformation of economies, reduction of poverty, attainment of Sustainable Development Goals (MDGs) and integration of the country into the global knowledge economy. "L' L'association congolaise pour l'avancement de la science, de la technologie et de l'industrie (ACASTI), believe that the last three decades R&D has been marginalized in the DRC. Researchers and innovators have access to very limited resources to engage into research and innovate. At the same time, the University system is becoming heavy and less effective in delivering its core missions (teaching, outreach and research), and meeting the international standards. The little research carried out in universities and research institutes is dictated and funded by donor organizations (Belgian cooperation, USAID, and others).

According to http://uis.unesco.org/en/news/rd-data-release, there is limited capacity for R&D in DRC. The country had 199.68 researchers per million inhabitant in 2009. Only 8.7% of them were female. The majority of them are government employees and/or from HEIs, and small proportion is coming from Private non-profit organizations. It is worthwhile to note that almost a similar percentage of researchers have been recorded in HEIs and government in 2015 compared to 2009, when the majority of the researchers were from HEIs. The majority of government employees in research belong to research centres including Institut National d'Etude et Recherche Agronomique-INERA, "Conseil National de Sécurité Nucléaire-CNSN, Comité National de Protection contre les Rayonnements Ionisants- CNPRI, Conseil National du Travail, Congo Research Group, Centre de Recherches Geologiques et Minieres-CRGM, Institut de Recherche en Sciences de la Sante-IRSS, Centre de Recherche en Hydrobiologie-CRH, Centre de Recherche Agro-Alimentaire and Observatoire Volcanique de Goma-OVG. However, INERA remains by far the largest research centre in DRC employs close to half the country's agricultural researchers, has a broad mandate covering crop, livestock,

forestry, and fisheries research. It operates 12 research centers and stations across the country focusing on locally relevant adaptive research.

Despite the facts that young people are being recruited in many of these institutions, the majority of the staff remain old and few capacity building exercises have been conducted including for technicians. This is coupled with brain drain of academic staff and the plethora of administrative staff who are generally not retooled in terms of management of HEIs and research Institutions.
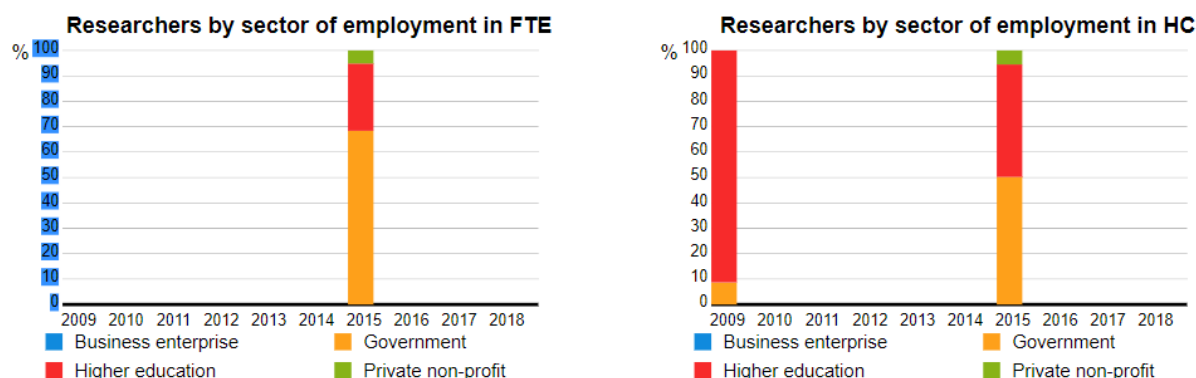

Figure 11: Researchers by sector of employment

5.2.2 Status of existing infrastructure

Most of existing infrastructure at HEIs and government research centres are old and poorly maintained. The majority of the centres and HEIs laboratory and library are old. Laboratories and libraries in the HEIs are cannot accommodate the increasing number of students. The most of the equipment are either old or missing to conduct even simple practicals. Furthermore online laboratory exercise cannot be adequately conducted because of the limited internet connectivity, limited access or lack of electricity in several HEIs. Yet the country possesses one the biggest hydro-electrical potential, and produces sufficient electricity for the country, however, the distribution and management of this commodity is one of the major challenges.

5.2.3   Public Investment in R&D

Data on public investment in R&D in the country is very scanty, since there is no mechanism of collecting and managing this information. However, UNESCO estimated that DRC spent between 0.5-1 % of GDP on R&D in 2015. It is also important to note that there no mechanisms to collect data on research (type, relevance, quality, effectiveness) being conducted by the different stakeholders across the country. In fact most of the public investment in R&D has been allocated to small demonstrations projects, maintenance on the infrastructure and transport.

5.2.4   Institutional Arrangements for Public Research & Development

Various countries have created institutions for R&D and strategic plans. In DRC, research and Development is conducted both at Universities and in research centres. Though the research priorities are clear for Research Centres, HEIs don't have generally a research agenda. Students can only do what they can afford with family resources. There is also a weak linkage among the main institution actors in the national system of innovation namely include universities, public R&D institutes, private enterprises, financial institutions, technology support agencies, and policy makers in undertaking research and development activities. This is mainly because of the dysfunctional science governance system, lack of

networking and inter-sectoral cooperation, limited influence of academic and professional associations and lack of public resources allocated to R&D.

5.2.5 Policy Instruments for Research & Development

The existence policy instruments can contribute to the promotion of R&D. DRC used to have different STI policy scattered in different sectoral policy documents including National plan for agriculture, policy on National Education. However, DRC has developed a draft Policy on STI which need to be finalized. In addition the policy Framework n ° 14/004 in February 2014, emphasis that the use of Science and Technology is a sine qua none factor of the economic development of the DRC. The policy emphasizes enhancing institutions governance, improvement of infrastructure, promotion of science and technology training, strengthening collaboration between R&D institutions. There also within Africa, several initiatives to promote innovation systems which DRC has ratified including the agenda of the Southern African Development Community (SADC), the Agenda 2030 as well as the African Union.

5.2.6 Technology Support and Regulatory Agencies

One of key component of national innovation systems are system of enhancing standard, quality and metrology (Mugabi, 2011). In DRC control of the compliance to standard is done by the Congolese Office of Control - OCC. OCC is generally poorly equipped and skills and competencies of staff vary across the country. To ensure that OCC deliver good services to its customers, a partnership agreement exist with the Bureau Veritas BIVAC BV. The Ministry of the Environment and Sustainable Development (MEDD) is in charge of the implementation of environmental policy, particularly the conduct of environmental and social assessments, through the Congolese Environment Agency (ACE).

5.2.7 Technological Readiness and Innovation Capacity

Technological readiness represents the ability of an economy to adopt existing technologies its industries productivity enhancement; while innovation capacity, is the ability of a country to expand the frontiers of knowledge and create new technology. Technological readiness is determined based on factors such as firm-level technology absorption, laws relating to information and communication technologies, FDI and technology transfer, personal computers per 100 inhabitants, and internet users and mobile phone subscribers. Because of a relatively long period of instability, unfriendly taxation system only the mining firms have remained in several districts of DRC. However, the GSMA Mobile Connectivity Index is rated low to medium range with a score of 26.8, while mobile coverage reaches 44.58% penetration rate in the country, with just over 40% of the population covered by a 3G connection. This penetration rate is much lower than in Zambia (78%), Rwanda (68%) or Uganda (68%). In addition, major roads connecting the different parts of the countries are damaged at several points. Electricity supply is unreliable and sporadic in several parts of the country; despite the enormous energy potential that the country possesses. According to Jenal and Cunningham (2019) there are many factors in the DRC that would make innovation to succeed in DRC. These include the lack of adequate market-supporting institutions to overcome various market failures and trust issues, coordination and search costs, may incentivise many to mainly trade in simpler goods and services, or the costs of coordinating any more difficult economic activities may be too high. They also observed that rent seeking in the public and private sectors may undermine the introduction and dissemination of innovations throughout the economy.

5.3 Financial investment in Education

The resources made available to the education sector as a ratio of GDP is presented in Figure 12. Public expenditure on education amounted to just over 462 billion Congolese francs (CF) in 2012. This represented 1.8% of the country GDP, and 63.8% increase compared to the 2005 expenditure. The annual expenditure on education has been increasing annually (p=0.03) by about 40.47 billion CF (the equivalent of 0.1% of the GDP). In 2014, the expenditure on education increased by 18.7% compared to its value of 2010 (MEPSINC/METP/MESU, 2015).

During the process of endorsing the new sector plan, the government committed to bringing the share of its budget allocated to education to 20% by 2018 and to maintain it at that level until 2025 (MEPSINC/METP/MESU, 2015). This will requires doubling the financial resources devoted to the sector, from 1.3 billion USD in 2016 to 2.8 billion USD, in 2025. This strategy proposes an allocation of 69% of the resources to the payroll due to the increase in staff and measures for the gradual implementation of free education, including improving the rates of support for teachers and increasing their salary level now indexed to changes in per capita GDP. The mobilization of additional public resources for education presupposes that the ministries concerned are better equipped to negotiate more favorable budgetary decisions that are more in line with international standards.
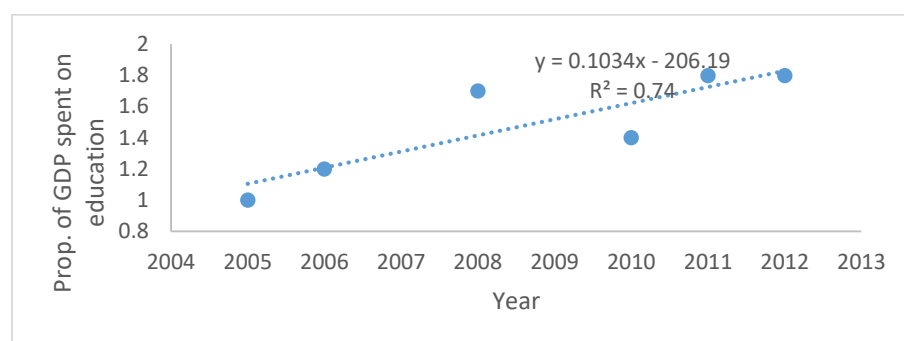
Figure 12: The trend in the proportion of GDP allocated to education in DRC (2005-2012)

The trend in public expenditure allocated to Ministries, including the different line Ministries of education, over the period 2005-2012 is displayed on the Figure 13 below. Only the expenditure under MESU significantly increased during that period. Percentage expenditure under MEPSP and other Ministries (OM) has declined slightly, while under MAS the percentage expenditure remained constant over the years.

Figure 13: Percentage of expenditure allocated to Ministries for the period 2005-2012

The biggest proportion of the expenditure is dedicated to paying the personnel (Table 1). Purchasing of goods and subventions and transfers accounted for about a third of the expenditure. The amount allocated on personal has increased annually by 4.02% to expense of all the expenditure which have been declining over the years. Since 2007, Personal and purchase of goods costs followed a quadratic shape with opposite concavities.

Table 1: Operation costs in MESU

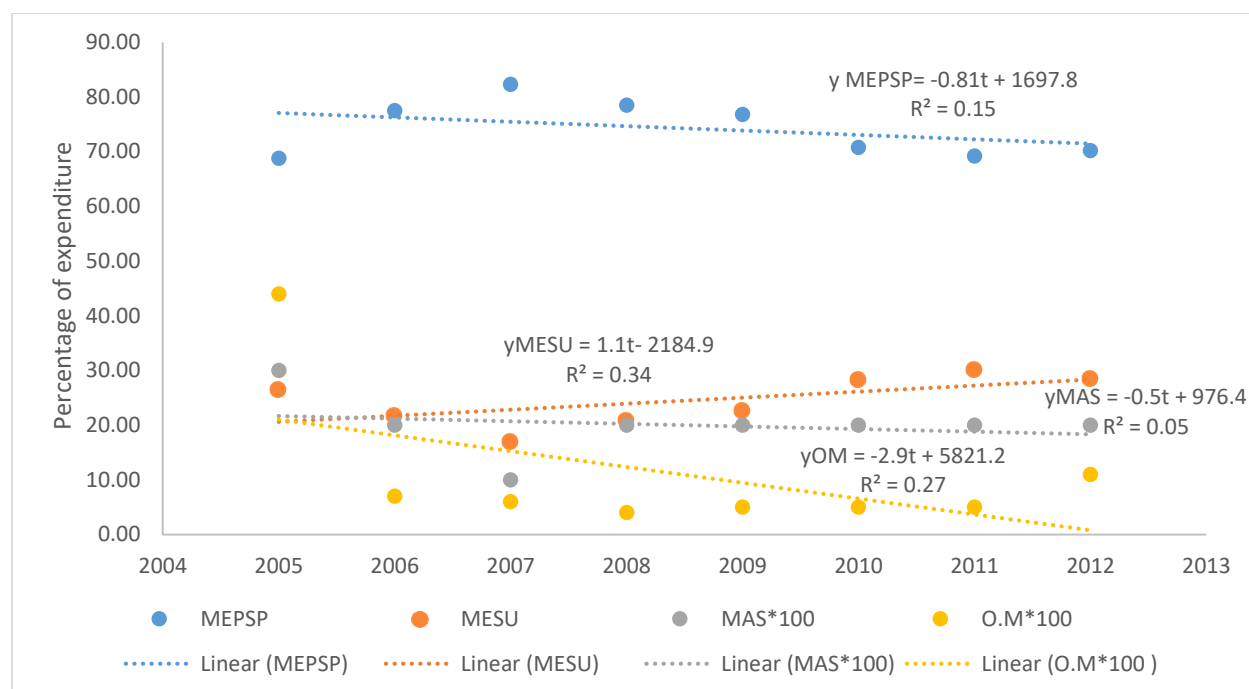| Operational costs	2005-value (%)	Average (2005-2012)	Annual increment (%)
Personnel	64.7	90.6	4.02
Purchase of goods	24.7	6.9	-2.59
Subventions and transfers	10.6	2.2	-1.07
Social expenditures	0	0.3	-0.42*
TOTAL	100	100	-0.06

* This was computed from 2007 values.

The total amount allocated to HEIs benefits from public expenditure almost in the same proportions as secondary education (general, technical, vocational and pedagogical). This is the same trend in several countries in sub-Saharan Africa, preschool education suffers from significant public underfunding. DRC is, characterized by inter-sectoral trade-offs not favorable to education, a situation made more difficult by the levels of mobilization of internal resources which are still limited.

The Figure 14 below shows the percentage expenditure per type of HEIs in 2012. Relatively high percentage (35%) is allocated to pedagogical HEIs (Training teachers of secondary schools), followed by Universities, and the least was allocated to research (12%) institutions. Universities and Technical HEIs received each about the quarter of the budget.
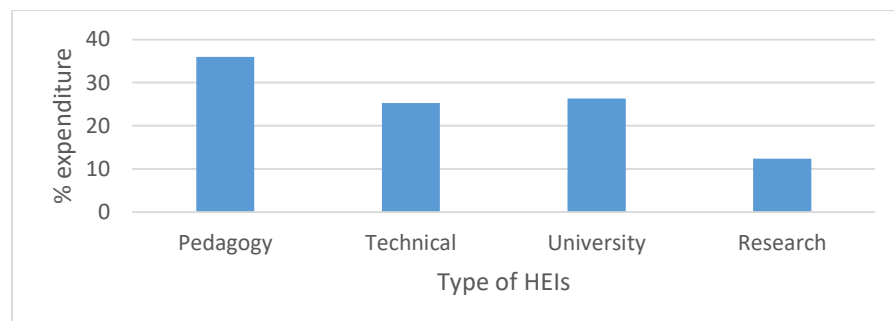

Figure 14: Percentage expenditure of public funds to the different type of HEIs

However, the country is still considered to carry a significant risk of debt distress. According to ADB (2011) it is vulnerable to the drop in exports and the increase in borrowing costs. Since the cancelling of the US $ 7 billion as very heavily indebted poor countries in 2010, the country has continued to borrow (PEA, 2013); and the risk incurred is that the income generated will be lower than the amount of the debt service (World Bank, 2012). Prudent debt management is recommended to ensure that the country's vulnerability does not increase.

Table 2 shows the cumulative cost of operations since 2005. Between 2005 and 2012, the cumulative costs of operations amounted 106.48 billion franc. The biggest portion of the operation costs was spent on the equipment, repair and rehabilitation and studies. Salary and construction were only allocated 0.16% and 4.3% of the total operation costs; respectively. The distribution operation costs favored more the MEPRS compared to MESU and other Ministries.

Table 2: Total operation costs from 2005-2012 (in billions of CF)

Operations	MEPSP	MESU	MAS	Other Ministries	TOTAL
Construction	4.56	0.03			**4.59**
Salary	0.178				**0.18**
Rehabilitation/repairs	26.92	5.62		0.01	**32.55**
Studies	19.98			0.03	**20.01**
Equipment	42.61	6.42	0.07	0.05	**49.15**
Total	**94.25**	**12.07**	**0.07**	**0.09**	106.48

5.4 Research needs and challenges in higher education

5.4.1 Tremendous increment in student enrolment in HEI

Most of the public universities are overcrowded, because of the growing enrolments associated with both widespread population and parents expectations from university degree. DRC has one of the highest demographic rate on the African continent, and the biggest part of its population is young. For the year 2009/2010, students who are registered in senior six, the final year for the secondary school, were 414471. Fortunately this represents only 13% (31297 pupils) join the HEIs every year. In a scenario that only 50% of the students pass their exam and 25% of them register to join HEIs, this will represent half of the 2009/2010 number students in the HEIs. In their current status, both public and private sector cannot meet burgeoning demand. Most of the public HEIs are old and poorly maintained; while the private HEIs are generally of small capacity than the public HEIs. In addition, parents perceive that current domestic provision is of low quality, explaining why parents who can afford send the children abroad, in addition to insecurity conditions in the eastern part of the country. The majority of parents in DRC believe that having a university degree open doors to better life. However, the salary have remained meagre even for people who attended Master degrees in the HEIs.

5.4.2 Limitations of Inherited systems

DR Congo inherited the education system from the colonialists and the Belgian's tradition of 'free university education for all. Universities in DR Congo have been generally charging very low tuition fees as tertiary education is widely perceived as a 'public good. Subsequently several private HEIs are reportedly unable to cover the total costs of educating students, and have raised concerns over the impact on the quality of provision. Even public universities are overwhelmed by the dramatic increase number of students with no proportional support from the government. Despite the fact that the Belgians have tried to overhaul and standardize their system to the European system of education, DRC education system has remained intact, with timid attempts towards internationalization. The mechanism for changing curricula and introducing new courses is cumbersome and is effectively dysfunctional; the "Commission Permanente des Etudes" of the Ministry of Higher Education which finally approves changes has not met for long. This system is a legacy of the past when centralisation was the main objective of educational policy. However, HEIs have found methods to introduce new programs that are in demand (such as biotechnology or information technology), obtaining temporary recognition from the line Ministry.

In many Universities across the globe and in Africa, programme are revised frequently, generally every five years, to take into account the needs of the stakeholders and especially the demand from industries and the job markets. Only a few public HEIs are authorized to run postgraduate programmes because of the limited HEIs capacity in the country. This closed association coupled with brain drain, has hindered progress and building capacity for many HEIs. Most of the catholic HEIs for example use the institutional links with universities in Belgiam to build their own capacity and/or develop mechanisms to share resources with universities with comparative advantages. Language presents its own challenges for DR Congo. In a context where both ICT and online learning remain dominated by the English language, DR Congo faces an additional financial hurdle in developing course content and materials in French (not to mention in the indigenous languages

of the sub-region). Language barriers has also limited exchange and mobility in strong HEIs in the East and Southern part of the continent.

5.4.3 Under investment in Research and innovation

Underinvestment in R&D in DRC is serious. The higher education system has remained largely private but supported by extremely limited public budgets that demoralize the personnel and can't foster growth in the system. This is in spite of the rapid and somewhat anarchic development of the private sector. From a system of private provision heavily supported by public funds at independence, higher education in the DRC has shifted to a system of mixed public and private provision, which is almost entirely privately financed. However, this change was neither smooth nor planned and occurred due to abrupt and major changes or reversals in policy, creating an uncertain environment for the development of the sector. The current financing mechanism for both students and teaching fraternity, excludes students from poor backgrounds and favors professors in the big institutions, is inequitable, apart from being sub-optimal from the economic point of view. The government funds research staff salaries, but funding for actual research programs and the much-needed rehabilitation of R&D infrastructure is largely dependent on volatile donor support (FAO, 2013). Large-scale operations in DR Congo tend to be almost entirely owned and managed by foreign players, as it is difficult to secure local investment due to poor socio-economic conditions.

Although universities employ a much higher (and younger) proportion of PhD-qualified scientists compared with National Agricultural Study and Research Institute (INERA) and other government agencies, few of them have the time or resources to focus on research. An increasing number of private universities and nongovernment organizations have also become involved in agricultural R&D in recent years, but their capacity is limited. Linkage with industries and diversity in partnership have remained very poor. This is attributed to the inherent poor capacity of HEIs, the long period of instability which has scared most of the donors, limited number of industries because of tax regime and corruption of official.

5.4.4 Gender participation in school and work

Women in the DRC have not attained a position of full equality with men. During the Mobutu regime women enjoy some legal rights (e.g., the right to own property and the right to participate in the economic and political sectors), however, the custom and legal constraints still limit their opportunities. Female participation in the private sector economy is lower than in most African countries (World Bank, 2013). Female inclusion in the private sector in DRC lags behind than in other countries in all measures of participation considered. Similarly, female participation as firms' owners and managers is not only low. About 14% of the firms are owned by a female manager in, below the global average of 19%. The percentage of female workers in the workforce was stable at 19% but notably lower than the average of 34%. In spite of the different national legislative provisions and international conventions which the DRC has adopted, the level of female representation in public decision making positions is put at less than 10% for the country. The proportion of women unable to undertake an economic activity for lack of resources is put at 44% against 22% for men. The distribution of jobs is marked by deep disparities between the sexes. According to AfDB, (2008), women occupy only 2.8% of waged jobs, which are concentrated in farming, the informal sector, and commerce.

5.4.5 Confusing policy and legal framework

There is a confusing policy and legal framework hampering the development of higher education resulting into an uncontrolled and imbalanced quantitative growth with a rapid deterioration in quality. This curtails even its contribution to its role in promoting economic development as well as in improving the quality of primary and secondary education. The change in the system to a mixed public and private provision was also neither smooth nor planned and occurred due to abrupt and major changes or reversals in policy, creating an uncertain environment for the development of the sector.

5.4.6 Lack of academic freedom

In most of the HEIs, the leaders are appointed by jeopardizing the institutional governance efficiency. HEIs don't have autonomy of the programmes they run, and to some extent the student recruitment. Even where such institutional control is not formally in place, academic freedom can be constrained by the broader political restrictions on freedom of speech, and the government's propensity to marginalise, arrest, or threaten those who criticise the regime. It is important to note that academics only thrive when they are given the liberty to pursue original and timely issues, and the space to provide critical analysis. Their work, in turn, challenges society to grow and improve.

5.4.7 Disorganized student recruitment process

DRC made a shift from elite training to mass training. During this shift, the recruitment process was significantly altered. The key university entry criteria is having at least 50% pass mark in the State examination (Examen d'Etat) and having resources to pay for tuition fee. Finding a student who specialized in pedagogy in secondary school doing medicine or engineering at university is not a rare case in DRC. This student will certainly experience various challenges at university.

5.4.8 Limited trainings in emerging disciplines

The lack of trained teachers in new disciplines is the obvious constraint, but non-availability of books is another major problem. In some HEIs, lecturer develop their course module, sell them to the students. Lack of adequate library and laboratory in most of HEIs has had a deleterious effect on the quality of instruction in the sciences and in medicine. Fees from students are insufficient to cover the cost of materials especially in the natural sciences. Subsequently students receive a theoretical training, with limited practical exposure. The sharing of laboratory and libraries between HEIs has been the main way in which access has been expanded without heavy investments in equipment. The same practice has been applied for the human capacity. But this has contributed to lengthening the academic year in both sectors and indirectly to raising the costs of education for students.

5 Conclusions and recommendations

DRC has large and growing higher education system, which includes public institutions and private largely dependent on family funding. Due to demographic pressure the enrolment is rapidly increasing in both public and private HEIs, reducing significantly the government

resources allocated to train a student. This is likely to overwhelm the entire HEIs if preventive measures are not taken considering the socio-economic environment of the student families.

Despite recent efforts to improve budget allocation to education, public education has remained underfunded compared to most other countries in the region, with only 10.9% of the government budget allocated to education and implementation budget of 1.8% of GDP in the sector. In addition, the sector is facing various challenges including, limited academic autonomy in selecting leaders and designing the curricula, proliferation of HEIs, and a plethora of administrative staff both in the ministry and in the HEIs. Congolese women and girls do not benefit from equitable representation in the HEIs in the DRC at all levels. There is inequality in access to higher education, academic careers and managerial functions as a pyramid that tapers from the bottom to the top. R&D and Science, technology and Innovation has been marginalized for the last two decades.

Based on the above results and conclusions, there is need to:

- Ensure adequate funding of the education system and its future expansion. This funding should aim at increasing in the unit cost of operations and equipment in order to make viable the higher education system. This will also require diversification of funding sources.
- Develop medium to long term plans to resolve the HEIs structural and governance challenges that threaten to compromise the quality of the training provided by the HEIs. The quality of HEIs students not only depends on the quality of the HEIs academic staffs, the quality of the learning conditions at HEIs but also the quality of the pre-university training. There is therefore need to enhance the learning conditions in the pre-university schools, standardize the training at these levels, promote more practicals than theories and thinking than memorizing.
- Build capacity of HEIs academic and administrative staff, through south-south and north –south partnerships. However, taking into consideration the current quasi isolation of the country at international level, there is a need to push for more south-south collaborations. There are various HEIs in the different regions of the continent which could offer adequate training to human resources in DRC. To this effect, RUFORUM as a network of universities for capacity building offer multiple opportunities for the country.
- Strengthen the capacity of the "Commission Permanente des Etudes" of the Ministry of Higher Education, to be able to perform its tasks, and regularly evaluate programmes and accredit them.
- Create a credible quality assurance system, which would have authority over both public and private HEIs.
- the use of innovation systems approach to strengthen the technological capabilities of the country
- Evaluate the scientific and technical potential of R&D institutions;
- Institutionalize the collection and management of HEIs, R&D, and Science, Technology and Innovation (STI) statistics with a view to producing indicators for Experimental Research and Development (R&D) and Innovation;
- Create and strengthen partnerships between major stakeholders in the national innovations systems for enhanced R&D and STI within the country.

Reference

Baharanyi, N., Karki, L. B., & Mutaleb, M. (2014). Democratic Republic of the Congo: AET background study.

Banque Mondiale (2003) Financement et qualité de l'enseignement primaire et secondaire en RDC. Fiche d'information RDC.

Banque Mondiale (2004) "Improving Tertiary Education in Sub-Saharan Africa: Things That Work." Report of a regional training conference held in Accra, Ghana, September 22–25, 2004. Papers and final report available at www.worldbank.org/afr/teia.

Banque Mondiale (2005a) Education in the Democratic Republic of Congo Priorities and Options for Regeneration. World Bank, Washington, D.C. 20433, U.S.A

Banque Mondiale (2005b) Le Système éducatif de la République Démocratique du Congo : Priorités et alternatives, 184 p.

Banque Mondiale (2015). Revue des Dépenses Publiques du secteur de l'éducation en République Démocratique du Congo: Une Analyse d'Efficience, d'Efficacité et d'Équité, Rapport No. ASC14542

Bashir, S. (2009). Changing the trajectory: education and training for youth in Democratic Republic of Congo. The World Bank.

BEFS. (2013). Democratic Republic of the Congo: BEFS Country Brief. Rome: FAO. Retrieved from http://www.fao.org/energy/36342-0d2a826525757566a86e626cfa3de1fb0.pdf.

Bigohe, J.B. (2014). L'intégration de l'éducation au Développement Durable dans l'enseignement primaire et secondaire en République Démocratique du Congo : Etat des lieux et perspectives d'avenir (Cas de quelques écoles dans la ville province de Kinshasa), Mémoire /Master 2, Université Blaise Pascal/École du Professorat et de l'Éducation, Clermont-Ferrand/France.

Bloom, D. E., Canning, D., Chan, K. J and Luca, D. L. (2014). Higher Education and Economic Growth in Africa (December 18, 2014). International Journal of African Higher Education, 2014, 1(1): 22-57, Available at SSRN: https://ssrn.com/abstract=25401662004.

Bloom, D., Canning, D. and Chan, K. (2006) Higher Education and Economic Development in Africa. Washington DC: The World Bank

Bloom, D., Canning, D. and Kevin, C. (2005). Higher Education and Economic Development in Africa. Harvard University, World Bank (AFTHD)

Bou-Habib, C. and Kebede, E. (2016). Democratic Republic of Congo: Product and Market Concentration and the Vulnerability to Exogenous Shocks, the World Bank, Policy Research Working Paper 7700, Macroeconomics and Fiscal Management Global Practice Group, June 2016.

Carnoy, M., Castells, M., Cohen, S.S. and Cardoso, F.H. (1993) The New Global Economy in the Information Age: Reflections on our changing world. University Park: Pennsylvania State University Press

Centre National d'Appui au Développement et à la Participation Paysanne CENADEP (2009). Province orientale :le diamant et l'or quelle part dans la reconstruction socio - économique de la Province ? (Report). Archived from the original on 25 November 2009.

Cellule Technique pour les Statistiques de l'Education-CTSE. (2011). Le Tableau de Bord de l'Education en République Démocratique du Congo, Annee scholaire 2009/2010, Kinshasa

Ministère de l'Enseignement Primaire et secondaire. 2011. Draft Plan Intérimaire de l'Education-, Novembre 2011, p. 11.

Dunia, P & Zongwe. D. P (2019). "Democratic Republic of the Congo", Online Compendium Autonomy Arrangements in the World, March 2019, at www.world-autonomies.info.

Essl, S., Celik, S. K., Kirby, P., Proite, A. (2019). Debt in Low-Income Countries Evolution, Implications, and Remedies. World Bank, Policy Research Working Paper 8794, Macroeconomics, Trade and Investment Global Practice March 2019

Goossens, F., Minten, B. & Tollens, E. (1994). *Nourrir Kinshasa, l'approvisionnement local d'une métropole africaine,* L'Harmattan, Paris, p. 404.

Kabuya, K. F and Cassimon, D. (2010). Global Financial Crisis Discussion Series Paper 15: Democratic Republic of Congo Phase 2. Overseas Development Institute 111 Westminster Bridge Road. London SE1 7JD

Kalonji, N. (1984). *La pauvreté dans les quartiers périphériques de Kinshasa,* Analyses Sociales, Vol. I, 3, Kinshasa, pp. 3-23.

Kruss, G., McGrath, S., Petersen, I. & Gastrow, M (2015). *Higher education and economic development: The importance of building technological capabilities. International Journal of Educational Development, 43, 22–31.*

Jenal, M., and Cunningham, S. (2019). Rapid assessment: Disruptive Technologies for Private Sector Development in the DRC. Oxford Policy Management

Lapole Kanga, J.C. (2013). Assessment of the Heavily Indebted Poor Countries Initiative in the Democratic Republic of Congo. GREAT Insights, Volume 2, Issue 1. January 2013. Maastricht: ECDPM

Martin, S. & Jucker, R. (2005), "Educating Earth-literate Leaders", Journal of Geography in Higher Education, Vol. 29 No.1, pp. 19-29.

Maton, J. (1991). *Zaïre: Structural Problems of the Balance of Payments,* Ghent.

MINEPSP/CTSE (2013), *Annuaire statistique de l'enseignement primaire, secondaire et professionnel, année scolaire 2011-2012.*

Ministère de l'Enseignement Primaire Secondaire et Initiation a la Nouvelle Citoyenneté, Ministère de l'Enseignement Technique et Professionnel, Ministère de l'Enseignement Supérieur et Universitaire. Stratégie sectorielle de l'éducation et de la formation 2016-2025. Décembre 2015.

Mugabe, J., O., (2011). Science, Technology and Innovation in Africa's Regional Integration: From Rhetoric to Practice. ACODE Policy Research Series, No. 44, 2011. Kampala.

Nachega, J.C. (2005). "Money Demand, Inflation, and PPP in the Democratic Republic of the Congo," International Monetary Fund, (forthcoming) Working Paper, (Washington: International Monetary Fund).

Okeke, I. N., Babalola, C. P., Byarugaba, D. K., Djimde, A., & Osoniyi, O. R (2017). Broadening Participation in the Sciences within and from Africa: Purpose, Challenges, and Prospects. *CBE life sciences education*, *16*(2), es2. https://doi.org/10.1187/cbe.15-12-0265

Okeke, I., Babalola, C., Byarugaba, D. Djimde, A. & Osoniyi, R (2017). Broadening Participation in the Sciences within and from Africa: Purpose, Challenges, and Prospects. CBE Life Sciences Education. 16. 10.1187/cbe.15-12-0265.

Oketch, M. (2016). Financing higher education in sub-Saharan Africa: some reflections and implications for sustainable development. High Education (2016) 72:525–539 DOI 10.1007/s10734-016-0044-6.UNICEF. 2017. UIS, Montreal.

Pillay, P. (2010). Linking Higher Education and Economic Development: Implications for Africa from three successful systems. Cape Town: Centre for Higher Education Transformation professionnel, année scolaire 2011-2012.

Rowe, A. L. (2010) "Education for sustainability: Developing MBA students' critical reflective and action learning in their work context", Review of Business Research, Vol. 10 No.2, pp. 145-149.

Saint, W.(2009). Tertiary education and economic growth in sub-Saharan Africa. The World Bank Report. Retrieved April 29, 2009, from www.bc.edu/bc_org/ avp/soe/cihe/newsletter/Number 54/p14_saint.htm.

Salazar-Xirinachs, J.M., Nübler, I. and Kozul-Wright, R. (2014). Industrial policy, productive transformation and jobs: Theory, history and practice. *Transforming Economies. Making Industrial Policy Work for Growth, Jobs and Development*.

Serageldin, I. (2000) University governance and the stakeholder society. Keynote Address, 11th General Conference: Universities as Gateway to the Future, Durban, 20–25 August 2000, International Association of Universities

The World Bank (2009) Accelerating Catch-up: Tertiary education for growth in sub-Saharan Africa. Washington DC: The World Bank

UIS (United Nations Educational, Scientific and Cultural Organization Institute for Statistics). 2012. "Reaching Out-of-School Children Is Crucial for Development." Education for All Global Monitoring Report, Policy Paper 04, UNESCO, Paris.

UNESCO (2006). Education for sustainable development toolkit; http://unesdoc.unesco.org/images/0015/001524/152453eo.pdf

UNESCO Institute for Statistics (2005): Global Education Digest 2005.

UNESCO (2011). The Hidden Crisis: Armed Conflict and Education. Education for All Global Monitoring Report. Paris: UNESCO.

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Fertility Patterns 2015 – Data Booklet (ST/ESA/ SER.A/370).

Varghese, N.V. (2004). "Patterns in ownership and operation of private higher education institutions". In: N.V. Varghese (Ed.), Private higher education. Paris: IIEP-UNESCO. International Institute for Educational Planning http://www.unesco.org/iiep

von Tunzelmann, N., & Wang, Q. (2007). Capabilities and production theory. Structural Change and Economic Dynamics, 18(2).