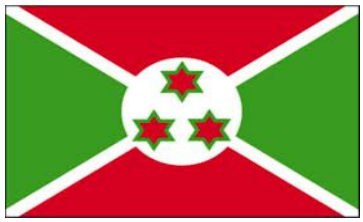

REPUBLIC OF BURUNDI
Ministry of High Education and Scientific Research

IMPLEMENTATION ACTION PLAN AND STRATEGIES OF THE NATIONAL POLICY FOR SCIENTIFIC RESEARCH AND TECHNOLOGICAL INNOVATION
2014-2018

BUJUMBURA, May 2014

ACRONYMS AND ABBREVIATIONS

ACODE : Advocates Coalition for Development and Environment
ACVE : Green Belt Action for Environment
AFEB : Burundi Women and Environment Association
AMI : African Mathematics Institute
AMRS : African Materials Research Society
ARC : Rapid Appreciation of Blindness
ARCT : Telecommunication Regulation and Control Authority
ARV : Antiretrovirals
AU : African Union
AUC : African Union Commission
BAD : African Development Bank
BBN : Bureau of Standardization and Quality Control in Burundi
WB : World Bank
BST : Bureau of Science and Technology
BV : Water sheds
CAM : Medical Insurance Card
CDS : Health Center
EAC : East African Community
CEEAC : Economic Community for Central African Countries
CEFORMI : Center for Studies, Training and Research on Infectious Diseases
CELAB : Center for Language Studies in Burundi
CEPGL : Economic Community for the Great Lakes Countries
CERADER : Center of Research in Agronomy and Rural Development
CERDA : Center of Studies and Research for the Agronomic Development
CERTA : Center of Studies in Agri-food Technologies
CFPTAM : Centre of Training of the Aeronautical and Metorological Technical Staff
CHUK : University Hospital of Kamenge
CNB : National Center for Biosafety
CNLS : National Council for the Fight against AIDS
CNR : National Referential Center
CNRSIT : National Center for Research in Science, Innovation and Technology
CNSTI : National Commission of Science, Technology and Innovation
CNTA : National Center for Food Technologies
Co. Co : Communal College
CORAF/WECARD : Western and Central African Council for Agriculture Research and Development
CREDSR : Research and Study Center for companies under Rehabilitation Process
CRIDIS : Center of Interdisciplinary and Social Research
CRUEA : Center of University Research in Alternative Energies
CRUPHAMET : Center of University Research in Codex and Traditional Medicine
CRUST : Center of University Research in Earth Science
CRUME : Center of Multidisciplinary University Research on Environment
CSLP : Strategic Framework of Growth and Fight Against Poverty
CT : Technical Cooperation
CURBA : University Center for Research in Applied Biology
CURDIF : University Center for Research in Computer Development
CURDES : University Center for Research in Economic and Social Development
CURMES : University Center for Research in Epidemiological Medicine and Health
CURPEL : University Center for Research in small flock

CURSAP	: University Center for Research in Public Health
EDS	: Demographic Survey and Health
EAC	: East African Community
EDSB	: Demographic Survey and Health in Burundi
ENS	: High Teacher Training School
EPISTAT	: Epidemiology and Statistics
IMF	: International Monetary Fund
FOSA	: Health Training
FSA/ITS	: Faculty of Applied Science/High Technical Institute
GAVI	: Global Alliance for Vaccines and Immunization
GIZ	: German Technical Cooperation
GSEA	: Sectoral Group of Water and Sanitation
HRST	: Human Resources, Science and Technology
IDH	: Human Development Indicator
IEC	: Information, Education and Communication
IGEBU	: Burundi Geographic Institute
IMB	: Institute of Mathematical Sciences in Burundi
IMC	: International Medical Corps
INASE	: National Institute of Space Science
INEAC	: National Institute of Agronomic Studies in Belgian Congo
INECN	: National Institute of Environment and Nature Conservation
INSP	: National Institute of Public Health
IOV	: Objectively Measurable Indicator
IPPTE	: Very Highly Endebted Poor Countries Initiatives
IRA	: Acute Respiratory Infections
IRAZ	: Institute of Agronomic and Zootechnical Research
IRRI	: International Rice Research Institute
ISABU	: Institute of Agronomic Science in Burundi
KFW	: German Financial Cooperation
ISTEEBU	: Institute of Statitistics and Economic Studies in Burundi
LACA	: Laboratory of Control and Chemical Analyses
LMTC	: Fight against Transmitted and Deficit Diseases
LNBTP	: National Laboratory of Buildings and Public Works
MCIPT	: Ministry of Trade, Industry, Posts and Tourism
MDCD	: Ministry of Communal Development and Decentralization
MEBSEMFPA	: Ministry of Elementary and Secondary, Vocational and Professional Education and Literacy
MEEATU	: Ministry of Water, Environment, Land Management and Urban Planning
MEM	: Ministry of Energy and Mines
MESRS	: Ministry of High Education and Scientific Research
MFPDE	: Ministry of Finance and Economic Development Planning
MFPTSS	: Ministry of Civil Service, Labour and Social Security
MII	: Insecticide Sprayed Mosquitonet
MINAGRIE	: Ministry of Agriculture and Livestock
Min Inter	: Ministry of Home Affairs
MJGS	: Ministry of Justice and Keeper of the Seals
M J S C	: Ministry of Youth, Sports and Culture
MPACEA	: Ministry to President's Office in charge of East African Community Affairs
MPBGP	: Ministry to the President's Office in charge of Good Governance and Privatization
MRECI	: Ministry of Foreign Affairs and International Cooperation

MSNDPHG	: Ministry of National Solidarity, Human Rights and Gender
MSP	: Ministry of Public Health
MSPLS	: Ministry of Public Health and Fight against AIDS
MTICRP	: Ministry of Telecommunication, Information, Communication and Relations with the Parliament
MTTPE	: Ministry of Transport, Public Works and Equipment
NEPAD	: New Partnership for Africa's Development
OCDE	: Organization for Trade and Economic Development
ODEB	: Organization for the Defense of Environment in Burundi
OMD	: Millennium Development Goals
WHO	: World Health Organization
NGOs	: Non Governmental Organizations
PADPNTIC	: Action Plan for Development of ICT National Policy
PAGIRE	: Action Plan for the Integrated Management of Water Resources
PANA	: National Action Plan for Adaptation to Climate Changes
PDDAA	: Detailed Program for Agriculture Development in Africa
PETS	: Public Expenditure Tracking Survey
PEV	: Extended Vaccination Program
PNDS	: National Plan for Health Development
PNDTIC	: National Policy for the Development of Information and Communication Technologies
PNIA	: National Plan for Agriculture Investment
PNILP	: National Integrated Program for the Fight Against Malaria
PNILT	: National Integrated Program for the Fight against Tuberculosis
PNRSIT	: National Policy on Scientific Research and Technological Innovation
UNDP	: United Nations Development Program
PSDEF	: Sectoral Plan for Education and Training Development
PTF	: Technical and Financial Partners
PTME	: Care Taking of Mother-Child Transmission
PVVIH	: Human Immuno-Deficiency Virus Positive People
RCMRD	: Regional Centre for Mapping of Resources for Development
R-D	: Research - Development
REGIDESO	: Utility of Production and Distribution of Water and Electricity
RGPH	: General Census of the Population and Habitat
RNB	: National Gross Revenue
RSI	: International Health Regulation
SAN	: Agriculture National Strategy
SETIC	: Executive Secretariat of Information and Communication Technologies
AIDS	: Acquired Immuno-Deficiency Syndrom
SIG	: Geographic Information Systems
SKA	: Square Kilometer Array
S.M	: Mathematical Sciences
STI	: Science, Technology and Innovation
STR	: Science, Technology and Research
SWOT	: Strengths, Weaknesses, Opportunities and Threats
ICT	: Information and Communication Technologies
UB	: University of Burundi
UNICEF	: United Nations International Children's Emergency Fund
USAID	: United States Agency for International Development
USD	: United States Dollar
VIH/SIDA	: Human Immuno-Deficiency Virus / Acquired Immuno-Deficiency Syndrom

PTA : Preferential Trade Area

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CHAPTER 0. GENERAL INTRODUCTION

The current realities show enough that developed countries are the ones which have invested enough in the research activities and resources allocated to the sector. Consequently, the countries with poor natural resources should invest much more in the sector by rationalizing the use of human, material and financial resources on research, innovation and technological development activities.

The situation currently experienced by Burundi imposes us such a process. We can no longer allow ourselves to rely on the sole sector of agriculture where cultivated croplands are becoming rare and deteriorated due to heavy demographic pressure now very hectic to put under control. The organization and management mechanisms of the scientific research in science and technology is an imperative in order to address the challenge and better respond to the current development priorities for our country.

In fact, science, technology and innovation (STI) are now universally recognized as powerful drives for economic development at the national level and as key factors for poverty reduction, prevention of diseases and for environmental conservation. The scientific capacity strengthening for a sustainable development, as well as the use of findings of scientific discoveries cannot be obtained without a global framework for science, technology and innovation. Burundi must initiate solutions through policies and programs, by establishing institutions and partnerships, in order to diversify economic opportunities.

It is in this respect that the Minister in charge of scientific research and innovation has set in place a Commission in charge of designing a National Policy for Scientific Research and Technological Innovation (PNRSIT). The fundamental orientation of this policy consists of developing and valuing the national potential. Therefore, the Government of Burundi intends to encourage the promotion and progress of knowledge, improve productivity and value natural resources through new and even audacious approaches vis-à-vis the national realities. It is notably an industrial policy which is endogenous and self-centered on natural resources and opportunities, likely to develop non-agriculture employment, mastering the organization and integrating social and cultural values.

The implementation of the policy required a formulation of a Strategic Action Plan (SAP) to materialize the interventions likely to lead the country towards a real and sustainable economic growth.

The present Strategic Action Plan indicates the manner how the activities retained in the National policy document for Scientific Research and Technological Innovation are implemented. In this respect, a matrix of the logic framework summarizes, in a chart, the main goal, the underlying specific goals, the main activities to be undertaken, the expected outcomes, the measurable indicators (IOV), the institutions responsible of the implementation of each activity as well the provisional budgets.

Concerning the timeline, the Action Plan covers a period of five years (from 2014 to 2018) and indicates the manner how the implementation of the different activities will be undertaken. This is a slipping Action plan whose effective implementation depends on the rapidity with which the institution in charge of its implementation will access required financial, human and material means. It was realized with the technical assistance of UNESCO through the Spanish Cooperation Funds for capacity building in terms of STI policy for Africa.

The present Strategic Action Plan document comes further to the National Policy for Scientific Research and Technological Innovation (PNRSIT). It contains the activities to be undertaken for the effective implementation of the PNRSIT. This is in line with the Burundi vision 2025, of the Strategic Framework of Growth and Fight Against Poverty, 2nd generation (CSLP II). It goes in line with the Consolidated

Action Plan on Science and Technology in Africa and Sector based Plan for the Development of Education and Training (PSDEF).

Given that it is an iterative process based on the values and principles of the National Policy for Scientific Research and Technological Innovation involving the whole of development partners of the country, the Action Plan is a flexible and dynamic document which could be amended at any moment according to the needs of the National Commission of Science, Technology and Innovation (CNSTI) to be created to pilot and follow up the process.

Burundi, being less technologically advanced, must make much more effort in order to stop lagging behind. It also has to count on its own resources just like other countries such as India after independence, China after revolution and Japan of M'iji era. In fact, according to the data collected from the World Bank (World Development Indicators, 2001), India and China of 1970 had economies comparable with the one of Burundi. Even when compared with the other East African countries (EAC), Burundi accuses a critical delay in technologies as indicated in the Chart 1 here below.

Chart 1 : General indicators of the East African Community

Country	Burundi	Kenya	Rwanda	Tanzania	Uganda	Tot	Average
IDH Rank	185	143	166	152	161		
Population (millions of people)	8	41	11	46	34	140	
R.N.B. / hab.	368	1492	1133	1328	1124		1256
I D H	0.32	0.51	0.43	0.47	0.45		0.46
Life expectancy	50.4	57.1	55.4	58.2	54.1		56.2
Level of secondary and more education (%)	7.20	29	7.70	7,40	15		15.1
KWh/ (an×hab.)	23	162		70			113
% of rural population	89	78	81	74	87		77
Area in thousands of km²	28	583	26	940	237	1814	

Source : RDH 2011, UNDP

- Rank: Classification according to the composite indicator of human development IDH (over 187 classified countries)
- Population in Millions in 2011
- IDH composite indicator of human development as defined by UNDP
- Level of training: the percentage of people aged of 25 and more years who have completed secondary education or more.

The chart 2 gives a projection of a goal to be achieved according to the Burundi Vision 2025 [V2025] which projects 720 $ per capita in 2025, that is 490 in 2018. This chart indicates the long and medium term projected progress for Burundi. Thus in 2017, the Burundian population is projected at 9.7 millions.

Chart 2 : Development Planning up to 2042 for Burundi

	2011	2015	2020	2025	2030	2035	2042	Norway
Population in millions of people	8.5	9.4	10.6	12	13.6	15.4	18	
Gross Income (USD/ 2005)	368	540	2084	2761	3659	4849	7200	47000
Life expectancy	50	56	60	62.2	64.5	66.9	74.5	81.1
IDH	0.32						0.7	0.94
Level of secondary education or more (%)	7.2	9	12	16	21	28	41	99.2
KWh / an / hab.	23	50	93	175	329	620	1500	23000
% of rural population	89	78	67	57	48	33	22	

Besides, to achieve a technological level likely to help us enjoy the projected outcomes, we obviously need to produce corresponding products and this leads to the assessment of the required human resources. If we consider that a PhD holder executive has an optimum productivity when assisted by 10 M.A. holders as described in Chart 3 here below, we have for 2018, for a total population estimated at 9.7 millions, a number of 250 PhD holders. China, which is one of the countries considered as model countries produces 8,000 PhD holders per year, which, proportionally, would give 200 PhD per year to Burundi (Tumushabe & Mugabe, 2012). With a total productivity, Burundi would have 2,500 PhD holders in 2025 instead of one fifth of this total.

Chart 3 : Jobs per grade

Grades (proportion)		**#en 2025**
A+ (sec+9 and +) PhD and Specialist Medical doctors	1	540
A+ (sec+6 and +) M.A. and General Medical Practitioner	10	5400
A0, A1	100	54000
A2, A3	1000	540000
TT (All works)	10000	540000

It is required to closely assure training/employment adequacy. If needs lie in engineering, we should not train in Arts for the sole reason that this would be less expensive.
The Chart 4 classifies professions in 4 categories with equal numbers. If the PhD holders are 400, 100 will be Civil Engineers, mathematicians and physicians (category 3). This distribution generally corresponds with what is done in China where 70% of the graduated are found in scientific fields (Tumushabe & Mugabe, 2012).

Chart 4 : Number of graduated per field of specialization ratio

1	Agronomy - chemistry – geology – biology	100
2	Medical Science – Pharmacy – Education Science – Psychology – Sociology	100
3	Civil Engineering– Maths – Physics	100

4	Arts – Law - Economics – Administration	100

To those technologists, we need to avail not only conducive learning environment, but also the secondary education must provide good quality candidates.

Chart 5 provides some of the industries to be promoted according to their degree of complexity as categorized according to the level of complexity.

Chart 5: Industries per level of technology

Level	Industry
Very high	Aeronautics and Space Pharmaceutical products Information processing material Equipment for radio-tele communication Precision medical instruments
High	Electrical machines and devices Automobiles, trailers Chemical products Railroad rolling stock Machinery and equipment
Average	Petroleum products, nuclear fuels coking Rubber and plastics Non metallic mineral products Ship construction and servicing Basic metallurgical goods Metal works
Weak	Manufacturing and reconditionning activities Paper, paperboard, edition, printing and wood Foods, beverages, tobacco Textile, clothing, furskin and leather
Very weak	Use of self-tracted material Use of tracted or pushed motos Use of wheels and animal draught power Manufacturing of wood made tools

Source : St-Pierre, 2002

Finally, to achieve a general development, technological research and innovation must be permanently on top of decision makers' ideas.

CHAPTER 1. VISION, OPPORTUNITIES CHALLENGES OF THE ACTION PLAN

In December 2010, Burundi drafted a key prospective guiding document, that is « Burundi Vision 2025 » which is a reference for development in the coming fifteen years and traces the main guidelines for economic and social growth of the country.

It intends to set Burundi on the way for a sustainable development by 2025. In terms of quantity, the Vision intends to reduce the negative trends of the Gross Domestic Product (GDP) per capita of 137 USD today at 720 USD in 2025 and reduce the poverty rate at 50% instead of 67% today. The stability of the population growth rate, the food insecurity and economic growth, based on agriculture, is part of the major challenges identified in the « Vision 2025 » document. Considering the rare sources of the country, prioritization will be crucial in the selection of policies, goals and strategies.

By 2025, Burundi will be in sustainable peace and sociopolitical stability with an economic growth which allows all citizens to access education and aspire for an economically, socially and humanly acceptable life.

It is in this respect that the strategic plan for the promotion of science, technology and innovation will significantly contribute for the socio-economic development of Burundi and welfare of its population. It is notorious that a population educated in terms of science and technology is in fact a real engine for prosperity in any country.

The success of the strategy to develop technology and research in Burundi will pass through partnership with the actors of the public life, that is, the world of science, policy makers, economic operators and the population. The development of science, technology and research will then contribute for the improvement of the quality of the population living conditions, the economic growth and improvement of the population knowledge in terms of science and technology. The strategic plan for science, technology and innovation is then designed in order to meet the needs of the country in terms of poverty reduction and sustainable development.

One of the main outcomes expected from this strategic plan is notably the transformation of the rural area into a world with direct contact with modern technology. This will allow the communities to no longer only rely on agriculture, but rather initiate other income generating activities in a sustainable manner. This will create a national dynamics of economic and social growth in Burundi and in the region. No country in the world has ever developed without science, technology and innovation.
In its efforts of economic upswing, the Government of Burundi has just highlighted the sector of agriculture and livestock which constitutes the basis for food and main source of foreign currency for the country. It is in this respect that the Government called upon all public powers and private sector to engage in this logic which must propel the country on the way of a sustainable development.

It is equally in this respect that the Government of Burundi, via its Ministry of Agriculture and Livestock, already encourages the reform of the sector in order to make Burundi leave the economy of subsistence for the market economy through diversification and intensification of production, conservation, transformation and trading of products.

In the course of implementation of the national policy for scientific research and technological innovation, Burundi is faced with a number of challenges among which the main ones are listed here below :

The agriculture sector is characterized by an agriculture of subsistence with less use of inputs given the status of general impoverishment of the community. The agri-food technologies are still at the

embryonic stage with very few structures of food product processing; hence, the importance of post harvesting losses. While the country is full of significant power sources (water, wind, solar, etc.), this section remained less advanced and this constitutes the major obstacle for development because no country in the world has developed without developing the energy sector.

The country is still classified among the most densely populated with 310 inhabitants per Km^2 and a total population of 8 053 574 inhabitants in 2008. This population presents an annual growth rate of 2.4%, which leads to predict it will become 11.5 millions in 2023 whose main portion (more than a half) living under the bottom line of poverty. This causes, inter alia, consequences, enormous difficulties of access to health services.

Despite the efforts deployed, the country remains behind in terms of information and communication technologies, which strengthens its landlocked situation.
The Government of Burundi is convinced that it is possible to significantly reduce poverty if the country has a sustained economic growth rate, development of its human resources and an effective commitment of the sectoral ministries, civil society organizations, economic operators and international organizations in the implementation of different national policies intended for economic growth.

The stability of population growth rate, food security and economic growth based on agriculture are part of the major challenges identified in the « Burundi Vision 2025 » document.

The Government of Burundi adopted, in January 2012, a Strategic Framework of growth and Fight against poverty, second generation (CSLPII), in which priority investment sectors have been identified and mentioned in the following four axes:

- Strengthening the rule of law, consolidation of good governance and promotion of gender equality;
- Transformation of the Burundian economy for a sustained growth and job creation. ;
- Improvement of the access and quality of basic social services and strengthening the base of social protection;
- Space and environment management for a sustainable development.

To better succeed, Burundi will create a national framework of collaboration and set in place innovation mechanisms which would cover education, scientific and technological research institutions, services of product design, private enterprises and other mechanisms through which products and production processes are reflected ; the first responsibility of such a platform is the strengthening of national capacities in terms of selection, absorption and promotion of technologies.

According to the African Union, through the Nairobi Ministry Declaration on STI (2012), the ministries in charge of STI decided that the African countries meet their commitment of devoting at least 1% of the Gross Domestic Product (GDP) to Research-Development (R-D) and set in place national policies in STI by 2015. It is hereby worth mentioning that countries like China and India, which serve as lighthouse for Third World countries, have devoted to R-D respectively 1.5 and 0.8 % (Tumushabe & Mugabe, 2012), and those two countries are envied by the whole world given their rhythm of industrialization.

CHAPTER 2. STRATEGIC MEASURES

2.1. STATUS OF STI IN BURUNDI: SWOT ANALYSIS (STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS)

The integrated consideration of the elements of the matrix helps to identify challenges (passing beyond weaknesses to benefit from opportunities) and the risks (use of strengths to resist to threats) in order to set up strategic measures concerning the five axes of the STI Strategy.

Strengths

- Availability of the political framework (Vision 2025, CSLPII) and the firm will of the Government to make of science, technology and research a tool for sustainable development;
- Existence of sector based policies of ministries as well as a legal and institutional framework in the fields of agriculture, health or environment;
- Existence of planning tools such as the data from the inventory of infrastructures;
- Existence of some research centers and universities with a number of researchers who have acquired high level knowledge in their areas of expertise;
- Existence of national and private laboratories likely to serve for analysis or trials, with qualified staff, although in a limited number;
- Presence of foreign operators with the potential of developing the world of communication;
- Existence of local NGOs in the fields such as health and environment.
- Existence of farmers' associations;
- Membership of Burundi in different political groupings and regional organizations as well as international commitments underlying the promotion of research;
- Existence of international partnerships with participation of centers and researchers of Burundi;
- Existence of donors in activities concerning research, notably in the fields like health.

Weaknesses

- Lack of enough political, scientific and strategic coordination of the different sectors;
- Difficulty to adapt high education programs in all key areas with the needs of the country;
- Lack of enough expert researchers and lecturers especially in high education, as well as the embryonic nature of post-university training;
- Lack of motivation of researchers, thence, brain drain;
- Lack of status of researcher and research staff;
- Weakness of research in private universities;
- Lack of infrastructures to implement research programs;
- Lack of enough laboratories and qualified human resources for quality control;
- Low development of manufacturing and transformation industries;
- Lack of enough activities of technological innovation and modern production systems as well as valuable products in the export markets;
- Lack of inventory of knowledge, efficient mechanisms of defense for intellectual property and appropriate channels for publication of technologies to potential users;
- Lack of culture of entrepreneurship;
- Poor level of financial means for research and development activities and the funding of laboratory equipment;
- Low rate of public funding and low investment in the STI field by the private sector;
- High dependence of the financial support from international organizations;
- Low level of collaboration among regional and international institutions;
- Lack of culture of research and innovation.

Opportunities

- Conducive condition of the agro-ecological and hydrological framework : High potential of the country vis-à-vis some renewable energies (hydropower, solar, wind, biomass) ;
- The regional integration of the country with the projects of road and infrastructures construction in the East African Community;
- New possibilities of production and improvement of the living conditions of the population based on an easy access to power;
- Development of an operational agriculture partnership as well as individual initiatives (micro-rural entrepreneurship) ;
- Possibility of exploiting potential cross-borders' markets;
- Engagement of industrial enterprises and services on the way of innovation by establishing collaboration among research institutions and enterprises;
- Policies of free healthcares in favor of some categories of the population such as under five year old children and pregnant women, as well as fight against avoidable diseases using vaccination;
- Existence of specialized public and private laboratories as well as specialists in biotechnology which allows to value the biological resources of the country;
- Sub-regional, regional and international integration;
- Regional and international cooperation with effective bilateral and multilateral partnership.

Threats

- Dependence on the external support for the areas that are so much strategic as energy, exploitation of natural resources or the Agri-food sector;
- Irrational management of the rural and urban territory without taking into account the availability of drinking water and water treatment capacity;
- Climate changes likely to reduce vegetal and animal production or cause disappearance of non tolerant species, cause drought or water floods as well as proliferation of some diseases;
- Lack of private investment in key sectors of the economy;
- Reduction of international donor funding;
- Regional and international competition;
- Existence of some cultural barriers hindering the resort to new methods and techniques, like in health.

2.2. HORIZONTAL STRATEGIC MEASURES

For the implementation of the strategy, bodies in charge of research in Burundi, in particular the National Commission of Science, Technology and Innovation and the Ministry of High Education and Scientific Research (MESRS), in the exercise of their functions stipulated in the STI Law, must develop horizontal actions indicated here below in relation with each line or measure of the STI strategy (Chart 6).

Those actions are related to the analysis of the situation of science and technology in Burundi (SWOT analysis) as well as the main goals and lines for the long term national policies, and the legal framework as provided under the STI Law and intends for the consolidation of a sustainable system of science, technology and innovation in Burundi. All those actions will also contribute for the support of economic

and social research priorities as they are mentioned in the areas established in the document of national policy of research and technological innovation.

The actions prescribed in the STI strategy are twofold: serve (1) as political guide and support for the preparation of the normative framework to be applied by the research and innovation entities and actors, (2) regular allocation of budget resources which allow maintaining the strategic vision.

Each of those actions must be planned with a timeline of activities corresponding resources intended for the period of 2014-2018. This strategic planning must clearly show the performance indicators for each action, for instance the annual evolution plan of the number of research groups, thus allowing monitoring and evaluation of the strategy complementarily with the Action Plan.

Chart 6: Description of horizontal strategic measures

Strategic Axes	Strategic measures
1. RESEARCH CAPACITIES (HUMAN RESOURCE)	1.1 STRENGTHENING CAPACITIES OF RESEARCHERS AND RESEARCH TECHNICIANS
	1.2 ESTABLISHING RESEARCH UNITS NOTABLY IN THE AREAS CONCERNING ECONOMIC AND SOCIAL NEEDS
2. INSTITUTIONAL & INFRASTRUCTURE FRAMEWORK	2.1 DEVELOPMENT OF THE REGULATORY AND INSTITUTIONAL FRAMEWORK
	2.2 RESEARCH AND CREATION OF INFRASTRUCTURES WHICH SUPPORT SOCIOECONOMIC AND PRODUCTIVE DEVELOPMENT
	2.3 RESEARCH AND CREATION OF INFRASTRUCTURES FOR RESEARCH AS WELL AS TECHNICAL CENTERS IN FAVOR OF PRIORITY SECTORS
3. KNOWLEDGE TRANSFER (RECHERCH-PRIVATE SECTOR-CIVIL SOCIETY)	3.1 PROMOTION OF TECHNOLOGICAL SERVICES AND INNOVATION NETWORKS TO SUPPORT SECTOR BASED POLICIES
	3.2 PUBLICATION OF SCIENTIFIC AND TECHNICAL KNOWLEDGE TO POTENTIAL USERS
	3.3 STIMULATING THE INNOVATION OF THE PRIVATE SECTOR AND CREATION OF INNOVATIVE ENTERPRISES
4. REGIONAL/ INTERNATIONAL COOPERATION	4.1 PARTICIPATION IN REGIONAL AND INTERNATIONAL RESEARCH PARTNERSHIP
	4.2 PARTICIPATION IN NETWORKS OF RESEARCH CENTERS AND LABORATORIES OF METROLOGY, ANALYSIS AND TECHNICAL TRIALS AT THE REGIONAL AND INTERNATIONAL LEVELS
5. SCIENCE AND SOCIETY	5.1 PROMOTION OF SCIENTIFIC VOCATION OF YOUNG MEN AND LADIES
	5.2 AWARENESS RISING AND SENSITIZATION ABOUT STI

2.2.1. RESEARCH CAPACITY (HUMAN RESOURCES)

2.2.1.1. STRENGTHENING CAPACITIES OF RESEARCHERS AND RESEARCH TECHNICIANS

To mobilize the required scientific experience, Burundi needs to train qualified researchers notably through high education and research institutions, and practices in technical laboratories, as well as the support using structures which allow regional and international mobility intended to efficiently integrate them in the research system of the country. This requires a tremendous government effort to promote and fund scientific technological research, in areas such as biotechnology particularly aiming at finding solutions to address priority social issues, in a stable and sustainable manner.

The initiatives to be developed are:

- Stimulation through competitive work contracts, incorporation of human resources qualified in research: (1) attracting graduate at post graduate young men and ladies for scientific and technological research, (2) integrating good quality researchers capable of setting up research groups, notably researchers based abroad; (3) establishing measures to attract young ladies to the career of researcher and socio-professional and family integration for more senior researchers;
- Establishment and development of public career of researcher with actions intended for the (1) promotion of territory, inter – disciplinary mobility and mobility among research centers, (2) coordination of policies for the staff of research centers;
- Training of human resources in the activities of: (1) research, (2) techniques of research and laboratory management, (3) science and technology management.

2.2.1.2. SETTING UP RESEARCH UNITS, NOTABLY IN AREAS CONCERNING ECONOMIC AND SOCIAL NEEDS

The scientific and technological research always require more of creation and promotion of research groups with a sufficient critical mass to progress and give continuity to generation of new knowledge in more and more specialized areas, so that they can collaborate with other public and private agents of the national research system, as well as regularly participating in research projects or programs in regional and international cooperation.

The initiatives intended to develop are:

- Designing the map of the scientific and technological capacities of Burundi;
- Designing the map of scientific and technological needs of Burundi, in particular the ones of rural women and youths;
- Specialization and aggregating knowledge and skills: building a data base of researchers similar to the style created by Lattes in Brazil ;
- Support to the consolidated research groups, with a medium term perspective of continuity specifically supporting new or emerging groups;
- Promotion of the cooperation and coordination of research groups: (1) inter-disciplinary; (2) supervised by ministries and diverse research centers; (3) public – private ; 4) specialized on socio-economic inclusion and equality of young men and ladies;
- Improvement of competitiveness of researchers and their relation with productive and social demands;
- Promotion of excellence scientific and technical researches in some leading sectors related to national priorities;
- Implementation of quality procedures in research works.

2.2.2. INSTITUTIONAL INFRASTRUCTURES & FRAMEWORK

2.2.2.1. DEVELOPMENT OF THE REGULATORY AND INSTITUTIONAL FRAMEWORK

To create conducive environment for R&D, we will adopt measures allowing to improve the governance of public institutions by providing them with an appropriate model of research management and its application so that it can develop in parallel with the local productive and social needs. Besides, we are going to encourage the strengthening of institutional capacity for the creation and implementation of standards and regulations to manage the environment, health or economic and social risks, by facilitating the participation of the civil society and private sector as well as the increasing link with the international programs.

The initiatives to be developed are:

- Development of the legal framework: (1) STI Law, (2) Decrees to establish the National Commission for Science, Technology and Innovation and a fund to finance research and innovation;
- Strengthening research governance institutions: (1) the structure stipulated in the Law, (2) status of researcher, notably in the universities and health sector;
- Creation of capacities for research and analysis of research policies ; integration of the field of analysis in scientific and technological policy;
- Training of managers of science and technology through (1) seminars, (2) specialized academic training, (3) Information sharing in the regional/international area.

2.2.2.2. STUDY AND CREATION OF INFRASTRUCTURES TO SUPPORT SOCIO ECONOMIC AND PRODUCTIVE DEVELOPMENT

We intend to organize a research and implementation of coordinated initiatives and investments for the creation of new networks of public infrastructures and support to the production systems ; in particular, in priority areas of agriculture, health, energy and environmental sustainability and in the sectors of more discriminated populations (women and youths) which have an incidence on the training and promotion of knowledge and innovation for job creation based on a large participation of the civil society.

2.2.2.3. STUDY AND CREATION OF RESEARCH INFRASTRUCTURES AND TECHNICAL CENTERS IN FAVOR OF PRIORITY SECTORS

The study and creation of institutional scientific capacity supported by the required physical infrastructures (laboratories and equipments) in priority areas such as biotechnology for application in agriculture and medical science will be required in order to maintain the lines of activity of R&D beyond the achievement of the projects disseminated in the institutional environment.

The initiatives to be developed are:

- Study and creation of scientific and technological infrastructures and laboratories and technological and centers for trials or analysis to support the productive sector and low scale farmers who are the majority in the country;
- Improvement of the training of the staff and the quality of the management of infrastructures (equipments, organization) ;
- Coordination of scientific and technological laboratories and infrastructures in order to improve investments in equipments in a coordinated manner and reach a joint use of infrastructures with the researchers;
- Coordination of activities of laboratories, libraries and research data base ;
- Coordination of the policies of institutions on the technical staff;
- Promotion of the joint participation in the national, regional and international infrastructures.

2.2.3. TRANSFER OF RESEARCH KNOWLEDGE TO THE PRIVATE SECTOR AND CIVIL SOCIETY

2.2.3.1. PROMOTION OF TECHNOLOGICAL SERVICES AND INNOVATION NETWORKS TO SUPPORT SECTOR BASED POLICIES

The measures in favor of knowledge transfer which expedite the processes for the implementation and adaptation of knowledge and technologies in diverse sectors, such as crops and medical diagnosis, will base on an allocation of structures to assist for the protection of research findings and capable of establishing effective mechanisms of transfer and use of technology ; and in technical networks to support innovation associating the researchers with the social and productive fabric to meet and anticipate on the future needs. A major part of those structures is intended to promote communication among producers and users of knowledge and provide necessary services for their development.

The initiatives to be developed are :

- Development surveillance tool to collect, analysis and publish research findings intended for their exploitation;
- Definition of a model for protection of intellectual property, knowledge and research findings in order to ease its transmission and use;
- Establishment of effective mechanisms of technological linkage and transfer in research centers, universities and co-business or productive associations and the civil society;
- Development of services to support the trade of research findings in network with regional or international platforms.

2.2.3.2. PUBLICATION OF SCIENTIFIC AND TECHNICAL KNOWLEDGE TO POTENTIAL USERS

The research and innovation system must respond to the social claims, but also the productive sectors, then it must detect the research groups and innovative technologies with strong potential for implementation in the key sectors ; developing the use of methods of the economic and technological intelligence for capturing, analyzing and publication of the research findings and encourage relationships among research institutions and the producers and enterprises, and stimulate the mobility of researchers, technologists and technicians as well as stable public-private partnership.

The initiatives to be developed :

- Detecting research groups and innovative technologies with a high potential compared with the key sectors and technologies of the economy;

- Promotion of relationships among research centers and enterprises and stimulation of mobility of researchers, technologists and technicians as well as stable public-private partnerships in science and technology;
- Establishment of specific incentives for researchers who submit their patents or devote a part of their efforts to publication and implementation of those technologies and advanced service providing;
- Incorporation of professionals in research management to the research groups' institutions;
- Inter-sector transfer which expedites the processes for implementation and adaptation of knowledge and technologies in diverse sectors;
- Transfer between researchers and enterprises from a close collaboration and participation based on the real needs and anticipating on future demands;
- Technical and scientific support of the staff in charge of agriculture expansion to meet the needs of the low scale farmers.

2.2.3.3. INCENTIVES FOR INNOVATION OF THE PRIVATE SECTOR AND CREATION OF INNOVATIVE ENTERPRISES

The predictable role of the private sector in Burundi in research and innovation as well as in scientific management information will require stimulation of its participation in the investment, by reducing the obstacles to innovation associated with a still limited scientific and technological culture. In this respect, we will have to create effective regulatory instruments which guarantee the participation of the private investment in R&D and the stimulation of innovation, including, if necessary, tax incentives. Beside all this, we add other measures to support the creation of new innovative enterprises based on technology as one way to strengthen the economic activity, from the university and other research institutions.

The initiative to be developed:

- Promotion of innovation activities in the enterprises as a factor of modernization and improvement of their potential of competitiveness;
- Tax incentives or others for enterprises which implement innovation projects;
- Promotion of research and development of partnerships oriented towards the needs and requirements of the productive sectors;
- Publication and promotion of key authorized technologies, in particular biotechnologies for implementation in the sectors of health, agriculture and environment, the technologies on production processes and information and communication technologies;
- Creation services of sensitization, training and support to creation of innovative enterprises especially for rural youths and women.

2.2.4. REGIONAL/ INTERNATIONAL COOPERATION

2.2.4.1. PARTICIPATION IN REGIONAL AND INTERNATIONAL RESEARCH PARTNERSHIPS

The promotion of international participation of research centers, universities, enterprises and groups must be a determining factor for the evolution of scientific and technical knowledge and introduction of innovations. Consequently, international scientific collaborations will have to be promoted; the participation in programs, regional and international agencies and infrastructures, as well as an increase of capture of investments and funding of the R&D coming from abroad. The intensification of links with

scientific researchers and Burundian professionals abroad will have to be encouraged by direct actions and the creation and consolidation of Burundian researchers' community abroad.

The initiatives to be developed:

- Creation of formal/professional networks of publication and policy sharing and STI political instruments with international agencies and cooperation agencies for an effective coordination of its supporting activities and the agenda of R&D in the country ;
- Coordination of the activities of Burundi and the States in the region in order to create an integrated framework of cooperation in the research and innovation, and design a long term strategy allowing Burundi to influence policies on science and technology in the region;
- Strengthening scientific, technical and business partnerships with the international and multilateral organizations and a given country, for the implementation and funding of mobility and training of researchers, infrastructures and projects in cooperation.

2.2.4.2. PARTICIPATION IN RESEARCH CENTER NETWORKS AND LABORATORIES OF METROLOGY, TECHNICAL ANALYSIS AND TRIALS AT THE REGIONAL AND INTERNATIONAL LEVEL

Strengthening the links of cooperation through specialized networks of collaboration among scientific research and innovation groups; among laboratories which are part of research institutes, or creation of strategic partnerships with other countries, and in particular the region, as well as the international organizations to support cooperation for development, will contribute for the improvement of the activity of researchers and increase the scientific and productive capacities. The incorporation of productive sectors and enterprises with specialized networks will favor the transfer of knowledge, the identification and development of new products and services and the improvement of social and economic development.

The initiatives to be developed are :

- Increase a wide visibility of the research activity in Burundi and increase the attractiveness of Burundi as a country with a potential of scientific and technical research in order to attract researchers and investments for science and technology;
- Networking centers for research, laboratories or technical centers to regional and international networks in order to facilitate the training of the research staff;
- Increase the size and quality of services and research projects as well as to improve the management of the scientific and technical quality;
- Creation and consolidation of the research communities, technicians or entrepreneurs of Burundi abroad.

2.2.5. SCIENCE ET SOCIETY

2.2.5.1. PROMOTION OF THE SCIENTFIC VOCATION OF YOUNG MEN AND LADIES

The scientific culture of the society cannot be separated from education, training and increase of scientific culture with creativity, notably among young generations at all ages. Also this should privilege the emergence of the new scientific and technological vocations. Consequently, the practical activities which privilege the critical thought, the understanding of the scientific method and the interest for science, the innovation and entrepreneurship should be initiated from the very first stages of training as social, cultural and economic change levers.

For the case of women, a minority in the research sector in Burundi, special measures, of scientific promotion in class, scholarships for priority areas, accompanied with senior researchers during the secondary education and other will be proposed.

2.2.5.2. AWARENESS RISING AND SENSITIZATION ABOUT THE STI

The challenge consists of shortcutting distances among the scientific and technological world and the society in general. Thus, in terms of dissemination of the findings of the R&D activities, we intend to promote an understanding of the research, technology and innovation as activities which privilege the development and welfare of the society through networks and platforms which will allow mobilizing the scientific communities at the service of the society.

The search for adequate and sustainable solutions for the issues of water, environment, health, food or energy will require an action of sensitization intended for particular groups such as farmers, women, political institutions and others in order to involve them in the actions and projects requiring large participation based on the understanding of the nature of the areas such as genetic engineering.

The initiatives to be developed:

- Promotion of the scientific and technological culture and innovation among the Burundian population, through creation and publication of the content of the scientific dissemination in the medias;
- Joint organization of public events such as annual fair of science and conferences on the subject among citizens and researchers;
- Support to the scientific institutions, universities and enterprises in the work of publication of research findings;
- Involvement of teachers of secondary education in the orientation of the scientific and technical training of the youth as well as the culture of entrepreneurship, resulting in the public presentation of the findings of youths' works;
- Identification of the communities of political, economic or social leaders, in order to regularly communicate them sensitization actions on the current issues in science and technology, in collaboration with research institutions.

2.3. PARTS OF THE STRATEGIC ACTION PLAN

The STI strategy is equipped with a stable legal framework and political and administrative responsibility intended to increase the impact of the public interventions, by avoiding overlaps and gaps and supported by effective implementation mechanisms, such as:

- Draft law on Science, Technology and Innovation in Burundi, which will establish a model of GOVERNANCE for the functional subdivision of the system, with attribution of responsibilities on the scientific policy to the MESRS and the creation of the National Commission for Science, Technology and Innovation ;

- A stable framework of COORDINATION and MANAGEMENT, with a centralized management body at the DGSTR, in a regular linkage with diverse ministries and institutions involved in the programming, the funding and achievement of actions included in the STI Action Plan ; a body which has contact points for each established priority area , procedures and communication and information medias which assure an adequate representation of interests of each and consulted action of the public administration in the achievement of goals, vis-à-vis all actors of the research and innovation system;

- The use of appropriate funding instruments, since the allocation of budget resources and search for associated funding opportunities in partnership up to the use of instruments of the participation of actors such as institutional agreements and calls for project proposals;

- Instruments for MOBILIZATION of researchers and increase the level of PARTICIPATION of the enterprises and the private sector or the civil society during the implementation and funding of the R&D, as well as the attraction of investments in R&D from abroad and foreign enterprises;

- The harmonization of criteria and practices of PROJECTS' ASSESSMENT before adopting the decision of funding and monitoring of the implementation, based on the best practices which assure the optimum allocation of public resources, added to a strong pressure on the practices of assessment involving independent experts;

- The development of an INFORMATION SYSTEM with the indicators of monitoring the research activity and free access to data and dissemination of the publication and research findings on own or shared sites;

- The procedures and instruments of MONITORING and EVALUATION of the strategy and Action Plan based on simple, flexible and dynamic schemes facilitating communication and interaction with the beneficiaries of research policies and decision making.

2.4. PRIORITY AREAS OF INTERVENTION

2.4.1. AGRI-FOOD TECHNOLOGIES

2.4.1.1. Context and justification

The Burundian economy strongly depends on the agriculture sector which, on its own, occupies more than 90% of the population, contributes for more than 50% to the Gross Domestic Product and supplies 95% of the food offer and more than 95% of the income from export (currency). The analysis of the nutritional situation shows that about 75% of the national population suffers from hunger and food insecurity with more consequences on the most vulnerable population.

In terms of food security, the country does no longer happen to meet the food needs of the population and the situation is very critical: 85% of families are regularly faced with food shortage. The level of acute malnutrition is higher than 10%. The coverage of needs in essential nutrients is assured at 75% for carbohydrates, 40% for proteins and 22% lipids with an insignificant consumption of food commodities rich in vitamins and minerals (fruits and vegetables) especially in rural area.

These situations are noted in all provinces of the country. The chronic food deficit noted these years requires an appropriate intervention. The main source of food offer for Burundians is made of harvest of food production crops. The consumption of animal lipids and proteins is very limited. It is the same for fruits and vegetables (CE (2009): Food Facility Burundi- AOP; Technical Country Document.).

During the last ten years, the sector of agriculture stagnated, even stepped back, due to critical consequences of the crisis, but also due to the fact that the supply chains of agriculture inputs were disturbed or that the farmers had no more purchase power to acquire necessary inputs. The productions always show a decreasing trend and no longer manage to cover the nutritional and financial needs of population in a continuous growth.

In a country like Burundi which produces or could produce a varied series of agriculture products, the agri-food industry represents a significant potential source of growth, income, employments and currencies. However, it remains less developed; which urges the country to import agri-food products that could certainly be produced domestically in a competitive manner, thus reducing the deficit of the commercial balance. During its development, this industry would allow limiting notably losses of primary products as well as the sale of low quality products. It would also contribute to reduce the effects of seasons in terms of availability of agri-food products. Besides, this industry would offer markets for the primary products, thus privileging their expansion, and would contribute for a regular supply of consumers in quantity and quality at an affordable price. It would also help the country to position itself as new promising links.

In the area of agri-food technology, there must be:

- A well equipped laboratory and an adequate material for quality control of food products;
- A capacity building in the training of technicians and organize retraining sessions;
- A strengthening of researches on marshland crops in order to fight against malnutrition and related diseases.

The area of agri-food technology presents strengths, weaknesses, opportunities and threats as indicated here below:

2.4.1.2. Situational Analysis

Strengths **:**

- Existence of a legal and regulatory framework (PANA, PNIA, sector based policy, etc.) ;
- Significant contribution of local products for food security in the areas of production and urban areas;
- Excellent quality of fruits produced in the whole country (juice produced are natural with less chemical products) ;
- The breeding of heavy stock is a tradition in most provinces of the country ;
- Existence of farmers' associations ;
- Existence of farmers who have acquired a certain technique in the conduct of the livestock;
- Adoption of a new approach of community solidarity channel;
- Existence of improved drying and transformation techniques;

Weaknesses **:**

- Strong population pressures on the cultivated croplands;
- Rainwash and continuous deterioration of the fertility of the cultivated croplands;
- Low degree of transformation of agro-pastoral and halieutical products;
- Low level of training and information;
- Low monetary income of the population worsened by the harsh access to agriculture loans, quality seeds ad specific inputs;
- Poor understanding of post-harvest technologies;
- Lack of enough technological innovations and appropriate production systems;
- Lack of enough laboratories and qualified human resources for food products and export products quality control;
- Means of transport to costly consumption centers;
- Poor supervision of the sector by government structures;
- Difficult access to land by private investors;
- Seasonality of production;
- Lack of varieties preferred by the export market ;
- Badly organized trading of inputs;
- Budget inferior to the needs of the sector.

Opportunities :

- Existence of a legendary and operational partnership;
- Conducive agro-ecological conditions;
- Existence of dense hydrological network (big rivers and their affluents) ;
- A national demand likely to drain the whole dairy production ;
- An obvious political will ;
- Development of individual initiatives (rural micro-entrepreneurship) ;
- Possibility of exploiting potential crossborder markets.

Threats :

- Climate changes;
- Disappearance of pasturelands due to high density of livestock;
- Degradation of the environment ;
- Introduction of diseases at the borders;
- Parasite attacks ;
- Lack of competitiveness of products locally transformed compared with imported products,
- Depreciation of the Burundian currency.

Tableau 7 : ***Logic Framework of the area of agri-food technologies***

Area 1: **Agri-food technologies**	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timelin**					**Budget X 100.000 USD**	**Research center**
Priority areas					2014	2015	2016	2017	2018		
	Reducing losses.	1A1A : Creation of a framework for information sharing on technologies.	Center created	MINAGRIE (a) University (u)	1					1	CERDA
1A. Post-harvest losses		1A2B : Inventory of current technologies and practices to reduce post harvest losses.	Inventory produced	MINAGRIE (a) University (u)		1				1	CERDA
	Building infrastructures.	1B1C : Construction of barrages.	3 pilot barrages in Imbo, Moso and Bugesera (studies).	MINAGRIE (a) University (u) TP (t)		1	1	1		3	
1B. Promotion of irrigation to produce for a longer period		1B2A : Rain water collection for irrigation.	5ha/an	MINAGRIE (a) University (u) MEEATU (v)	1		1		1	3	
		1B3B : Management of marshlands.	Survey on 5 marshlands	MINAGRIE (a), Uni(u) Mineetu-v		1		1		2	
	Management of anti erosion terraces.	1C1C : Establishment of radical terraces for steep slopes.	1 pilot terrace per commune	MINAGRIE (a)Uni(u) MEEATU (v)	1		1		1	3	

Area 1: **Agri-food Technologies**	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research Centers**
Priority area					2014	2015	2016	2017	2018		
1C. Erosion prevention		1C2C : Tracing contour lines for soft slopes.	1 contour line per commune.	MINAGRIE (a) Uni (u)		1		1		2	
1D.Farm mechanization	Improving production per worker	1D1A : Introduction of animal draught power.	15 Center for stock breeding and dressage.	MINAGRIE (a) Uni (u)	1		1		1	3	
		1D2D : Use of tractors and motos.	2 Centers.	MINAGRIE (a)				1		1	
1E. Fishery	Improving production fishery, fish farming and aquaculture.	1E1D : Promotion of good practices in fisheries.	Fishermen sensitization and training created.	MINAGRIE (a) MEEATU (v)	1		1		1	3	
		1E2C : Diversification of fish species.	15 Fish farming stations created	MINAGRIE (a) MEEATU (V)	1	1	1	1	1	5	CURPEL
		1E3D : Fish food production.	Production unit of fish food set in place.	MINAGRIE (a) MEEATU (V), UB (U)			1			1	
		1E4D : Study on conservation.	Study undertaken; setting in place a cold room for fish.	MINAGRIE (a) Transport (t)			1			1	
		1E5D: Farming non conventional species (algae, Rana sp., crocodiles, etc.).	5 Trial unit Set in place.	MINAGRIE (a) MEEATU (V)	1	1	1	1	1	5	CURPEL
1F. Beekeeping	Increasing honey production	1F1A : Setting in place of dissemination centers for bees.	2 Centers created	MINAGRIE a) Univ(u)	1		1		1	3	CURPEL

Area 1: **Agri-food Technologies**	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research Centers**
Priority area					2014	2015	2016	2017	2018		
		1F2B : Setting in place an apiculture products transformation center.	1 Center created	MINAGRIE (a) Industrie (c)		1		1		2	
1G. Soilless and non traditional growing	Diversifying income sources	1G1D : Introduction of non traditional crops (patchouli, Tamarindus indica, etc...).	2 crops introduced per year	MINAGRIE (a) Universities(u)	1	1	1	1	1	5	CERDA
		1G2A : Researches on farming and producing insects and Eumycota (fungi).	2 insects et 2 Eumycota (fungi) studied	MINAGRIE (a) Universities (u)	1	1	1	1	1	5	CERDA
1H. Agro-pastoral integration	Diversifying and protecting the species	1H1B : Control and fight against epidemics and diseases of animals.	A national network for surveillance created	MINAGRIE (a) Universities (u)	1		1		1	3	IRAZ
		1H2A : Control and fight against diseases of plants.	National surveillance network created	MINAGRIE (a) Universities (u)	1	1	1	1	1	5	CERDA
		1H3D : Promotion of good race livestock for fertilizers and animal products.	1 dissemination center created	MINAGRIE (a) Universities (u) ONG(o)		1		1		2	
		1H4D : Protection of animals with vaccines.	1 production center of vaccines created	MINAGRIE (a) Universities (u) Industry (c)			1		1	2	

Area 1: **Agri-food Technologies**	**Specific goals**	**Activities**	**IOV**	**Responsables**	**Timeline**					**Budget X 100.000 USD**	**Centres de Recherche**
Priority areas					2014	2015	2016	2017	2018		
	Improving agriculture production	1H5A : dissemination of good methods of agriculture production.	Farmers' school in each commune.	MINAGRIE (a) Universities (u)	1		1		1	3	CERDA
		1H6A : Use of selected seeds.	Center of dissemination of seeds in each commune.	MINAGRIE (a) Universities (u)	1	1	1	1	1	5	
		Production of selected seeds 1H7A.	1 Center for seed production.	MINAGRIE (a) Universities (u)	1	1	1	1	1	5	CERADER
1I. Agri-food Transformations	Improving income by conservation and consumability of the products.	1I1A : Dynamization of the dairy sector (transformation and conservation of milk and derived products).	1 dairy per province.	MINAGRIE (a) Universities (u)	1		1		1	3	CERTA
		1I2C : Construction or rehabilitation of storage warehouse.	1 model hangar per commune.	MINAGRIE (a) Universities (u) Min Inter (i)		1		1		2	
		1I3A : Transformation and conservation of diverse agriculture products .	1 transformation unit per commune.	MINAGRIE (a) Universities (u) Industry (c)		1	1	1	1	4	CERTA
				TOTAL	13	17	16	16	17	79	

2.4.2. MEDICAL SCIENCE

2.4.2.1. Context and Justification

- ***Demographic situation***

According to the general census of the population and housing of 2008 the Burundian population was of 8.053.574 inhabitants with 50.8% of women and 49.2 % of men and an annual population growth of 2.4% (RGPH, 2008).

If this rhythm is maintained during the next two decades, Burundi could count 10.2 millions of people in 2018, and 11.5 millions of people in 2023. With a population density of 310 inhabitants per km² at the national level, Burundi is classified among the most densely populated African countries. This population essentially lives in the rural area, that is, 9 inhabitants over 10. The indicator of Burundi fecundity is of 6.4 children (EDSB, 2010) average per woman, which is very high. Productive women almost represent the half of the total feminine population, i.e. 46% with a consequence of rapid growth of the population. The increasing population in Burundi is a challenge for a country with limited resources but with lots of needs in socio-health issues in terms of use and demand for health services.

- ***Access to health services***

The Ministry of Public Health and Fight Against AIDS has initiated some structural reforms to improve access to healthcare geographically speaking by setting in place health districts. The geographical access is satisfactory as the population in general (80%) (Survey PETS, 2008) can access a health center at under a 5 km distance, although there are geographical discrepancies especially in favor of urban centers.

The access is also assured by road. In fact, most of the health structures (more than 90%) are accessible by road even if they are sometimes in poor conditions. This means of communication plays a key role in the system of reference and counter-reference.

Concerning access to financial means, most of the Burundian families resort to direct payment in order to fund their health related expenditures. With a low purchase power, this mode of payment limits the population access to cares.

To address this issue, the Government had set in place a Medical Assistance Card (CAM) in 1984. However, this card is only accepted in some approved public health structures because related credits are hardly paid back or are paid with delays.

For the civil servants, a mutual fund for civil servants covers their needs at 80% of the total cost, the rest is directly paid by the beneficiary and the Ministry of Public Health and Fight against AIDS for its staff. The private insurance companies, community mutual funds as well as the initiatives of HIV positive people do exist but do not cover the whole country.

To increase the level of access to health cares of some categories of vulnerable people, the Government of Burundi decided in May 2006 to set in place the policy of free healthcare for under five year aged children and cares related to pregnancy and childbirth in public or assimilated health structures. In April 2010, the passage at the FBP scale, allowed the Government to subsidize the free cares. The Government also initiated, in 2010, free first level anti-malaria medication.

However, some cultural barriers hinder the resort to health services and prevent precocious care for the patient, expecially for some vulnerable groups such as Batwa. Even if the resort to traditional medicine is not documented, some patients prefer to resort to traditional healers or prayer groups.

- ***Offer of health cares***

In general, public health structures seem to better respect good practices related to the permanence of offer of health cares. The cares are generally offered everyday, 24 hours over 24, with custodial services organized according to the needs in the proportions of 71.1% of the public health centers and 81.4% of public hospitals, approved and private (Survey FOSA, 2010). However, the lack of enough equipment and accommodation hinders the full availability of the offer with discrepancies among provinces. Concerning traditional medicine, it is a sector which still lacks a legal framework and which needs to be organized, structured and supervised.

- ***Diseases with high morbidity and mortality rate in Burundi***

The status of health of the population is characterized by a high rate of morbi-mortality related to transmitted and non-transmitted diseases.

The analysis of the epidemiological situation indicates that the diseases which constitute the main causes of morbidity and mortality are Malaria, acute deep infections, diarrheic diseases, malnutrition, HIV/AIDS, tuberculosis, traumatisms and burns. The National Plan of Health Development 2011-2015 has particularly highlighted the fight against 3 pathologies including Malaria, HIV/AIDS and tuberculosis without forgetting transmitted and non-transmitted diseases.

1. Malaria

It remains the main cause of morbidity and mortality in the population. In 2009, the proportion of Malaria among all pathologies is estimated at 74% and the number of cases continuously increases since the last five years. The rate of morbidity has reduced from 36.23% in 2005 down to 34.07 in 2010 with a mortality rate in hospitals of 39.55% in 2005 to 34.07% in 2010 (Report PNILP, 2010).
The rate of families who regularly use a sprayed mosquito net (MII) is of 52.5% (family survey in 2009) with a rate of use, for children aged of under five years of 44.1%. The preliminary findings of EDS 2010 show an increase of use rates of MII up to 45% for under five year aged children and 50 % for pregnant women (EDSB, 2010).
Despite those efforts, gaps observed are related to the stock out for first line medication, abusive use of quinine, the persistence of monotherapy, the high cost of spraying products, poor use of MII and low involvement of the community.

2. Tuberculosis

Tuberculosis remains a public health issue in Burundi. It occupies the fifth position among the causes of morbidity in Burundi (Statistical directory, EPISTAT, 2009). The most concerned age category is the one of 15-54 years (86.6%) with a masculine prominence (64.4%) (Report PNLT, 2010). The rate of notification of contagious cases (TPM+) and all types of tuberculosis (TTF) are respectively of 54 and 91 cases per 1000 inhabitants in 2009. The number of TPM+ cases newly declared and put under treatment has increased from 2004 to 2010 passing from 3087 to 4590 TPM+NC. Tuberculosis prevails all over the national territory but with discrepancies according to regions and density of the population.
The HIV prevalence for tuberculosis patients is of 26% (national survey on the HIV prevalence in tuberculosis patients realized in 2007). The availability of resources, the strengthening of capacity of the staff, the messages used in the course of the population sensitization and support of the authorities and partners are

the origin of the improvement of indicators. However, efforts are still to be deployed for an early detection of cases, the geographical coverage of CT and CDT, the surveillance of multi-resistant tuberculosis.

3. HIV/ AIDS

In Burundi, the epidemiological profile of HIV is the generalized type with 2.97% of average national sero-prevalence and 3.6% within the aged population between 15-49 years. The female gender is more concerned with 2.91% against 2.81% for the male gender. From 2002 to 2007, the HIV infection continues to increase in the rural area (2.5% to 2.8%) while there has been reverse of trend in the urban area (9.4% to 4.6%) (Performance and impact assessment in CSLP I, 2010)

The HIV/AIDS infection is the fourth cause of mortality in Burundi and sensitively increases the workload of curative services. HIV/AIDS has got a significant negative impact on the economic and social indicators of the country in health, education, social and population related issues. The number of HIV positive people and HIV orphans is continuously increasing. To cope with this situation, a national strategy of response to the fight against HIV-AIDS 2007-2011 has been designed. Its implementation allowed reaching a blood test rate of 18% (CNLS Report, 2010) in the general population, a coverage in PTME of 19.4 % (CNLS Report, 2010), a rate of access to ARV of 30% (PNDS Assessment of 2006 – 2010, June 2010), an HIV pediatric care taking of 3.7% (CNLS Report, 2010) with an active queue of 17 500 people in 2009 who receive the ARV therapeutic combination (Target: 60 000). Despite the efforts deployed by the Government of Burundi in collaboration with the partners for a more adequate care giving, the acquisition of ARV in sufficient quantity, including pediatric types, remains a challenge.

Significant efforts are deployed in the fight against HIV/AIDS, notably the strengthening of the HIV/AIDS sector in the health sector, the strengthening of leadership, the passage to the scale underway, preventive and care taking interventions. The Government has done of the universal coverage the backbone of its policy in the fight against HIV/AIDS and has adhered to all international and regional initiatives: (UNGASS 2001) on the universal access to prevention, cares, treatment and socio-economic assistance. To respond in a more appropriate manner to the HIV epidemics, the efficient response on the multi-sectoral approach, the involvement of the civil society, the private sector and community.

However, some difficulties have been identified as medication and reagent stock outs, the lack of equipment to determine CD4, the patients' biological follow up, the passage to the PTME scale, the increase of the geographical coverage of ARV and CDV sites and integration of services in the FOSA (inter alia, HIV/PF, HIV/maternal health).

4. Diarrheal diseases

They constitute the third cause of morbidity for under five year children with a rate of 9% according to the statistical directory of 2009. Twenty five percent (25%) of under five year children have suffered from diarrhea during the two weeks preceding the EDS (2010). These diseases mostly comprise helminthiasis, typhoid fever, amebiasis, food poisonings commonly referred to as « diseases due to dirty hands ». The default of sanitation and hygiene, the lack of enough drinking water, the default of evacuation system of solid wastes mostly explain the high prevalence of diarrheal diseases.

5. Diseases avoidable with vaccination

The fight against diseases avoidable with vaccination remain a priority in the health system. With the support of its partners, the Government has extended the list of diseases avoidable with vaccination by introducing, since 2004, the vaccines against haemophilus influenza type B and viral hepatitis B. it is also worth noting

that the process is underway to introduce the vaccine against pneumococcus, the rota virus and the second dose of vaccine against measles.

Thanks to the daily vaccination activities, the vaccine coverage always remained high, going beyond 90% for some antigens according to the annual report of PEV PEV (2010). The 2009 PMS national survey showed that the vaccine coverage rates were higher at 80% for the main antigens (EDSB, 2010) (Polio3 :87,3%, DTC3 or penta 3 : 95.4% and VAR : 94.3%). The EDS survey EDS 2010 also shows that the results of the daily vaccination passed beyond 85% for most of the antigens. The children completely vaccinated reach a rate of 83% according to the same survey. This good national coverage hid the discrepancies among health districts. In fact, about ten health districts do not reach 80% of vaccination coverage for VAR and DTC3.

The program benefits from the support of partners such as UNICEF, WHO and CAVI who intervene in the technical assistance, purchase of medication and vaccination materials in more than 80%. This external dependence remains a threat for the vaccination activities. Despite this situation, efforts are deployed in order to maintain the acquired momentum. Burundi is part of the African countries which have succeeded to interrupt the transmission of the wild poliomyelitis virus, but the threat of importing the poliovirus keeps on weighing on the country. This is the reason why the surveillance of acute flaccid paralyses continues.
Burundi is also classified among the countries that have succeeded to eradicate the natal tetanus since 2009 but, as for poliomyelitis, the surveillance continues and activities intended to maintain the high level of immunization are regularly conducted.

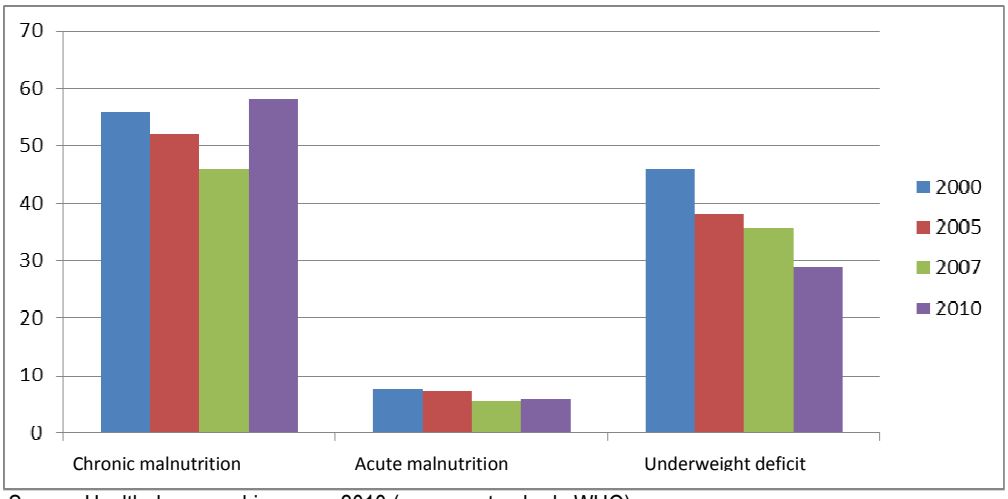
6. Acute respiratory tract infections

They represent the second cause of morbidity and mortality for children of under five years of age (PNDS Assessment Report 2006 – 2010, June 2010) and gathers around a heterogeneous group of viral, bacterial and parasite pathologies. The most frequent infection is pneumonia which caused 22.4% of morbidity among under five year children in 2009. The hospital mortality related to pneumonia is of 7%. Over 178 cases of decease recorded in 2009 due to pneumonia, 80 cases are aged of under one year, i.e. 45%. Those cases of decease represent 17.6% of the whole of the deceased children below one year of age. These data are substantiated by EDS 2010 according to which 17% under five year children suffered from cough with short and rapid breathe (symptoms of IRA) during the last two weeks which preceded the survey.

7. Malnutrition

Chronic malnutrition remains a very critical issue in Burundi. According to EDS 2010 (Chart 1), 58% of under five year old children suffer from chronic malnutrition among which 29% are severe cases. On contrary, the acute malnutrition is below the warning line as defined by WHO (MAG >10%) in Burundi (National nutritional survey 2005 (LMTC – UNICEF)) and EDS 2010 report a rate of 6%. The underweight deficit in the surveyed provinces were still high (more than 30% (National nutritional survey 2005 (LMTC – UNICEF))) and according to EDS 2010 it is of 29%. In the 6 provinces covered by the survey, the prevalence rates are higher than 55%. In two of those provinces, (Kirundo and Muyinga), the prevalence rates are higher 65%. And according to the EDS 2010 Survey, the chronic malnutrition rate is of 58%.

Chart 1: Evolution of the malnutrition rates in Burundi (2000-2010)



Source: Health demographic survey 2010 (z-score, standards WHO)

This situation is related to all factors such as the level of education for women, recurrent food deficit, deficit in micronutrients, inadequate practices for nursing infant and infant's feeding, with a rate of initiation to maternal breastfeeding during the first 24 hours of 74 % only and an exclusive breastfeeding rate of 69%.
The current strategy of intervention is the integrated care taking of malnutrition in the FOSA and at the community level.

8. Mental health issues

The social crisis of 1993 has significantly worsened the situation and caused a significant degradation of mental health of the population. In 1998-1999, a national survey conducted on a sample of 1100 people in « normal » standards of living at their homes (ISTEEBU, World Bank*: National Survey on the living conditions of the Population,* Bujumbura 1999) revealed that numerous Burundians suffer, at different levels, from mental health problems. About 59.33% of the people investigated state that the crisis deeply affected their life while 56.34% of the people state that they are unhappy and discouraged whose 20.29% declare they are often unhappy. Besides, 55.61% acknowledge having troubles to have a sleep and they have nightmares. Sexual violence against women has caused lots of psycho-affective traumatisms which have altered their mental health (WHO, Assessment report of the mental health system, 2008). The quality of care taking psychiatric pathologies and psychological troubles is so poor essentially due to insufficiency of qualified human resources, specialized infrastructures and of products.

9. Epidemics, disasters and health emergencies

Concerning the fight against epidemics, a strategy of integrated surveillance of diseases and response has been adapted to the Burundian situation, but it requires updating. The «Strategy of Integrated Surveillance of Diseases and Response» helped in the implementation of the minimum packet of intervention intended to control the diseases with an epidemic potential and protect the population. Diseases with an epidemic potential under epidemiological surveillance are, inter alia, the measles, cholera, meningococcus meningitis, Malaria, the acute flaccid paralysis, the bacillary dysentery, the shigellosis, the recrudescent typhus and the hemorrhagic fever. A surveillance system of diseases covering all levels of health pyramid is operational through the rapid intervention team and EPISTAT.
To confirm the diagnosis, the reference laboratories CHUK and INSP participate in the biological diagnosis of suspected cases and epidemic suspicions. However, it is equally worth mentioning the critical insufficiency of

laboratory activities both at the intermediary and peripheral levels and the absence of rapid response team. In the context of implementation of the International Health Regulation (RSI, 2005), there is a contingency plan for the fight against epidemics and health emergencies.

10. Neglected tropical diseases

It is a group of diseases like onchocerciasis, geo helminthiasis, schistosomiasis, trachoma, hydrophobia and cysticercosis.
The onchocerciasis is known as meso or hyper-endemics in 10 health districts over a total of 45 districts in the whole country. The treatment of the mass uses the strategy of « treatment on ivermectin under community instructions was implemented in 2005 in Cibitoke - Bubanza as well as in Burundi and Rutana in 2006. The therapeutic coverage rate varies from 68% to 76% in 2009. The MSPLS, in collaboration with its partners, is in a phase of setting in place a strategy of eradication of the onchocerciasis transmission.

The helminthiases constitute an issue of the public health over the whole national territory. The surveys conducted in 2007, 2008 and 2009 showed the prevalence which goes far beyond the 20% considered as the maximum bottom line admitted by the WHO.

The urinary schistosomiasis is not yet reported in Burundi while the intestine schistosomiasis is meso/hyper endemic 9 provinces (>10%). Those provinces are notably: Cibitoke, Bubanza, Bujumbura, Bujumbura Mairie, Bururi, Makamba, Kirundo, Rutana and Ruyigi. Since 2007, the fight against schistosomiasis is mainly based on the mass treatment during national campaigns and case per case praziquantel based treatment in health structures.

Since long ago, the trachoma was a less known disease in Burundi. It is only in 2007, that a survey conducted in 43 communes showed a prevalence of 30.33%. Over 1473 adults aged of at least 15 years investigated, only 3 would show signs of trachoma Trichiasis in at least one eye, i.e. a prevalence of 0.20% (MSP, 2008).

The cysticercosis, factor of major risk of epilepsy in Burundi (Nsengiyumva *et al*., 2003), is found in the regions where they practice pork breeding in poor hygiene conditions. It seems frequent in Burundi because 4 areas (Kayanza, Ngozi, Bururi, Cibikoke) have been identified. In Kiremba – Ngozi, the seroprevalence is of 31.5% (Nsengiyumva, 2010).
The fight against blindness [26] started in 2005 with the first workshop on the public health issue. The country was subdivided into 7 ophtalmic regions. The Western region is the most active as it concentrates the majority of human resources, equipments and infrastructures. The northern region conducted a study on the prevalence of blindness which revealed that 62.5% of causes of blindness are avoidable, among which 57.5% are curable and 5% which could have been prevented. The main cause of blindness is the cataract at a rate of 55% followed by abnormality of the posterior segment of the eye at 22.5%.

- ***Situation of the main resource in the health sector***

1. Human resources

The total number of 15,941 agents are distributed among 5,957 nurses, 418 medical practitioners and trainees, 16 midwives, 827 other qualified medical staffs and 8,739 staffs (DRH survey, November 2010).

Concerning medical practitioners, the general ratio for the whole country is of one medical practitioner per each 19,231 inhabitants while the WHO standards require a ratio of one medical practitioner per 10,000 inhabitants. The ratio nurse per inhabitant is satisfactory with a nurse per 1,349 inhabitants (the WHO standards require one nurse per 3,000 inhabitants). Burundi is also faced with a critical lack of government

midwives (1SFE for 124,312 women at the reproduction age). Let us mention that more than 50.5% of medical practitioners and 21% (PETS survey, 2008) of nurses exercise in Bujumbura.

The qualitative insufficiency is partially explained by the absence or insufficiency of supervision at the level of public and private education institutions, the non selective recruitment of candidates in private schools, lack of adaptation of the programs to the needs of the job market and insufficiency of planning the needs in terms of staff.

Measures are required in order to assure quality training for the medium and long term particularly for the midwives. The management of human resources is characterized by heavy centralization of staff management actions at the central administration; which leads to situations that sometimes hamper the smooth functioning of the health structures in place.
The absence of job description and career plan for the agents and the absence of provisional management of numbers are indicators of the human resource poor management.

2. Material resources

The MSPLS counted, in 2010, 17 offices of health provinces, 45 offices of health districts among which some do not have constructions, 735 health centers and 63 hospitals. The lands of some of those structures are not delimited and do not have property documents, water and electricity also hinder the improvement of quality health cares.
In spite of the standards defined in 2004, several structures are still to be equipped with biomedical materials in compliance with the packet of the services offered.
Both for infrastructures and equipments, there is a lack of a policy and a plan for maintenance at the national level which should guide all interventions.
Moreover, the MSPLS does not have either a coverage extension plan or an investment plan. In those conditions, it is required to make an inventory of the existing and design an investment plan in order to guide the decision making process in terms of layout and rehabilitation.

3. Financial resources

According to the national health accounts of 2007, the funding sources of the health sector are: 17% public (ministries including IPPTE funds and public entities), 43% (Health national accounts, Burundi 2007, August 2009) private (among which 40% for families and the rest by associations, religious and non religious NGOs, les enterprises) and 40% from external support (bilateral cooperation, multilateral cooperation and NGOs, international foundations and initiatives) (for detailed data related to the budget distribution, refer to the document of sector based policy of the Ministry of Public Health and Fight against AIDS).

2.4.2.2. Situational analysis

Research in the health sector is a crosscutting pillar required for the improvement of performance of the health system and fight against the disease. The understanding of strengths, in the « upstream », underlying the status of the health of the population and their incidence on the health is a prerequisite for the establishment of a coherent public health policy. Besides, an appropriate and scientifically documented knowledge of the performance of the health system, the status of the health of the population, the main causes of morbidity and mortality within the population, health interventions and their incidence is required for an informed decision making. Research in Burundi health sector knows strengths, weaknesses, opportunities and threats.

Strengths :

- Burundi has adhered to international commitments underlying the promotion of research as Millennium Development Goals, the traditional codex, strategy for health in Africa 2007-2015 adopted by the African Union in 2007, the Mexico Declaration on research in health sector adopted in November 2004, the Abuja Declaration on research in the health sector of March 2006, the Accra declaration on research in the health sector for the control of disease and development adopted in June 2006, the Ouagadougou Declaration on the primary health care and health systems in Africa of April 2008 and the Alger Declaration of June 2008.
- The sector based policy of the MSPLS and PNDS recognize research in the health sector as a tire iron of health development and means used for the fight against diseases.
- PNDS 2011-2015 recognizes research as a means for health monitoring and evaluation and development.
- The presence of health training and research institutions: the reference center in HIV/AIDS, the university research center on codex and traditional medicine (CRUFAMET), health programs. (ex : PNILT, PNILP; CNLS), non governmental organizations such as « Population service International »(P.S.I) ; IMC, K « Kamenge University Hospital », « National Institute of Public Health » hosting the national reference laboratory, private universities (« University of Ngozi », « Hope of Africa University »).
- Presence in the country of scientific staff with international competence likely to help in the development of research in the health sector.
- Existence of partnerships.
- Free healthcare for under five year old children and pregnant women.

Weaknesses :

- Less developed research activities in the medical health;
- Absence of adequate infrastructures for research in the health sector;
- Insufficiency of qualified human resources;
- Insufficient funding of the research sector;
- Absence of research coordination bodies;
- Absence of a culture of research in Burundi ;
- No exploitation of the health research findings;
- Absence of appropriate channels for the publication of the research findings;
- Harmonized health training programs;
- Too old medical equipments that do not facilitate research activities;
- Lack of infrastructures, equipments and appropriate structures for the promotion of research;
- Misconception of the traditional medicine and its practitioners by the public and policy makers;
- Poor collaboration among sub-regional, regional and international medical science training institutions;
- Lack of high level pharmacists in the pharmacy sector;
- Lack of pharmaco-vigilance and research on medication side effects;
- Insufficient development of equipments in medical imaging likely to deepen knowledge on the diseases;
- Insufficient development of qualitative research;
- Insufficient development of biomedical science research.

Opportunities :

- Membership of Burundi in the East African Community;
- Active bilateral and multilateral partnership;

- Initiation of telemedicine and e-Heath System ;
- Private investment in the sector.

Threats :

- Global economic crisis;
- Import of some diseases such as poliovirus.

Chart 8: Logic framework of the Medical Science sector

Area 2 : Medical Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
2A. Malaria	Improving knowledge on Malaria	2A1D: Research on mosquito and Malaria	Research center created	MSPLS (b) China (x)UB (u)	1	1	1	1	1	5	
		2A2A: Studies on the resistance of plasmodium against anti-malaria drugs	5 studies completed	MSPLS (b) Universities (UB)	1		1		1	3	CEFORMI
2B AIDS	Improving knowledge on HIV and its response to anti-retrovirals	2B1C : Availability of genotype tests in hospitals' laboratories	15 hospitals equipped	MSPLS (b) Universities (UB)	1	1	1	1	1	5	CNR
		2B2D : Foreign partnership institution for our analyses	2 partners found	MSPLS (b) Universities (UB)				1		1	
	Following up patients under retroviral treatment	2B3C : Availability of material for CD4 tests	5 controls of availability	MSPLS (b) Universities (UB) Diverse (x)	1		1			2	CNR
		2B4A : Availability of antibiogram material.	5 controls of availability	MSPLS (b) Universities (UB)					1	1	
		2B5C : Layout and updating a follow up protocol	A protocole drafted	MSPLS (b) Universities (UB)	1			1		2	CNR

Area 2 : Medical Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
	Making antiretrovirals	2B6D : Establishment of partnership for manufacturing antiretrovirals locally	A production unit created	MSPLS (b) Universities (UB) industry (c)		1	1	1	1	4	
2C. Tuberculosis	Improving the diagnosis and patients' care taking	2C1B : Definition of better diagnostic practices	Statistics of improved diagnostics	MSPLS (b) Universities (UB)	1	1	1	1	1	5	CEFORMI
		2C2A : Availability of growing sites and antibiograms in reference hospitals	5 controls of availability per year	MSPLS (b) Universities (UB)		1		1		2	
		2C3C : Studies on the prevalence of multi-resistance to anti-tuberculosis drugs	5 studies completed	MSPLS (b) Universities (UB)	1		1		1	3	CEFORMI
2D. Diseases avoidable with vaccination	Preventing with vaccination and control of side effects	2D1C : Increase of vaccinal coverage	5 qualitative surveys conducted on the impression of the population vis-à-vis the vaccination.	MSPLS (b) Universities (UB) Home Affairs (i)		1		1	1	3	CREDSR
			5 surveys undertaken on the vaccinal coverage	MSPLS (b) Universities (UB) Home Affairs Ministry (i)	1		1	1		3	CURMES

Area 2 : Medical Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
		2D3C : Studies on the reactions to vaccines	5 studies undertaken on the effects of vaccination	MSPLS (b) Universities (UB)	1	1			1	3	CURSAP
2E. Reproduction health	Improving maternal health	2E1A : Availability of protocols and equipments to take care of gyneco-obstetrical pathologies.	Protocol drafted	MSPLS (b) Universities (UB)			1		1	2	CURMES
		2E2A : Organization of genetic engineering tests.	2 training sessions completed	MSPLS (b) Universities (UB)	1		1			2	
		2E3B : Training in Biology and medical imaging for diagnosis	5 teams trained	MSPLS (b) Universities (UB)			1		1	2	
	Increasing regular visits of maternal health centers.	2E4C : Surveys on the population's impression.	3 surveys completed	MSPLS (b) Universitiess (UB) Home affairs (i)	1		1		1	3	
		2E5C : setting up mechanisms to improve access to services	2 studies completed	MSPLS (b) Universities (UB)		1		1		2	CURDES

Area 2 : Medical Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
2F. Epidemic diseases	Reducing the incidence of the epidemic diseases	2F1A : Study of the factors of risk of recurrent epidemics such as cholera, dysentery and others.	5 studies completed	MSPLS (b) Universities (UB)	1		1	1	1	4	CEFORMI
		2F2B : Biological studies on different samples selected from the patients.	15 studies completed	MSPLS (b) Universities (UB) INSP (x)	1		1		1	3	INSP
		2F3A : Antibiograms of sensitivity to antibiotics used.	300 samples	MSPLS (b) Universities (UB) INSP (x)		1		1		2	
		2F4D : Establishment of partnership with specialized international and regional centers in the control of diseases.	5 epidemiologists trained	MSPLS (b) Universities (UB)		1	1	1	1	4	

Area 2 : Medical Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
2G. Non transmitted chronic diseases	Improving the diagnosis and taking care of non transmitted chronic diseases	2G1A : Availability of biological tests of diagnosis for diabetes, gout, thyroidan disfunction and others in the peripheral laboratories of the country.	1500 tests completed	MSPLS (b) Universities (UB) INSP (x)	1	1	1	1	1	5	CURMES
		2G2C : establishment of a national reference and research center for chronic diseases allowing deep biological researches on genetic engineering.	Research center created with 5 publications	MSPLS (b) Universities (UB) INSP (x)	1		1		1	3	INSP
		2G3A : Creation of mutual support groups to encourage free blood test for chronic diseases .	Protocol created and 5 mutual support groups initiated	MSPLS (b) Universities (UB)		1		1		2	CREDSR

Area 2 : Medical Science											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
2H. Community Medicine and Public Health	Having sufficient knowledge on the community and using it in the development of the health sector.	2H1B : Community qualitative and quantitative surveys to identify the key factors for behavior change.	5 studies completed	MSPLS (b) Universities (UB)	1	1	1	1	1	5	CRIDIS CURSAP
		2H2D : High level training of medical practitioner from the Ministry of Public Health.	5 medical practitioners trained	MSPLS (b) Universities (UB) INSP (x)	1	1	1	1	1	5	INSP
		2H3A : Initiation of sociological research techniques in order to identify the perceptions of the community and its expectations in terms of health care providing.	5 studies completed	MSPLS (b) Universities (UB)	1		1		1	3	CREDSR CURSAP
2I. Pharmacy sector	Targeting medication autonomy as much	2I1C : Creation of a department of Pharmacy at the University of Burundi and in private universities.	Pharmacy department created	MSPLS (b) Universities (UB)		2	2	2	2	8	

Area 2 : Medical Science											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
	as possible										
		2I2B : Strengthening capacities in the Pharmacy sector.	5 pharmacist retrainings	MSPLS (b) Universities (UB) INSP (x)	1		1		1	3	INSP
		1. Organization of controls at the borders in order to fight against counterfeit. 2. Strengthening capacities of the quality control Laboratory at INSP and BBN 2I3D.	500 samples completed per year	MSPLS (b) Universities (UB), INSP (x)	1	1	1	1	1	5	INSP
		2I4A : Creation of pharmaco vigilance center.	1 centre created	MSPLS (b)Universities (UB), INSP (x)		1		1		2	INSP
2J. Neglected tropical diseases	OS1 reducing morbidity and mortality related to neglected tropical diseases in the Burundian	2J1D : Study at the national level on the prevalence of geo-helmintiasis and other parasites.	5 studies completed	MSPLS (b) Universities (UB), INSP	1		1		1	3	INSP

Area 2 : Medical Science											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100,000 USD**	**Research center**
					2014	2015	2016	2017	2018		
	population.										
		2J2B : Active research on neglected tropical diseases not yet tested in Burundi	5 studies completed	MSPLS (b) Universities (UB) INSP(x)		1		1		2	CURMES
		2J3A : Campaigns of the rural population sensitization on prevention of neglected tropical diseases	3 campaigns studied	MSPLS (b) Universities (u) Min Home Affairs(i)	1		1		1	3	
		2J4A : Socio-anthropological studies to identify social indicators of transmission of geo-helmintiases and other parasites in the population	5 studies completed	MSPLS (b) Universities (UB)		1		1		2	CREDSR
			TOTAL		20	22	26	23	26	117	

2.4.3. ENERGY, MINES AND TRANSPORT

A. ENERGY SUB - AREA

Burundi possesses a varied number of energy sources. The energy report of year 2006 indicates that energy supply is assured at 94.06% by fuels from biomass such as wood fire, wood charcoal, and agriculture residual as well as peat, at 4.27% by power, at 1.65% by petroleum products and at 0.02% by other types of energy (MEEATU, 2008 in "Stratégie Nationale et Plan d'Action de Lutte contre la Degradation des Sols 2011-2016", MEEATU, 2011).

2.4.3.1. Context and justification

There is a good correlation between the energy consumed by the population and its level of development. Moreover, energy is not only required in order to meet the daily needs; but also, it is even an essential component of any activity which allows assuring a minimum of the economic and social development.

When we talk of energy, we also need to introduce the notion of power quality. It is thus obvious that a noble energy like electricity offers more interesting comfort and potential than for instance the one contained in the biomass. And when we talk of electricity, we should no longer think only of light, which is only one even minor aspect as this can be replaced, but much more the electrical engines, welding, use of sophisticated instruments such computers, laser bistoury, refrigerators,…, brief to all areas where muscular force and the raw nature cannot be of any help for us.

It is a serious handicap for all the sectors of the economic life to experience unfortunate and unexpected power cut because the flow of productivity here lost is hard to recover. Concerning the biomass, the one used in Burundi is essentially from wood and its derivatives. This use has got the consequence of contributing to the environmental degradation. Thus, the forest area has reduced from 40.5 % from 1990 to 2010 (Report on the Human Development, PNUD 2013).

Burundi has got a potential of hydro-electrical power estimated at 1300 MW among which only 32 MW are effectively exploited. In comparison with other African countries, it has got the lowest consumption of energy, i.e. 23 KWh/Pers/year and at least half of it comes from abroad. This situation of power deficit does not match at all with the needs of the East African Community. The power needs are very high. In fact, the sole mine deposit of Musongati will need at least 200 MW for its exploitation without forgetting the electrification of the rural areas; which explains the rehabilitation or layout of new power plants.

Besides, the country has got a hydroelectrical potential of 300 MW economically exploitable and distributed over the whole territory (Kaburantwa, Kagunuzi, Mpanda in North- West, Murembwe, Jiji, Muyovozi and Ruzibazi in South). It is equipped with an underground relatively rich in peat. In 2008-2009, the country produced 11 352 tons of peat against 9 764 the previous year, while a power station of 30 MW on peat would require 300 000 tons per year. The alternative energies are gradually taking a position especially for solar energy for isolated health centers and Kamenge University Hospital, but, biogas, wind energy and geothermal energy are almost inexistent.

To solve the frequent power disconnections, the Minister of Energy and Mines has resolved to use generators supplied by a private company. As Burundi is neither a country which is highly electrified nor producer of oil, transport energy is entirely imported from abroad. To illustrate the situation, if we reach

a consumption of 1500 kWh per year and per inhabitant, which is an optimistic but realistic goal for 30 years, we need an installed power of 3000 MW.

The natural forest ecosystems among which most of them constitute protected areas should occupy a total surface of 240.716 ha. The riparian population of these areas collect from them deadwood, firewood, charcoal wood and work wood. A surface of 4.366 ha was destroyed during the crisis of 1993.

The articifial forests occupy a surface of 164.000ha among which government forests are estimated at 99.000ha, the communal forests at 5.000 ha and the agri-forestry and private wood at 60.000 ha. Although this surface seems high, the forest policy intended to increase the forest cover up to 500.000 ha to meet the socio-economic and ecological need of the country! These forests are predominently made of species introduced, especially of the type *Eucalyptus, Cupressus*, *Callitris* and *Pinus* ("Stratégie Nationale et Plan d'Actions sur la Biodiversité 2013-2020").

The Burundian rural area, which hosts 96% of the population, only uses the wood as energy source. The demand is so significant and increases the rhythm of population while the offer decreases. The wood energy is especially used in the rural families, in boarding schools and tea factories for boiling, heating and lighting. In urban areas, the use of wood energy is rather much more almost exclusively centered on wood charcoal to cook food. The wood used originates from natural forests and artificial forests and comprises some well targeted species. In 2004, the consumption of wood energy-wise reached 5.905.500 tons (General Directorate of Water and Energy, 2006). Currently, the consumption must be higher given the demand, density and growth of the population.

The wood charcoal is obtained through traditional carbonization with a productivity of about 10% while we can increase it up to 20% through learning and publication of improved carbonization supported by improved fire places. The reduction of quantity of wood consumed has resulted into preserving trees in place. The using fire places only possess an energy production of 15% while there do exist ones with a power generation of 35%.

Without electricity, a series of possibilities of production and improvement of living conditions of the population is not accessible. Burundi is faced with a power deficit which only grows due to levels of the storage impoundments, consecutively with the reduction of rains and extended drought, while it intends to increase its industrialization rate. The rural population who only has wood as energy source could benefit from electricity and thus reduce the wood consumptions.

The peat exploitation to replace the wood could be beneficial, on condition that marshlands do not dry out. The renewable energies whose use rate is significantly reduced should attract the interest of research in future.

2.4.3.2. Situational analysis

Strengths :

- High population density, which makes the access to the national network relatively simple;
- Large quantity of peat (50 Millions of tons) ;
- High density of water streams for micro dams;
- Good contact with solar energy the whole year;
- Very luxurious vegetation for biogas.

Weaknesses :

- Poor access for the population to the electrical energy and a critical deficit of this energy consumption observed in rural and urban areas ; more than 94% of families consume wood

energy or its derivatives, indicator of critical poverty in Burundi;

- Poor electrical consumption in families : it is of 23 kWh/inhabitant/year while the African average consumption is more than 500 kWh and that we need to target a consumption of 1500 kWh in 30 years ;
- Under 3 % of families are connected with electricity;
- Petroleum products entirely imported and only count for 2.5% of the national energy balance;
- Scarcity of renewable energy favorable for the environment;
- Poor industrialization related to the availability of electrical energy (electricity represents 2.2 % in the national energy balance) ;
- Ineffective use of available energy;
- Lack of private investment in the energy sector;
- Low contribution to the sub-regional offer (30% of our electricity comes from abroad) ;
- Low technological level which makes it hard to adopt alternative energies as animal draught power, biogas, etc. ;
- Low use of existing resources by large energy consumers (who should use peat instead of wood) as brick-kiln, lime kilns, schools, camps, tea factories, etc.

Opportunities :

- Relative neighborhood with countries which have high hydro-electrical power. Rusizi has got a drop, of about 700m on about a hundred of km; Rusumo is not far ; the mega barrages of Ethiopia and Congo (Inga) are in the region ;
- Probable presence of petroleum deposits in the region and even in our country.

Threats :

- Risk of dependence from external support for such a strategic sector of energy;
- Dependence on external support for energy projects.

B. MINE SUB-AREA

2.4.3.3. Context and justification

Burundi host significant mine resources, inter alia : nickel (261 millions of tons), limestone (2.2 millions of tons), cobalt, Copper, platinoids, gold, titanic, vanadium (9.7 millions of tons). Mining is still of cottage-type and less structured; the situation is further complicated with the lack of processing plants, without forgetting transportation means which are very limited in a so much landlocked country as Burundi located at a 2000 km distance from the Eastern Cost and 3000 km from Western Cost.

There is an updated mining code, but the critical lack of energy remains a major hinderance for the development of the sector. To illustrate, the sole mine deposit of Musongati will require 250 MW while the country currently produces under one third. It is therefore urgent to undertake deep research for a maximum cost-effectiveness of this mine potential in order to generate both government and family income, by taking into consideration the impact of mining on the environment.

2.4.3.4. Situational analysis

Strengths :

- Documented presence of mine deposits across the country: nickel, phosphates, col-tan, cassiterite, China clay, etc. ;
- Presence of mining agreements already signed between Burundi and international mining companies.

Weaknesses :

- Current mining legislation with lots of gaps;
- Lack of coordination of some services with the mining sector (some infrastructures are built in areas with mining potentials) ;
- Degradation of the environment during research on mines ;
- No valuation of local expertise;
- Poor supervision and information of traditional exploiters of the already identified mine deposits;
- Lack of enough and modern infrastructures and equipments for the laboratories which intervene in the mining sector;
- Insufficiency of qualified staff.

Opportunities:

- Regional integration and cooperation which provides an opportunity for the development of the mining sector in Burundi.

Threats :

- Delay in the implementation of the mining programs by international companies;
- No control of geological data on mining sites and their potential consequences hampering the development of the sector.

C. TRANSPORT SUB-AREA

2.4.3.5. Context and justification

The transport of goods and people both inside and outside the country (within and without the country) is an imperative for development. Burundi has got possibilities of road, lake and air transport. We also intend to link Burundi with the ocean by rail or the Northern corridor of Mombasa via Uganda or Dar es Salaam via Rusaka.

For road transport, Burundi has got a very dense road network whose portion is asphalted and another portion is in dirt. The maintenance of that network is very expensive and adequate studies would help to save much economy for the country either by better maintaining the roads, or by optimizing the road constructions (balance asphalted roads / dirt roads). In fact, a well designed and maintained dirt road in a region with an average traffic can be a more economic selection. The land of the Congo-Nil Crest is very loose, a study of the more vulnerable areas on Rugombo-Kayanza and Bujumbura – Kayanza roads is urgent because the slightest road slide constricts the Capital City.

Burundi is small but some remote areas make up to 6 hour distance road to reach Bujumbura, hence the necessity of developing the network of internal aerodromes.

For the contact with the abroad, we count on the corridor of Mombassa -Kampala -Bujumbura, the corridor of Dar es Salaam - Kigoma - Bujumbura, the corridor of Dar es Salaam- Kahama-Kobero-Bujumbura and the corridor of Mpulungu-Bujumbura (lake). The corridor of Dar es Salaam - Kigoma-

Bujumbura is a rail-lake combination that we need to improve by doubling it with another railway which directly reaches Burundi.

2.4.3.6. Situational analysis

Strengths :

- Political will (mobilization of the population for community works to maintain and trace roads) ;
- The narrowness of the territory could allow to asphalt several roads with little means;
- Available manpower for the road construction works;
- In some areas, the simple management allows sensitively improving the road infrastructure.

Weaknesses :

- Country landlockedness;
- Poor development of public transport;
- Poor quality of road infrastructure;
- Insufficiency of human resources for the planning and implementation of tasks in relation with road infrastructure;
- Insufficiency of financial means to develop the road sector;
- Difficult topography of Burundi in some regions with a loose soil, likely to rock slide ;
- Lack of air transport in order to decongest the road network;
- Sea transport which is still to be improved;
- No respect of standards in the road construction and traffic.

Opportunities :

- Regional integration of the country notably, in the East African Community, with construction projects of regional roads;
- Effective bilateral and multilateral partnership.

Threat:

- No respect of standards on behalf of national and international entrepreneurs.

Chart 9 : Logic framework of the area of Energy, Mines and Transport

Area 3 : Energy, Mines and Transport											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget x 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
3A: Electricity	Providing enough electrical energy for the economic development and welfare of the citizens	3A1D : Drafting of an atlas of the sites of national and regional hydro-electrical stations.	Atlas produced	MEM (m) Universities(u)			1		1	2	
		3A2A: Study of the micro barrages to be developed and local funding.	2 studies per annum	MEM (m) Universities(u)		1	1	1	1	4	
		3A3C: Study of constructions and maintenance of thermal stations (fuel, peat).	1 study 30MW, 4 studies 5 MW	MEM (m) Universities(u)		1	1	1	1	4	
3. B Domestic energy	Saving energy sources	3B1B : Production and economic combustion of the peat.	study completed	MEM (m) Universities(u) MEEATU (v)	1		1		1	3	CRUEA
	Use of the most proper energy sources possible	3B2B : Installation, use and distribution of digesters.	study completed	MEM (m) Universities(u) MEEATU(v)		1		1		2	CRUEA
	Ecological and economic use of the wood	3B3B : study on big or small plantations for firewood.	5 Studies completed	MINAGRIE (a) Universities(u) MEEATU(v)	1	1	1	1	1	5	CERDA

Area 3 : Energy, Mines and Transport											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget x 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
		3B4B : Study and dissemination of carbonization methods.	2 studies and 1 fair in each commune	MEM (m) Universities(u) MEEATU(v)			1		1	2	CRUEA
		3B5D : Study and dissemination of improved fire places.	1 study and 1 fair	MEM (m) Universities(u) MEEATU(v)	1	1		1		3	CRUEA
3C. Semi-industrial energies	Safekeeping the environment by using wood substitutes	3C1C : Study of the use of peat and dissemination in high scale wood consumption industries in tea plants, brick-kilns, lime kilns, cement factories.	5 studies completed	MEM (m) Universities(u) MEEATU(v)	1	1	1	1	1	5	CRUEA
	Supplying electricity to institutions far from the national network	3C2A : Establishment of an atlas of insolation, wind and geothermy.	Atlas produced	MEM (m) Universities(u) IGEBU(x)				1	1	2	CRUEA

Area 3 : Energy, Mines and Transport											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget x 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
3I Cottage-type mines	Rationalizing the exploitation of the existing mines	3I1A : Training of trainers in techniques of sustainable mining.	10 trainers trained per year	MEM (m) Universities(u) MEEATU(v)	1		1		1	3	CRUST
		3I2D : Studies proposing better methods of exploitation of different minerals.	5 methodes generated	MEM (m) Universities(u) MEEATU(v)		1		1	1	3	
		3I3A : Study on mine tax collection.	Study completed	MFPDE(f) Universities(u)	1					1	CURDES
		3I4A : Study on the establishment of a favorable code for the country and the investors.	Modern legal framework which encourages mines. Draft code.	MFPDE(f) Universities(u) MJGS(j)		1		1		2	
		3I5C : Socio-economic study on investment in the mine sector.	Study completed	MFPDE(f) Universities(u)	1		1		1	3	CURDES
	Searching for other minerals to be exploited	3I6 : Prospection studies.	15 Prospections undertaken.	MEM (m) Universities(u)	1	1	1	1	1	5	CRUST
		3I7A : studies on the treatment processes.	5 Studies conducted	MEM (m) Universities(u)		1		1		2	
3J. Industrial	Strengthening capacities of	3J1D : Updating	15 geologists –	MEM (m)	1	1	1	1	1	5	CRUST

Area 3 : Energy, Mines and Transport												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget x 100.000 USD**	**Research centers**
Mines	the staff exploiting the industrial mines	knowledge of geologists.	retrained mining engineers	Universities(u)							
3P. Roads and Ways	Connecting different national zones for a commercial, administrative and medical openness	3P1C : Studies on the optimum network for the shear thinning of the transport of goods and people.	5 studies completed	Universities(u) MTTPE (t) IGEBU (x)		1		1	1	3	
		3P2B : Studies on the achievement and optimal maintenance of asphalted and dirt roads.	10 studies completed	Universities(u) MTTPE (t)		1		1		2	
Rail network	Openness of the country	3P3B : Study on the optimal layout of railway towards Tanzania.	Study completed	Universities(u) MTTPE (t) IGEBU (x)			1			1	
Aerodrome network	Internal openness	3P4A : Study of optimal network of aerodromes	Study completed	Universities(u) MTTPE (t)		1		1		2	
				TOTAL	10	14	13	15	15	67	

2.4.4. WATER, DESERTIFICATION, ENVIRONMENT

2.4.4.1. Context and Justification

In Burundi, the national economy is mainly based on rain-fed farming. The agriculture sector then largely depends on seasonal climate changes which are not controllable by the farmer. The seasonal irregularities misguide the farmer in his usual farming calendar and destroys crop in a full vegetative phase, with the consequence of the most often reduction of agriculture productions.

Since about ten years ago, the water resources are in a gradual reduction due to poor space-temporal distribution of rainfalls; the North-Eastern regions of Burundi (Kirundo and Muyinga) are critically affected by the drought, which tends to desertification, and frequently shaken by hunger.

The complex of marshlands and lakes of the North East of Burundi is threatened by the drought and even disappearance due to the extension of agriculture, overgrazing and extraction of vegetation and peat by the riparian population.

The level of Lake Tanganyika increases of about one meter each year, and three to four meters if we consider the inter-annual variations. In fact, the level of Lake Tanganyika varied between 772 m and 777 m of altitude since 1929 to date, according to the variability of rainfalls in the watershed of the lake. The peripheral area whose altitude is located between the two levels constitutes the inundated plain. During the periods of rainfall deficit, this area was threatened by the riparian populations which tend to appropriate it for the needs of agriculture and habitat, with an immediate impact on the erosion of barges and the destruction of littoral ecosystems of the Lake Tanganyika.

The waters of Lake Tanganyika constitute an important fish reserve, an important means of communication with the Democratic Republic of Congo, Zambia and Tanzania, and a big part of the drinking water to the Bujumbura City and other small towns located along the shore of the Lake. Its protection by all riparian countries is more than required.

The lowlands of Imbo (altitude of 773-1000 m) receive lots of torrents from the regions of Congo-Nil Crest and Mirwa heavily flown through with steep slope. All the areas are sensitive to erosion along the draining axes, in particular during the period of heavy rainfalls. The disastrous situation of erosion, characterized with landslides, is constantly observed in Mumirwa and is likely to increase due to heavy rains. The persistence of traditional farming practices and the lack of anti-erosion devices provoke erosion on steep slopes thus causing pollution of the lakes and rivers and reduce the halieutic production.

The loss of superficial land impoverishes the cultivated cropland and makes it less fertile and thus less productive. The control of erosion and restoration of fertility is an urgent requirement. The Bujumbura communes crossed through by those torrents are particularly affected by this type of destructive erosion which is the cause of pollution of Lake Tanganyika. We absolutely need to reduce this type of erosion in order to safeguard both public and private infrastructures located in the surroundings of the drainage axes.

Despite climate changes observed, Burundi has got sufficient water resources if we consider the annual rainfalls (800 to 2000 mm), numerous rivers and lakes. Those resources are not used in an optimal manner to meet the needs of the country. Actions must be undertaken in order to collect and store rain water during the rainy season and use it for irrigation of croplands and domestic needs.

Piped running water is used for irrigation and good functioning of factories. Irrigated rice farming and sugar cane farming constitute one source of pollution due to the use of pesticides and chemical

fertilizers, thus affecting the life of aquatic fauna. The pollution is also caused by solid and liquid wastes originating from industries and cottage-type units as well as waste waters from households. Those industrial and family wastes are poured in sewers or rivers crossing the City of Bujumbura and are discharged in Lake Tanganyika. Cottage-type processing units, notably the palm oil and soap production units in the Imbo plain, discharge liquid wastes in rivers and Lake Tanganyika. All of those wastes favor the expansion of invasive species which reduce the concentration in oxygen dissolved in water and the disappearance of some living organisms such as fish.

The physico-chemical analyses of water from some sites in communication with Lake Tanganyika have indicated that the high concentration in fluoride, sulfide, nitrogen and phosphates species and heavy metals most of the time going beyond the recommended standards for the aquatic life. With this increasing pollution and the degree of pollution which has a direct influence on the quality of drinking water, the attitude of REGIDESO has been the movement of the capture point which was at 800m from the beach in 1981 up to 3.500 m in 1984. If the situation continues, the question here is to know if the next movement of the capture point is not likely to break the limits of water belonging to Burundi! It is therefore urgent to react in order to limit the progress of this pollution before it gets late. Researches on different types of water pollution are then required in order to value aquatic ecosystems.

2.4.4.2. Situational analysis

Strengths :

- Existence of a legal political framework: Water national policy, Water Code, Environmental, National Strategy and Action Plan in terms of Environmental Education and Sensitization, Water National Strategy, National Strategy and Action Plan for the fight against land degradation, Strategic Action Plan for the Integrated Water Management (PAGIRE), National Policy for Basic Hygiene and Sanitation (PNHAB), National Action Plan for Adaptation to Climate Change (PANA), Convention on the fight against Desertification;
- Clear political commitment through creation of the Ministry in charge of Water and Environment;
- Existence of para-statal institutions in charge of data on Water and Environment such as IGEBU, INECN and REGIDESO ;
- Existence of consultation frameworks: Water and Sanitation Sectoral Group (GSEA) Water National Strategy Technical Group;
- Existence of local NGOs intervening in the areas of water and environment such as «Green Belt Action for Environment » (ACVE), « Association for Environment Protection » (ENVIROPROTECT), « Organization for the Environment Defense in Burundi » (ODEB), « Association Woman and Environment in Burundi (AFEB) » ; Association for Environmental Cleanliness (Bujumbura), Community Health Agents (TPS), Water Communal control points and committees of water points and committees for hygiene;
- Existence of planning tools such as findings of the inventory of water and sanitation infrastructures (INEA), the mapping of potentials in underground water published by IGEBU, hydrological paper ;
- Membership of Burundi to political and regional groupings of countries in the sub-region (East African Community (EAC), Economic Community of the Great Lakes countries (CEPGL), Economic Community of the Central African countries (CEEAC) and signing of cooperation instruments in terms of management and valuation of shared water resources (ex. the Convention on the Sustainable Management of Lake Tanganyika, the Commission of the Basin of Lake Victoria, Cooperation Framework of the Nile Basin countries) ;

- Existence of donors in the activities concerning water and environment (ex. World Bank (WB), German Financial Cooperation (KFW), German Technical Cooperation (GIZ), African Development Bank (BAD), United Nations International Children's Emergency Fund (UNICEF), United States Agency for International Development (USAID), International World Vision Fund ;
- Existence of a dense hydrological network;
- Existence of trees and low shrubs of dry regions likely to provide grains for reforestation
- Existence of qualified staff, but in an insufficient number to conduct researches on the physiology of development of plants which resist to drought and train supporting staff;
- Existence of national and private laboratories likely to serve for water and soil chemical analysis;
- Existence of qualified staff, although in a limited number, to conduct researches in hydrology, fishery and fish farming, microbiology, genetics as well as aquatic pollution and train supporting staff.

Weaknesses :

- Lack of sufficient financial means to acquire laboratory equipment and fund development and research activities; Burundi largely depends on international organizations' support;
- Lack of network for political, scientific and strategic coordination of different sectors

water, environment) ;

- Lack of basic training structures in water and environmental techniques ;
- Lack of implementation of the water, land and forest conservatory management;
- Low capacity of the Bujumbura waste water treatment plant located at Buterere.

Opportunities :

- Existence of staff qualified in vegetal and animal systems, forestry, vegetal physiology, micro-biology, genetics, water chemistry and environmental science as well as the existence of trial sites and indigenous forest species that could serve as material of research on reforestation of semiarid zones which constitute the tools for relevant researches on aquatic and land ecosystems. In this respect, we need a funding resource mobilization for the development of the water and environment sector. The following actions would be with priority :
  - ❖ Construction of a new drinking water production factory for the City of Bujumbura;
  - ❖ Limnological and Hydrobiological researches of water of Bugesera lakes in order to supply drinking water to the population and practice irrigated farming and develop fishery and fish farming;
  - ❖ Researches on the different pollutions of the Lake Tanganyika and its tributaries in order to identify the biological indicators of pollution likely to serve in the surveillance and fight against them and contribute for the improvement of REGIDESO services;
  - ❖ Installations of settlement tank of water from different quarters of the Bujumbura City before they are discharged in the Lake Tanganyika;
  - ❖ Researches and dissemination of vegetal species (food crops and forest species) resistent to drought in order to serve for food and reforestation in the regions of Bugesera, imbo and Kumoso;
  - ❖ Researches and dissemination of farming practices adapted to the regions with steep slopes to reduce the soil erosion and the silting of lakes and rivers;
  - ❖ Researches on debits and stabilization of rivers which often provoke floods, mainly in the Imbo plain;

- ❖ Strengthening professional capacities in the water and environmental areas through creation of training fields in water and environmental techniques and science in high and secondary technical education institutions;
- ❖ Creation of training field in water science and technology;
- ❖ Research and development in water area.

Threats :

- Climate changes likely to cause drought or floods as well as proliferation of some diseases;
- Expansion of towns without taking into account the availability of drinking water and public latrines;
- Discharging wastes at the proximity of habitats, public market, rivers and in sewers of rain water;
- Drainage of domestic waste water in the sewers for rain water causing bad smells in the quarters;
- Propagation of invasive plants in the aquatic areas;
- Irrational management of marshlands that can cause their drought.

Chart 10 : Water, Desertification and Environmental Logic framework

Area 4 : Water, Desertification and Environment												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeling**					**Budget X 100.000 USD**	**Research Centers**
					2014	2015	2016	2017	2018		
4A. Environment	Guaranteeing a sustainable access to drinking water	4A1A : Creation of water periodic analysis center (Physical, chemical, biological and bacteriological characteristics) to respect cleanliness of drinking water.	Number of water analysis centers created.	MEM	1		1		1	3	CRUME
	Planning and better managing water resources so that they can be a basis for agriculture, energy and tourism development	4A2B : systematic evaluation of surface and underground water resources and hydrological systems assessment (basins of rivers, lakes and underground water) and creation of data base on water resources and hydrological ecosystems.	Data base available.	MEM (m) MINAGRIE(a) Universities(u)		1			1	2	
		4A3A : Management of new water sources to improve the availability of water in terms of quality and quantity both in urban and rural areas.	Number of sources managed	MEM () Public works (t)		1	1			2	

Area 4 : Water, Desertification and Environment

Priority area	Specific goals	Activities	IOV	Responsible	Timeling					Budget X 100.000 USD	Research Centers
					2014	2015	2016	2017	2018		
		4A4B : Protection of lakes and rivers against any type of pollution and invasive plants.	5 studies completed	MEEATU Universities(u)	1		1		1	3	CRUME
		4A5C : study of a good drainage of rain water.	10 sites surveyed	MEEATU Universities(u)		1		1		2	
		4A6D : defining measures and strategies to collect and store rain water.	5 studies completed	MEEATU Universities(u)	1					1	CRUME
	Assuring a good management of waste water	4A7D : drainage of domestic waste water in sewers different from the ones for rain water.	Absence of waste water in rain water's sewers.	MEEATU Universities(u)		1				1	CRUME
		4A8C : setting up a sanitation system likely to treat waste water from industrial, commercial, handcrafts, agricultural or livestock origins.	Number of stations for waste water treatment	MEEATU Universities(u)		1		1		2	
		4A9B : Designing and adoption of waste water rejection standards.	Law proposed	MEEATU Universities(u)	1		1			2	CRUME
	Stabilizing the fluviatile	4A10D : Construction of	Number of	MEEATU		1		1		2	

Area 4 : Water, Desertification and Environment

Priority area	Specific goals	Activities	IOV	Responsible	Timeling					Budget X 100.000 USD	Research Centers
					2014	2015	2016	2017	2018		
	dynamics of rivers	embankments and barrages.	embankments and barrages built.	Universities(u)							
		4A11A : Practice of regular sewer cleaning of rivers.	Periods of promulgated sewer cleanings.	MEEATU Universities(u)			1			1	
		4A12B : Protection of barges with wall construction or tree and grass plantation.	Constructed and plantations completed	MEEATU Universities(u)					1	1	
4B. Desertification	Better knowing the causes and scope of drought	4B1B : Strengthening networks of meteorological and hydrological observation to set up a data base over a long period.	Number of networks availed and equipped	MEEATU Universities(u)	1		1		1	3	CRUME
	Fight against deforestation, rain wash, cropland degradation, drought and desertification.	4B2A : Implementation of the afforestation and reforestation programs.	2 programs studied	MEEATU Universities(u)		1		1		2	
		4B3C : Promotion of plants which resist to drought.	Cultivated plant species	MEEATU MINAGRIE Universities	1		1		1	3	CRUME
		4B4D : Installation of woody plants on contour lines.	Contour lines covered with	MEEATU Universities(u)				1	1	2	

Area 4 : Water, Desertification and Environment

Priority area	Specific goals	Activities	IOV	Responsible	Timeling					Budget X 100.000 USD	Research Centers
					2014	2015	2016	2017	2018		
			plants								
	Preserving the biological diversity and natural resources	4B5C: Strengthening technical capacity in soil science and water management.	Number of trained technicians	MEEATU Universities(u)		1	1			2	
		Sensitization of the Government and NGOs for a firm commitment in the funding of the search for adequate and sustainable solutions to issues of erosion and land degradation 4B6D.	2 sensitization sessions of the Government and NGOs	MEEATU Universities(u)					1	1	
		4B7A : Sensitization of all categories of the population about the enforcement of the law in relation with biodiversity.	1 sensitization session per commune	MEEATU Universities(u) Min Hom (i)			1			1	
		4B8D : Inadequate training on conservation in favor of guards and managers of protected areas.	30 guards and managers trained	MEEATU Universities(u)				1		1	
		4B9C : Integration of issues related to biodiversity in the primary, secondary and university training programs.	3 modules on biodiversity produced	MEEATU Universities(u) MEBSEMFPA			1			1	
		4B10D : Design of rational exploitation plans of natural resources.	5 plans designed	MEEATU Universities(u)		1		1		2	

Area 4 : Water, Desertification and Environment

Priority area	Specific goals	Activities	IOV	Responsible	Timeling					Budget X 100.000 USD	Research Centers
					2014	2015	2016	2017	2018		
		4B11A : Design of management plans of all protected areas.	5 plans designed	MEEATU Universities(u)	1		1		1		CRUME
		4B12C : Design of a program for the conservation of rare elements or threatened elements of the biodiversity.	Program of conservation available	MEEATU Universities(u)			1			1	
		4B13A : Design and adoption of a law on prevention and fight against invasive exotic species .	Law in force	MEEATU Universities(u)		1		1		2	
		4B14C : Creation of national museum for the conservation and exposure of the biological material representative of the national biodiversity in order to better communicate it to the public.	A museum with biological material representative of the vegetal biodiversity	MEEATU Universities(u)			1			1	
	Cleaning up polluted ecosystems in order to improve the living condition of the human, animals and vegetation in place	4B15A : Expansion and diversification of cleaning stations of waste water in towns.	Number of cleaning stations of waste water	MEEATU Universities(u)		1				1	

Area 4 : Water, Desertification and Environment

Priority area	Specific goals	Activities	IOV	Responsible	Timeling					Budget X 100.000 USD	Research Centers
					2014	2015	2016	2017	2018		
		4B16D : Studies to know the level of pollution of water and soils.	Study findings published	MEEATU Universities(u)	1			1		2	CRUME
		4B17C : management of watersheds of rivers to mitigate the erosion.	Management plans available	MEEATU Universities(u)		1				1	
		4B18C: Establishment of pre-processing units in industries.	Number of pre-processing units	MEEATU Universities(u)			1			1	
		4B19D : Studies and monitoring of the industrial effluents and domestic wastes and their impacts on the biological diversity of aquatic ecosystems.	Number of studies completed and published	MEEATU Universities(u)	1		1		1	3	
				TOTAL	9	12	14	10	10	55	

2.4.5. BIOTECHNOLOGY AND INDIGENOUS KNOWLEDGE

2.4.5.1. Context and Justification

The sectors of agriculture and livestock have first been based on the local species which were adapted to the climate conditions in Burundi. With time, the performance of those species progressively reduced. Lots of cultivated plants were attacked by the diseases causing significant reduction of their production, others poorly adapted to the climate change. The soil erosion also contributed to the reduction of agriculture productions.

With the creation of INEAC, an arboretum was installed in Gisozi for grain conservation for some species introduced, improved vegetal species were selected but also attacked by the diseases after some years. The ISABU produced a work for the treatment of several vegetal diseases but also continued to do researches on the selection of species adapted to the climatic regions in Burundi with high productions and researches on the fertilization of soils, notably with local products (ex. phosphates of Matongo).

The genetic improvement requires that the material used to be more performing than the existing one and that it is conserved in good conditions. The modes of genetic conservation of forest species often used in Burundi are the conservation of grains in the cold room of the Department of forest in the Ministry of Water, Environment, Land management and Urban Planning (MEEATU) and the ex-situ conservation achieved in the form of forestation in full, seeds population, arboreta and botanical gardens.

The forestation in full are essentially made of exotic species. In the overpopulated regions, the agri-forestry is predominent and is mainly made of exotic species. The seeds' population comprises species of *Eucalyptus*, of *Callitris*, of *Grevillea* and of *Pinus.* The arboreta have been set in place by INEAC in Gisozi, by INECN in Butaganzwa and by PROCOBU company in Kajaga and at Buta for the conservation of some autochtonous, medical and exotic useful plants and also for the conservation of species which are progressively disappearing. Botanical gardens have been set in place by the University of Burundi in collaboration with the INECN and the ISABU in Gisozi and at Rohero campus Rohero, but they are currently either not maintained or are partially destroyed.

For the conservation and genetic improvement in terms of agriculture, the ISABU has got a bank of gens for food production and forage. It regularly sends accessions of disseminated varieties of the World Seeds Strong Chamber « Salvard Global SeedVault » located in Norway for the conservation for future useful use. The IRAZ does a collection of gens of vegetals and animals of the Great Lakes Region. The private sector also engaged in the micro-propagation of cutures with vegetative multiplication: the AGROBIOTEC deals with the micro-propagation for the banana crop and PHYTOLABU for banana and potato, the University of Burundi, on its turn, deals with the micro-propagation for the banana crop, malanga and Eumycota. The plants and seeds of Eumycota are disseminated in rural areas.

Concerning the animal genetic improvement, the National Center of Artificial insemination regularly receives gens from several European countries. Initiatives have been engaged for the genetic improvement of the local race « Ankolé » through introduction of exotic races (ex. Frisonne, Jersey, Brune de Suisse) for the production of milk, the introduction of the race Sahiwal and the caprine Boer race for meat. We must also mention the introduction of exotic races of porks (Large White, Pietrain), the use of hybrid species for egg production (pullet chicks of 1 day) in semi-intensive and family livestocks and the introduction of new types of stock breeding based on imported species of rabbit, duck and fowls.

In the framework of the increase of production of fish farming products, the Directorate of Water, Fishery and Aquaculture made supplies in seed stocks of *Tilapia* and of *Clarias*.

Besides, the products from the agriculture and livestock sectors begin to be transformed, preserved and conserved in a way to be consumed after a sufficiently long period. This constitutes a significant advantage for agriculture and livestock as there is a reduction of losses after production.

The National Framework of Biosafety (CNB) constitutes a strategy of orientation for a rational use with no danger of the Genetically Engineered Organism (GEO) in Burundi. The framework plans the choice of importing and using or not using the genetically engineered organisms.

The National Agriculture Strategy (SAN) stipulates a rapid promotion of the production and the rational application of biofertilizers, the sustainable protection of the genetic property, the revival and promotion of fishery and fish farming by preserving the halieutic germoplasm.

The Decree n° 1/033 of june 30, 1993 governing protection of vegetations in Burundi provides information related to the conditions of conservation of vegetations and vegetal products intended for mutiplication. The Ministry Order n° 710/954/98 of december 29 governing application measures of the Decree n° 1/033 of June 30, 1993 governing the protection of vegetations in Burundi provides details on the procedures of control at the multiplication stage: procedures related to the control of seed fields, control of health state of all the vegetations and vegetal products intended for multiplication in the farms, procedures related to the control of the import and export.

Before the European colonizers arrive in Burundi, the population was living in harmony with the nature which notably supplied them with edible wild plants, medical plants, protecting plants and others. The owners of traditional knowledge were appreciated for numerous services they rendered to the population.

Since his arrival in Burundi, the Belgian colonizer based on the traditional knowledge of Burundians, first, to understand them and from there, to initiate development plans of the country.

At the level of traditional medicine, several associations of traditional practitioners are recognized and researches on the floristic inventory of medical plants and of the phytochemistry are regularly conducted at the University of Burundi. A research project on the medical plants dealing with the tick fever and verminosis in Uganda, Rwanda and Burundi was presented in january 2013 by a team of experts from three countries.

All the same, researches on the floristic inventory of edible wild plants in Burundi and their food value are subject for several research papers at the University of Burundi. The ISABU and INECN are also interested in the researches on edible wild plants.

Burundi has signed the laws and conventions in relation with indigenous knowledge. The issues related to the traditional knowledge are evoked in the Law n°1/13 of July 28, 2009 related to the industrial production in Burundi. It indicates notably the purposes of the protection of traditional knowledge for the purpose of sharing advantages related to the exploitation of traditional knowledge of the communities in the areas of traditional medicine, agriculture and food. The Convention on the fight against the desertification invites the member countries to encourage the use and dissemination of knowledge, know-how practices of the local populations by adapting the technologies that are ecologically rational and traditional methods of agriculture and relevant grassland specialty to the modern socio-economic conditions. The National Strategy and Action Plan in terms of Biological diversity intends to protect and encourage the traditional use of biological resources compatible with their conservation and their sustainable use, to perpetuate, through enrichment and conservation, the agriculture and pastoral

resources through the introduction of exotic species but with no degrading or harmful effects. This is also mentioned in the Strategic Framework of Growth and Fight Against Poverty (CSLPII).

2.4.5.2. Situational Analysis

Strengths :

- Existence of political, legal and institutional framework: National Framework of Biosafety (CNB), National Agriculture Strategy (SAN); National Center of Food Technology (CNTA), National Strategy and Action Plan in terms of Biological Diversity (SNAP-DB) ; Decree n°1/033 of June 30, 1993 governing the protection of vegetations in Burundi, Ministry Order n°710/954/98 of December 29 governing application measures of the Decree n°1/033 of June 30, 1993 governing the protection of vegetations in Burundi ;
- Existence of public and private laboratories specialized in biotechnology ;
- Existence of seeds for the banana crop, malanga, potato, cassava and mushroom ;
- Existence of stock of gens of exotic animal species;
- Existence of several associations of traditional practitioners in the whole country;
- Existence of dispensaries which effectively use the traditional medicine;
- Existence of specialists in biotechnology and indigenous knowledge.

Weaknesses :

- Absence of collaboration between the specialists of different areas of the biotechnology and indigenous knowledge;
- Absence of inventory of knowledge and traditional practices of indigenous communities useful for the conservation and sustainable use of biodiversity;
- Lack of sufficient equipments and laboratory products to conduct researches on the cultivation of tissues and extraction of active substances of medical plants most used in Burundi;
- Absence of trials on the curative power of medication substances in order to produce modern local medications;
- Absence of department of phyto-pharmacy at the University of Burundi.

Opportunities :

- Existence of specialists in the area;
- Partnerships.

Threats :

- Climate changes likely to reduce the vegetal and animal production or cause the disappearance of some non tolerant species serving as research material;
- Diseases likely to originate from animals and plants serving as seeds.

Chart 11 : Logic framework of the biotechnology and indigenous knowledge

Area 5 : Biotechnology and Indigenous knowledge											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
5A Biotechnology	Strengthening research capacities in the area of biotechnology	5A1A : Creation of departments of biotechnology within universities and vocational institutions.	Departments of biotechnology created and equipped	MEEATU (v) MINAGRIE (a) Universities (u)					1	1	
		5A2B : Mobilization of scientific expertise .	List of employed experts	MEEATU (v) MINAGRIE (a) Universities (u)		1				1	
		5A3C : Creation of a multi-disciplinary laboratory in biotechnology (bioinformatics, biogenetics, molecular biology).	Pluridisciplinary laboratory created and equipped	MEEATU (v) MINAGRIE (a) Universities (u)	1		1		1	3	CURBA
	Identifying the viable organisms engineered likely to have harmful effects on the conservation and sustainable exploitation of the environment, natural resources and presenting risk for the	5A4D : Creation and strengthening of the bank of animal and vegetal gens.	Bank of gens available.	MEEATU(v) MINAGRIE,(a) Universités (u)		1	1	1	1	4	CURBA

Area 5 : Biotechnology and Indigenous knowledge											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
	human health.										
					2014	2015	2016	2017	2018		
		5A5B : Study of the ecology of species to be domesticated and preserved for an ecological orientation of reforestation and agri-forestry with indigenous species.	3 scientific publications of researches done	MEEATU(v) MINAGRIE,(a) Universities (u)	1		1		1	3	CURBA
		5A6C : Study of food value of engineered living organisms and their impact on the life of human and pet animals.	2 publications of findings obtained	MINAGRIE,(a) Universities (u)		1		1		2	CURBA
	Creating a regulatory framework allowing to make profit of potential advantages of the modern technologies and prevent its negative effects.	5A7A : Drafting and adopting a national law on the access and sharing of benefits resulted from the use of genetic resources.	1 Law in force	MINAGRIE(a) MEEATU(v) Universities(u)			1			1	

Area 5 : Biotechnology and indigenous knowledge											
Priority area	**Specific goal**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research center**
					2014	2015	2016	2017	2018		
	Mobilizing and integrating human, material, financial resources and scientific expertise available to domesticate and apply the technology in an efficient manner.	5A8D : Promotion of the Biotechnology to increase production of vegetal and animal species.	Increase of the production of vegetal and animal species	MINAGRIE(a) Universities(u)		1		1	1	3	CURBA
5B Indigenous knowledge	Benefiting from the indigenous knowledge as ski jump for development.	5B1A : Study of the local codex and extraction of active principles and medication scientifically proved.	5 medical plants studied	MiniHealth(b) Universities(u)	1	1	1	1	1	5	CRUFAMET
		5B2C : Inventory and duplication of traditional manufacturing technologies and a study on their improvement (metallurgy, pottery).	5 technologies studied	MEM (m) MININDUSTRIE, (c) Universities (u)		1		1		2	
				TOTAL	6	7	7	6	7	33	

2.4.6. MATERIALS, ENGINEERING AND INDUSTRY SCIENCES

A. SUB – AREA OF MATERIALS SCIENCE

2.4.6.1. Context and Justification

Burundi possesses significant qualities of raw materials from diverse origins which, if rationally transformed and used, could serve for its economic development. This is the case, first, of the wood and different plants, brief of woody species and their sub-products which serve as materials for : real estates and buildings (housing) ; combustible (energy and transport) ; cloth manufacturing, cosmetics and medication (health) ; food for human, animals and plants; production of bags and other ornamental ware, ropiness, paper, plates of thermal isolation, etc.

This is the case in 2nd time of animal and halieutic resources. They do not serve only for food consumption. Their components and sub-products end up, after being processed, by serving for other uses such as clothing and ornementation (ex leather, skins, molluscan shellfish), the health cares (via medications and other cosmetics for instance), etc.

The mines and quarrels in 3rd time (ex sands, quarry material, stones, clay, minerals and petroleum products) are at the basis of materials making for infrastructures and equipments. Among those materials, we have glasses, plastics, ceramics, briks, bitumen and other materials of the civil engineering, as well as metals.

From the 3 previous categories (and eventually others), the materials astutely processed as elements of the infrastructures and equipment of all socio-economic areas : energy, transport (land, maritime, air), agriculture, telecommunications, health, education, tourism, industry, housing, environment, etc.

The knowledge, processing, rational use and management of resources and local raw products cope with diverse constraints in Burundi. We can address them at a lower level (in terms of quantity and quality) of scientific, technical and institutional capacities (in terms of human, material, financial and organizational resources) required to perform adequate R-D works and lead to innovation in the areas of materials' science.

In fact, from the raw materials, Burundi must target to put at the market finite, competitive products, with added value, meeting the quality standards and income generators. In this respect, it must make well informed investments in order to develop the area. The few characteristics here below illustrate to what extent it is large (NEPAD 2006 ; AMRS, 2011; AMRS, 2013 ; AU-NEPAD, 2012).

- Classes of materials ; textiles and fibers; leathers and skins; polymers ; ceramics ; metals ; composites ; biomaterials ; nano materials ; meta- materials ; etc ;
- structures of materials : functional solids ; Wet materials; multi phase materials ; coatings ; etc ;
- Specific interests of study: physical and chemical aspects governing the functional elements (structural, electronic, thermal, chemical, optical, magnetic, combinations of 2 or several elements); analytical and digital methods of study; other aspects (imperfections and subsequent limitations, new process of synthesis, environmental considerations) ; etc.
- Types of use : energy and environment (batteries, hydrogen generation and storage, photovoltaic solar cells, catalytic materials, etc) ; biomaterials and health care (pulse triggering /control, regeneration of tissues, etc) ; electronic materials (inorganic and organic semiconductors, oxydes, ionic and mixed conductors, etc) ; optical materials (quantum dots, pleomonics, chromegenics, switching materials, etc) ; magnetic and spimaterials and

spintronics ; carbonaceous materials (nanotubes, fibers, graphens, fullerenes, etc); materials for for the metallurgy and the infrastructures ; agriculture and biotechnologies, etc.

2.4.6.2. Situational analysis

Strengths :

- Presence of materials in the country.

Weakenesses :

- Lack of national research programs;
- Insufficiency of skills and expertise;
- Dependence on foreign materials;
- Non convenient imported materials;
- Lack of motivation of the researchers;
- Lack of transfer of technologies to beneficiaries;
- Lack of attraction of the youth to hard sciences.

Opportunity :

- Sub-regional, regional and international integration.

Threat:

- Regional and international competition

B. ENGINEERING AND INDUSTRIES SUB-AREA

2.4.6.3. Context and justification

First of all, Burundi needs to systematically evaluate this sub-area in terms of diverse available infrastructures and equipments, current competence and expertise in Engineering Science, as well as cottage and industrial types of production units, chains or complex of materials, finite assembling and equipments. Then, as it is shown by the current situation (even though it is not sufficiently documented), it is necessary to set in place new programs and strengthen the existing ones in terms of training and R-D in diverse engineering sciences required for the socio-economic development of the country.

Those are namely: civil engineering, mechanic, electrical, electronic, chemical, agri-food, forestry, management and planning, textile, mine, metallurgical, aeronautic, aerospace engineering, etc..
At the center of those programs will be placed the R-D activities and high level innovation (doctoral and post doctoral) on issues of concepts and modeling, synthesis and treatment, tests and characterization, dissemination, use and management, etc., related to materials, infrastructures and equipments of all kinds. The design of those programs will have to clearly come up with a solid partnership and necessary links between the relevant R-D institutions – innovation (Units, Centers, Universities), the production and trade enterprises (industries, INE, market) the policy makers and funding institutions.

2.4.6.4. Institutional analysis

Strengths :

- Availability of local manpower.

Weaknesses :

- Insufficiency of a national expertise;

- Lack of enough financial means;
- Insufficiency of local raw materials;
- Poor development of small and medium industries;
- Insufficiency of manufacturing and processing industries;
- Insufficiency of electrical energy;
- No dissemination of the law on industrial policy.

Opportunities :

- International cooperation;
- Regional integration.

Threats :

- External competition;
- Hemming in.

Chart 12: Logic framework of the area of materials, engineering and industries science

Area 6 : Materials, Engineering and Industries Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
6A. Stone- ceramics	Valuing stones and ceramics	6A1A : studies on the clay and stone processing.	2 studies completed	Universities (u) MCIPT(c)			1		1	2	
		6A2B : studies on the cottage and industrial processes to produce porcelain and tiles.	2 studies completed	Universities (u) MCIPT(c)		1		1		2	
		6A3D : conducting studies on the revival of production of the industrial and cottage type glass.	2 studies completed	Universities (u) MCIPT(c) MEM(m)			1		1	2	
6B. Wood	Valuing woody and non woody products.	6B1B : studies on the process of wood work.	2 studies completed	Universities (u) MCIPT(c)		1		1		2	
		6B2A : Studies on the possibilities of substitution of the metal by wood	2 studies completed	UB, ENS MCIPT			1		1	2	
6C. Plastics	Valuing renewable plastics.	6C1B : Studies on the processing and re-use of plastics.	2 studies completed	Universities (u) MCIPT(c)		1		1		2	
6D. Metals	Promoting the sustainable use of metals.	6D1D : Studies on metal re-conditioning.	2 studies completed	Universities (u) MCIPT(c)		1		1		2	

Area 6 : Materials, Engineering and Industries Science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research center**
					2014	2015	2016	2017	2018		
6E. Biomaterials	Maximizing the use of agriculture products	6E1C : Studies on the processing and use of biomaterials.	2 studies completed	Universities (u) MINAGRIE (a) MCIPT(c)			1		1	2	
		6E2A : Studies on the production and use of biofuels.	5 studies completed	Universities (u) MINAGRIE (a) MCIPT(c)	1	1	1	1	1	5	CURBA
6F. Diverse	To make diverse materials cost effective	6F1B : Studies on the processes adapted to other diverse solid, liquid and gaseous materials.	5 studies completed	Universities (u) MCIPT(c)	1	1	1	1	1	5	
		6F2C : Studies on advanced materials (optics, optoelectronics, laser, semi-conductors, nanomaterials, …).	5 studies completed	Universities (u) MCIPT(c)	1	1	1	1	1	5	
6J. Mechanics	Establish operational mechanisms of maintenance of mechanical equipments.	6J1D : Studies on the optimal maintenance of the mobile support equipment and other mechanical tools.	5 studies completed	Universities(u) MCIPT(c)	1	1	1	1	1	5	

Area 6 : Materials, Engineering and Industries Science											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
	Manufacturing mechanical spares for industries.	6J2C : setting in place a mechanical engineering unit within the CNRSIT.	Mechanical engineering unit and central workshop for mechanical production set in place.	Universities(u) MTTPE(t)		3	3	3	3	12	
		6K2D : Studies on the manufacturing of diverse other chemical products.	5 studies completed	Universities(u) MCIPT MINAGRIE	1	1	1	1	1	5	
		6K3C : studies on the industrial manufacturing of basic pharmaceutical products .	5 studies completed	Universities (u) MSPLS (a) Mini Industry (c)	1	1	1	1	1	5	
6L. Cottage and small industrial types	Absorbing as much manpower as possible outside agriculture	6L1D: Socio-economic studies in order to organize workshops on professions	5 studies completed	Universities (u) Mini Industry (c) MEBSEMFPA	1	1	1	1	1	5	CURDES
	Setting in place integrated production chains	6L2A : manufacturing final products with most of the local intermediary products	Products locally available	Universities (u) MEM (m) MCIPT (c)		1		1		2	
				TOTAL	8	16	15	16	15	58	

2.4.7. INFORMATION AND COMMUNICATION TECHNOLOGIES, SPACE AND MATHEMATICAL SCIENCES

A. INFORMATION AND COMMUNICATION TECHNOLOGIES

2.4.7.1. Context and Justification

Lots of efforts to create conditions for the development of the sector of ICT have been made since years of 1996 and the relatively positive results continue to be registered in all of the ministries. The strategic vision of the national development policy of ICT (PNDTIC) intends to achieve the universal accessibility of ICT in order to expedite the economic growth.

To succeed all the projects, a high level training, the establishment of regional and international networks and the development of advanced researches in science and technology are required.

In Africa, the use of ICT is growing and the level of technical change is still low compared to the situation prevailing in other parts of the world. The ICT is today among the priorities of NEPAD to structure and develop other sectors. Africa is importer and consumer of ICT and its contribution to global research in software is limited. Despite the advantages offered by the innovation in software, there is a lack of capacity in the high education institutions whose resources are not sufficient compared to equivalent institutions in developed countries. Moreover, the infrastructure of information technology in these institutions is poorly developed and unequally distributed.

In addition to ICT (computers, telephone,…) which are means of communication requiring the active intervention of the beneficiary, we need to consider the traditional medias such as radio, television and even the disseminator at the colline level where information runs after the client. In the case of STI where in addition to producing the technology and innovation, we need to make all the social categories adopt them, these means are very important.

2.4.7.2. Situational analysis

Strengths:

- Existence of a legislation on medias;
- Existence of ICT department in education institutions;
- Presence of newspapers and diverse radios;
- High number of subscribers for mobile phone technology;
- Presence of foreign operators with a will of developing the world of medias

Weaknesses :

- Insufficiency of research in the area;
- Critical issue to access ICT,
- Unequal distribution of different ICT services over the national territory;
- Low speed of internet network;
- Low level of training in ICT;
- Insufficiency of funds, ICT infrastructures and materials;
- Issue of adapting the training programs to the needs of the country;
- Non-coordinated service computerizing;

- Insufficiency of competent human resources in ICT;
- Low level of the development of the ICT sector compared to other countries of the region and the world

.

Opportunity :

- Regional and international cooperation.

Threat :

- International competition.

B. SPACE SCIENCE

2.4.7.3. Context and Justification

The space science constitutes one of the areas which are not yet developed in Burundi. It comprises notably : Astronomy, astrophysics, Remote Sensing and Satellite imagery. They serve, inter alia, for the efficient management of issues related to telecommunications, natural resources, climate changes and meteorology.

2.4.7.4. Situational analysis

Strengths :

- Possibility of international collaboration thanks to a favorable geographic position;
- Small size of the territory constituting an advantage in the previous efficient management.

Weaknesses *:*

- Insufficiency of human and financial resources;
- Lack of material tools to apply it;
- Misconception of the importance of space science.

Opportunities :

- Existence of regional project (SKA : Square Kilometer Array) in South Africa ;
- Existence of a regional center at Nairobi (Regional Centre for Mapping of Resources for Development -RCMRD);
- Possibility of cooperating with the JRC (Joint Research Center) and diverse regional, continental and international Geographic Information Systems.

Threat :

- International protection on satellite data.

C. MATHEMATICAL SCIENCE

2.4.7.5. Context and Justification

In Burundi, the mathematics remain more theoretical than applied while they become more interesting when they reach the stage of concrete applications. They are found in all scientific disciplines (be it in hard or human and social science) and therefore cover all the socio-economic sectors.

2.4.7.6. Situational analysis

Strengths :

- High number of candidates for capacity building in these sub-areas;
- High volume of hours allotted to the course of mathematics in education institutions;
- Availability of lecturers qualified in mathematics.

Weaknesses :

- Insufficiency of human, material and financial resources to explore the ingenious world of applications;
- Absence of an Institute of Applied Mathematical Science;
- Lack of national and regional competitiveness in this area ;
- Lack of research on learning technologies in general, the learning of science and mathematics in particular.

Opportunities :

- Weakness related to material and financial means required in mathematical science;
- Existence of African centers of excellence for researches or mathematical sciences (AIMS), notably in South Africa, Senegal and in Ghana;
- Existence of a regional network of Institutes of Mathematics (African Mathematics Institute-AMI).

Threats :

- Regional and international competition at the market of application of this sub-area.

Chart 13: Logic framework of the area of ICT, Space Science and Mathematical Science

Area 7 : ICT, Space Science and Mathematical science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
7A. Dissemination	Disseminating the ICT in the population.	7A1C: Studies in the dissemination of ICT.	5 studies completed	Universities (u) MTICRP(f)	1		1		1	3	CURDIF
7B. Internet / Telephony	Using computer in an optimal way.	7B1C: Studies in the design of software.	5 studies completed	SETIC Universities (u) MTICRP(f)	1	1	1	1	1	5	CURDIF
		7B2B: creation of website for interaction of researchers from the East African Community on development solutions (relocated solvers).	Website created	EAC (k) Universities (u) MTICRP(f)	1		1		1	3	CURDIF
		7B3C: Study on the propagation of telephone as internal tool.	Study completed	SETIC Universities (u) MTICRP(f)		1		1		2	
7C. Radio-Television	Disseminating information and knowledge.	7C1B: Study on communication techniques.	Study completed	Universities (u) MTICRP(f)	1	1	1	1	1	5	CREDSR
		7C2A: designing technology dissemination programs.	5 programs produced.	Universities (u) MTICRP(f) MINAGRIE	1	1	1	1	1	5	CRIDIS
7J. Remote Sensing	Rationally exploiting satellite images.	7J1D: Satellite image processing	Number of satellite images processed.	Universities (u) IGEBU (x)							

Area 7 : ICT, Space Science and Mathematical science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
					1	1	1	1	1	5	CERAM
7P. Mathematics	Integrating the ICT in the mathematics and science teaching programs.	7P1B: Designing adapted softwares	Models of stimulation designed.	UB MFPDE	1	1	1	1	1	5	CRDS
	Stimulating the youth's interest	7P2A: Organization of olympiads	1 olympiad organized per science per year.	Universities (u) MTICRP (f) MEBSEMFPA	1	1	1	1	1	5	CRDS
		7P3D: Creation of adequate training tools in science.	1 slot of materials per year and per science.	Universities (u) MEBSEMFPA (e)	1	1	1	1	1	5	CRDS
				TOTAL	9	8	9	8	9	43	

2.4.8. SOCIAL AND HUMAN SCIENCE

2.4.8.1. Context and Justification

The social science are a key to understand a great number of socio-economic issues. However, at the national level, numerous research centers in human and social science have set up programs intended to support a relevant research for the design of policies. Thus, the use of scientific research and technological innovation in human and social science vary from country to country and, in numerous developing countries, it is still marginalized and is weakened by a significant lack of financial, institutional and scientific resources.

For the case of Burundi, the situation of research and technological innovation in the area is currently at its embryonic stage despite the existence of some research centers created here and there.
The linguistic situation in Burundi requires a particular attention and an intervention of the public powers. Four languages, Kirundi, French, English and Kiswahili are used and taught in Burundi. At the regional level, the integration of Burundi in the East African Community (EAC) obliges it to equip itself with mechanisms allowing him to integrate this community linguistically.

English will be a taught subject from the first year of fundamental education, in meantime, while waiting for the findings of a comprehensive evaluation of the language teaching. At the high education level, it will be the teaching language used in parallel with French, according to specificity of fields. That is the reason why it will be necessary to read and understand English, in such a way that the students can be able to do their works in the language they prefer. In this respect, the ministries in charge of education are going to organize the training in English language for their staff.

English will also be taught to the civil servants at work, in a form of training course, through capacity strengthening in English. It is in this logic that the project « Enhancing English Skills and Training/Setting up of English Language Centers » will be developed and will be equipped with language laboratories.

In the sector of culture, the Government is going to revive the Rundi Academy, whose creation instrument is dated from 1962 (King's Law n°01/96 of October 16, 1962). This institution will be a body intended to guide, coordinate and implement the national linguistic policy. It will benefit from a financial support of the Government, enjoying its management autonomy. Besides, the Government will create a Rundi Cultural Center, with its library, its website, its translation industries and Editing House. This cultural Center will also be able to train foreigners in Kirundi language. Still in this area, the Government will organize literary competitions in Kirundi and will reward the best writers; it will contribute for the publication of best works. In the same line, there will be organized festivals on rundi language and culture, whereby there will be exposed best works written in Kirundi and the best artistic productions on the rundi culture, and diverse cultural talents will express themselves.

2.4.8.2. Situational analysis

Strengths :

- Government commitment for the promotion of sports' and cultural activities;
- Existence of the Ministry in charge of Youth, Sports and Culture;
- Legal framework : King's Law n°01/96 of October 16, 1962 ;
- Project of reviving the Rundi Academy;
- Development of the private sector in the teaching of human and social science.

Weaknesses :

- Insufficiency of centers for Research - Development in human and social science;

- Insufficiency of a monitoring and evaluation system for the R-D in social and human science;
- Insufficiency of researching experts and lecturers;
- Lack of a culture of entrepreneurship;
- Absence of inter-disciplinarity in the research on social and human science;
- Dependence of the researcher on the donor;
- Inexistence of training center and design of software in economics.

Opportunities :

- Membership of Burundi to the East African Community;
- Availability of e-learning programs.

Threat :

- Negative impact on the globalization.

Chart 14 : Logic framework of the area of social and human science

Area 8 : Social and human science												
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
8A. Strengthening capacities in human and social science.	R1.1 : Integrating new programs in the academic curriculum.	8A1A: Development of diversified high level training and research programs.	5 researchers retrained each year; numerous new curricula available.	UNIVERSITIES (u)			1			1	
	R1.2 : Creating a high institute of arts' techniques	8A2C: setting up structures and programs of High Institute for arts' techniques.	50 Award Winners /year in arts' techniques	UNIVERSITIES, MINISTRY OF THE YOUTH, SPORTS AND CULTURE & PTF		1				1	
8B. Promotion of the framework for language and culture protection and development	R2.1 : creating a « Rundi » academy	8B1A: setting up functioning structures of the « Rundi » academy.	Physical address of the available Rundi Cultural Center	MINESRS, UNIVERSITIES, MINISTRY OF THE YOUTH, SPORTS AND CULTURE & PTF	1	1	1	1	1		CELAB
	R2.2 : Achieving a level where numerous executives and lecturers express themselves easily in English	8B2D: Training and setting in place of training centers for the English language.	Advanced course in favour of lecturers and other civil servants	UNIVERSITIES (u)	1	1	1	1	1	5	CELAB

Area 8 : Social and human science											
Priority area	**Specific goals**	**Activities**	**IOV**	**Responsible**	**Timeline**					**Budget X 100.000 USD**	**Research centers**
					2014	2015	2016	2017	2018		
8C. Promotion of sports' and recreational activities.	R3.1 : Creating public and private leisure centers in all the communes of Burundi.	8C1D: Promotion of public and private leisure centers in all communes of Burundi.	1 leisure center (public and/or private) is created by the Commune.	UNIVERSITIES (u) MINISTRY OF THE YOUTH, SPORTS AND CULTURE & PTF		1				1	
	R3.2 : Creating a study and training center in science and technologies of physical and sports' activities.	8C2B: Design and achievement of a study, research and training center in science and technologies of physical and sports' activities.	1 National study, research and training center in science and technologies of physical and sports' activities is created and is functional.	UNIVERSITIES(u) MINISTRY OF THE YOUTH, DPORTD AND CULTURE		1				1	•
8D Researches on the social dynamics.	R3.3 : Promoting peaceful coexistence	8D1C: Studies on the techniques of social coexistence	5 studies completed	Universities (u) Min Hom (u) Minijust (u)	1	1	1	1	1	5	CREDSR
		8D2B: Studies on the influence of peace on the development	5 studies completed	Universities (u) Min Hom (u) Minijust (u)	1	1	1	1	1	5	CREDSR
				TOTAL	4		5	5	5	24	

CHAPTER 3. FUNDING PLAN OF RESEARCH AND TECHNOLOGICAL INNOVATION ACTIONS

The research and technological innovation are not done for pleasure, they constitute a real investment as it is shown in the material progress in all the countries all over the world. A country which does not have a good research/development program cannot pretend to develop the welfare of its population as this has been proved by an American Economist Paul Romer in his works.

Investing in research is therefore like investing in an enterprise which has a yield of 30% and more. Which banks could resist before such a good rate now that they give loans at 20% of interest?

The country must consider that investing in technology is not a fancy shape but rather a necessity if it wants to achieve the goals of the Vision 2025 and the Goals of the Strategic Framework of Growth and Fight against poverty, 2nd Generation (CSLP II).

All the research findings and technological innovation must be applied, thus facilitating the functioning and causing scale economies and profits in the different sectors of national life.

The actions to be undertaken are subdivided into four based on their modes of funding:

- The national strategic projects which depend on the equity of Burundi (20%);
- The regional strategic projects whose equity come from different regional partners interested in the projects here in concern (20%) ;
- The projects partially or fully funded by international bodies (35%) ;
- Bi- and multilateral support (25%).

The classification here below takes into consideration the priorities of the projects although means are not equal. The first group, although it is the most important, cannot get lots of means because of poverty of the country. But it can be subject for national sensitization in addition to the Government equity. Here we refer to mobilizations as the ones that are done among parties, a research fund to be constituted from diverse national economic operators through voluntary or non voluntary contribution.

It would be interesting to also encourage the economic operators and the organs of the Government to consider the research sector as resources of which we need to make profit and reward them. If for instance a ministry has a project or must present a project to the donors, its first reflex should be to seek for the opinion, to remunerate the national research services, in the local universities and institutions. All those funds would contribute to revive research and technological innovation. A service of project studies for different ministries should be created and hosted within the General Directorate in charge of Research and Technological Innovation in the Ministry of High Education and Scientific Research in order to avoid limiting oneself at a sole university as the Research, Consultancy and Technology Transfer of Huye is attached to the National University of Rwanda. The first category would therefore drain 20% of the research funds because of the unsettled situation of the country's economy.

The second category is made of researches that the countries in the region consider of great strategic importance but that no country can succeed alone. As it is still a self funding, then which does not depend on chance factors of countries whose survival does not depend on them. The researches which depend on the chance factors are of higher priority and are related with the endogenous development which is the safer way for progress.

As for the country, the region is richer, the funding of regional project can be negotiated in order to achieve the same level as the national self funding, i.e. 20% of the whole research budget. In this group of bodies interested at the first level in the progress of Burundi, there is CEPGL, EAC, and ADB, the African Union, PTA, etc... To this group, the funding of research up to 20% should be requested for.

The most important source of income, even if it does not apply to the most important areas which must demonstrate a certain dependence compared to the funding source, is constituted by international bodies such as WHO, UNESCO, UNDP and the World Bank. Great diplomatic efforts must be deployed in order to mobilize about 35 % of the funding. The advantage of those bodies is that their funding can be stable and not depend on the diplomatic chance factors of some donor countries.

The last funding source, which is the least certain even if its means can be substantial, come from bi and multilateral supports which are most of the times tied aids, because they come with experts of the donor countries who, with equal competence, occupy functions which do not necessarily favor the achievement of the projects. These are the same aids which can fluctuate because of political changes of donor countries. That is the reason why we will allocate for it 25% of the funding which will be oriented towards the least important projects. In this catgory, we put european, american countries, etc. and the restricted bodies of which they are part such as European Union and ACP.

The main goal of such a distribution is especially to take the responsibility for its own development. Other countries have gone through similar hard times and manage to overcome them; Burundi and the region should believe they can also do so, but also demonstrated it.

If the whole of the projects are too ambitious, we need to limit ourselves to the most important projects; it is never good to undertake works that are left half done. We need to taste the success by undertaking achievable activities; this animates courage for more ambitious works. The secret is to use all available means, especially intellectual sources, the sole guarantor of the technological progress.

The chart 15 provides the evolution provided for under the STI budget per priority area and the Chart 16 the expected evolution of the funding of STI according to the origin of resources.

Chart 15 : Provisional Budget for the logic frameworks/area/year x 100 000 USD in Burundi

Priority area (X 100 000 USD)	2014	2015	2016	2017	2018	TOT.	%	Δ 2018 / 2014
1. AGRI-FOOD TECHNOLOGIES	13	17	16	16	17	**79**	**17%**	31%
2. MEDICAL SCIENCE	20	22	26	23	26	**117**	**25%**	30%
3. ENERGY, MINE AND TRANSPORT	10	14	13	15	15	**67**	**15%**	50%
4. WATER, DESERTIFICATION AND ENVIRONMENT	9	12	14	10	10	**55**	**12%**	11%
5. BIOTECHNOLOGY AND INDIGENOUS KNOWLEDGE	3	6	5	5	6	**25**	**5%**	100%
6. MATERIALS, ENGINEERING AND INDUSTRIES	2	14	12	13	10	**51**	**11%**	400%
7. ICT, SPACE AND MATHEMATICAL SCIENCES	9	8	9	8	9	**43**	**9%**	0%
8. SOCIAL AND HUMAN SCIENCE	4	5	5	5	5	**24**	**5%**	25%
TOTAL (X100 000 USD)	**70**	**98**	**100**	**95**	**98**	**461**	**100%**	**40%**

Chart 16: Provisional Budget for the logic frameworks / year x 100 000 USD according to the funding sources

Funding source (x100 000 USD)	2014	2015	2016	2017	2018	TOTAL	%	Δ 2018 / 2014
A. National Budget	20	26	27	25	26	124	27%	30%
B. Regional cooperation	13	16	17	14	17	77	17%	31%
C. International bodies	18	31	30	28	27	134	29%	50%
D. Donor countries, NGO	19	25	26	28	28	126	27%	47%
TOTAL	**70**	**98**	**100**	**95**	**98**	**461**	**100%**	**40%**

Chart 17: Elements of the macro-economic and budget framing 2014– 2018

Elements of the macroeconomic framing						
		2014	**2015**	**2016**	**2017**	**2018**
1.	**Demographic data**					
	Total Population (in thousands)	9,067	9,285	9,507	9,735	9,969
2.	**Gross Domestic Product**					
	National GDP in current value per capita FACE VALUE	283	317	404	461	526
	National GDP in current value (billions of BIF) chart 27 CSLP 2	2565	2943	3840	4488	5244
	Growth rate (%)	14.6	14.8	14.8	14.1	14.1
3.	**Total Public Expenditure**					
	Total expenditures of public administration (billions in BIF)	1305	1412	1766	1975	2202
	Ratio : Public expenditures on GDP (%)	50.9	48.0	46.1	44	42
4.	**Public research related expenditures**					
	Budget for the Ministry of High Education and Scientific Research	49	50	50	54	54
	Budget of Scientific Research and Innovation		1,59	1,72	1.67	1,7
	Percentage of the budget of MESRS/total expenditures of administration	-	-	-	-	-
	Research related expenditures of other ministries and other public funds (INSP, ISABU, UB, ENS public/para-statal enterprises) in billions of BIF)		1.56	1.88	2.38	2.05
	Total public research related expenditures (billions in BIF)		3.15	3.6	4.05	3.75
	Ratio : Government expenditures on research/total expenditures (%)		0.002	0.002	0.002	0.002
5.	**Private research related expenditures**					
	Private enterprises					
	Total direct research related expenditures of enterprises (billions of BIF)		1	1	1	1
6.	**Expenditures of Technical and Financial Partners (PTF)**					
	Total expenditures of PTF (billions BIF 13.3 % of the GDP)	341	391	511	597	697
	Expenditures of PTF on research (billions of BIF)		10.25	10.4	9.15	9.95
	Proportion of research related expenditures for PTF on their total expenditures		2.6	2	1.5	1.4
	Total expenditures on researches (billions of BIF		14.4	15	14.2	14.7
	In (millions US$)		9.6	10	9.5	9.8
	In % of the GDP		1	0.78	0.67	0.57

Source	2014	2015	2016	2017	TOTAL	Percentage
Government*	3.15	3.6	4.05	3.75	14.55	25
PTF	10.25	10.4	9.15	9.95	39.75	68.2
Private	1	1	1	1	4	6,8
Total in billions of BIF	14.4	15	14.2	14.7	58.3	**100%**

CHAPTER 4. THE PLAN MONITORING AND EVALUATION

4.1. RISKS

The risks related to the implementation of the present Strategic Action Plan (SAP) could be of a political and institutional nature. Given the means that will be required for the implementation of the SAP, we can now rely on the prevailing peaceful environment, after more than twenty years of a generalized crisis, a crisis which also affected research institutions.

Institutionally, we will count on the establishment of a National Commission in charge of Science, Technology and Innovation (CNSTI). Its role is to ensure good implementation of the activities contained in the SAP and to undertake necessary procedures for its funding. An effort will be deployed in order to search for and develop a network for university cooperation throughout the world starting with agreements likely to be revived with historical partner countries.
Besides, the experience and lessons learnt from the ongoing research projects will constitute the basis of the extension of actions.

Besides, the Government has committed to implement the PNRSIT in all sectors of the economy from year 2014. It wishes to request the support from all stakeholders to achieve aspirations of this plan in a bid to expedite the development of Burundi and the process of society transformation.
The chart 18 indicates the risk matrix.

Chart 18 : Risk matrix

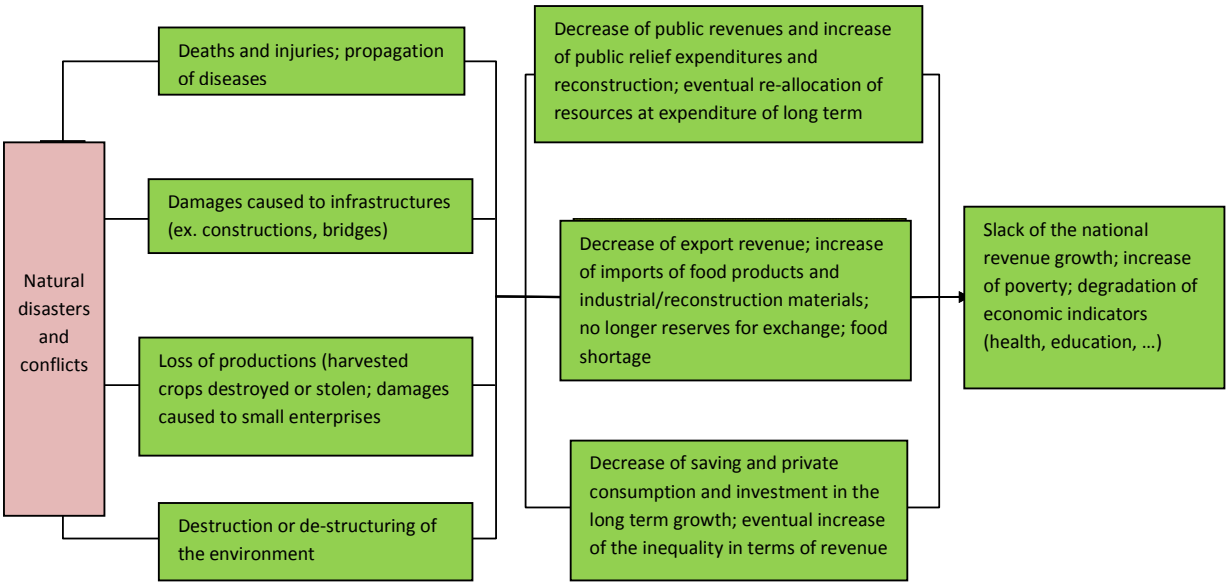
Risks	Degree	Probable consequences	Mitigation measures
1. Political context : resurgence of the crisis	Medium	Withdrawal of donors ; critical reduction of revenues	Good governance, follow up by the international community
2. Limited capacities of the governmental institutions at all levels	High	Poor implementation of the action plan and strategies; No achievement of goals	Strengthening the capacities of the actors involved in the implementation of the Plan
3. Incapacity of the Government to achieve its tax policy and increase revenue	High	Lack of interest of the private sector to invest in the key sectors of the economy	Good governance and mobilization of external funds ; IMF and WB supports
4. Insufficient political commitment to initiate reforms of public institutions in the agriculture sector required for the coherence with the CSLP and SAN	High	Deadlock in the privatization process (coffee, tea, cotton) ; maintenance of the economy which hampers the private sector	PTF support to undertake reforms and adoption of accompanying measures
5. Climate changes	High	Reduction of production and deterioration of food security	Rational management of water and other natural resources
6. Mobilization of resources in other sectors on which the agriculture sector depends, i.e. the road infrastructures, energy, etc.	Medium	Slack of the growth of the agriculture sector	Good governmental coordination; Support of the international community
7. No water control	High	No productive grains	Code of water, trainings, technical supervision and mobilization of investments
8. Land issues	High	Land insecurity and weakness of the private investment	Adoption of the land code
9. Trade related obstacles	Medium	Poor functioning of the market, low revenue of export	Respect of regional commitments; development of infrastructures and networks of communication

Source: Adaptation from PNIA (MINAGRIE, 2011)

The most frequently identified obstacles and cited in the literature of the research development in the rural area are both endogenous and exogenous. Among the endogenous factors, we can cite the reluctance of the local environment vis-à-vis the innovation, competitions among professional actors or mutual mistrusts; which makes it hard to establish any form of partnership.

Concerning the exogenous factors, it is possible to cite the natural disasters (floods, heavy winds, drought, earthquakes, …), as well as the wars and any other type of conflict (fig.2).

Figure 2: Long effects of natural disasters and armed conflicts on economic resources



Source: Ndimubandi (2006)

4.2. THE SUSTAINABILITY OF ACTIONS

The mission of the Government will consist of enlarging the field of knowledge for the benefit of the whole of the society and to support the activities of research-development in the areas where mechanisms of the market are defaulting or do not suffice to meet the needs of the society or specific goals of the Government.

Finally, it is worth showing some general considerations which should be taken into account as pre-conditions for the success of a policy of science and technology in a small country like Burundi:

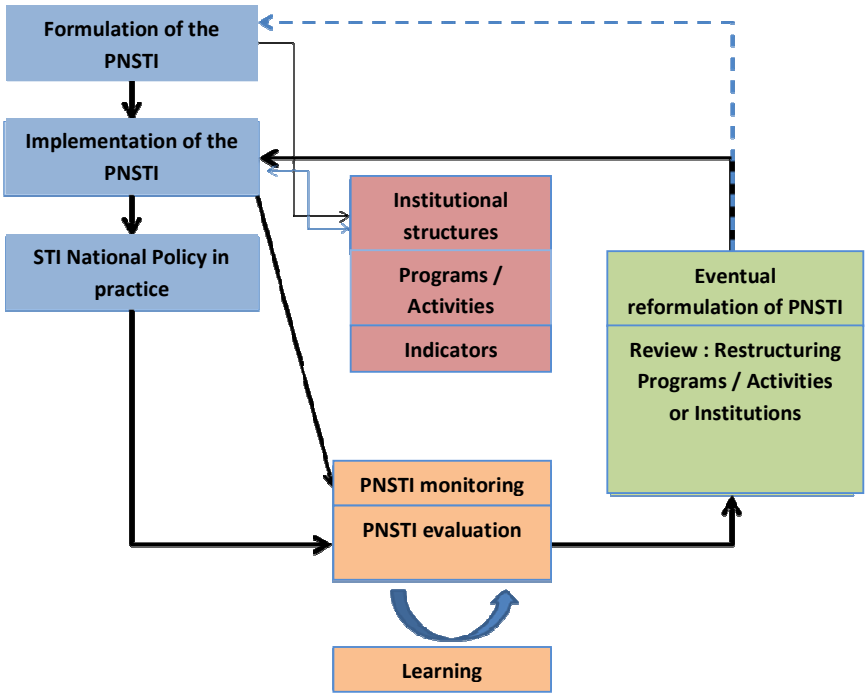
- A firm and sustainable political will on behalf of the higher authority of the country and an involvement of the Government, both through direct funding and through deeply reflected guidance of the high education system and research for a contribution to the technological innovation proportional to its contribution to the development of the basic knowledge.
- The choice of a limited number of priority sectors of intervention in which comparative advantages help to maximize the results by reducing the risk and uncertainty. We should never neglect the traditional sectors of the country where results, in order to be innovative, are no less full of consequences at the level of the employment and at the basic industrial structure. It is usually in those sectors that we find the first « success stories » whose psychological importance and effect of training are not negligible.
- The establishment of research units very significant for the minimal critical mass which makes them productive, by avoiding the attempt to create very big centers whose freedom of manipulation is limited and which are less adaptable to the new knowledge and new technologies, as well as to the amendments of the national policies. During the establishment of those units, it is important to seek

to develop diverse types of partnerships of research by basing on the promising initiatives expressed within the institutions and enterprises: the diversity of formulas is a guarantee for success.

- A constant concern for the development and establishment of new technologies with, on the other hand, a continuous adaptation of the programs.
- Consultation mechanisms created as forum for expression of opinions of the main actors, both institutional and individual. It is in this way that the discussions on the science and national priorities escape from an oligarchy in place which is likely to drain through all its own interests. We must make an effort to assure a minimum force of democratic expression on this essential dimension of the development of a nation.

The sustainability of actions, a mechanism of monitoring-evaluation is necessary. The figure 3 illustrates the architecture of the policy cycle since its formulation up to its review. The procedures and instruments of MONITORING and EVALUATION of the strategy and Action Plan to facilitate the communication and interaction with the beneficiaries of research policies and decision making are developed under item 4.3.

Figure 3 : Architecture of the policy: from formulation to the review



Source: Adaptation from Ministry of Infrastructure, Science and Technology, Republic of Botswana (2011)

4.3. MODEL OF MONITORING AND EVALUATION

1. Introduction

The increasing impact of science, technology and introduction of innovations (STI) on the economic and social realities require the establishment of public policies likely to mobilize all relevant sectors as well as to achieve an optimum use of resources.

At the time when, after adoption by the Government of Burundi in 2011 of the National Policy on Scientific research and Technological Innovation, the implementation of the policies on scientific research and technological innovation in Burundi takes a new pace with the launching of the Strategy and Action Plan 2014-2018, the incorporation of monitoring and evaluation instruments is also an important element which helps the responsible to make adequate decisions in order to set in place corrective measures in a bid to reach the targeted goals and to contribute with relevant orientations on the adaptation of the Strategy and the design of future research policies.

The collaboration of UNESCO in the implementation of its policies includes assistance notably for the establishment of a system of monitoring and evaluation vis-à-vis the goals determined as a fundamental element to allow understanding the evolution and the impact of policies as well as the adequacy of mechanisms to implement the STI policy. This article analyzes the approaches and procedures to develop in order to count on an efficient system to achieve the intended purpose.

The systems of evaluation are the continuous learning processes (IPTS-JRC, 2002) which constitute a structural element for periodical application in the definition of strategies to and from programs of research and innovation. They are attached to the goals and logic of established goals and must cover the diverse steps and components of its implementation:

1) the phase ex ante evaluation, focused on the consideration of objectives and strategic measures, as well as the instruments to be used and the action plan, in order to note if it is appropriate to achieve the STI policies; of course given that this phase can sometimes happen with adjustments of the political logic.

2) the phase of evaluation for the selection of projects and actions which require financial support of the action plan, according to proper procedures and criteria of different instruments or existing programs (quality, management, impact) which are applied to the proposals submitted. Those initial evaluations have got a natural continuity in the follow up of the development and technical and economic final evaluation of actions or individual projects funded by the Plan.

3) the phase of monitoring the STI action Plan, which goes through the whole planning period and which is not only related to the integration of all monitoring processes of individual projects but also to the management of the whole action plan.

4) the phase of ex-post evaluation of the results of the impacts and obtained by the strategy and the implemented plan and which provide necessary remarks on the achievement of the goals of the policy as it was implemented. In the case of programs and pluri-annual STI plans, ideally, we will have to use bi-annual or medium term evaluations.

This only targets the phases 3 and 4 cited, of ex-post monitoring and evaluation of the Strategy and STI Action plan in Burundi 2014-2018 which were prepared according to the methodology of « Logic framework » intended for the production of prior information we will need before having regular reports on progress, after, to set in place correction measures if necessary and finally provide an overview of the consequences of the implementation of policies.

The effects of ex-post evaluation will provide a fundamental contribution for the renewal of the action plan in the period after 2018, as well as for the review of policies and strategies in place, what we referred to as “ex-ante evaluation” (phase 1)

Also, progressively with the creation of programs and instruments for the implementation of the Plan, we will have to define the method and criteria for evaluation of the actions and projects likely to be supported by the resources and funding of each program (phase 2). The approaches of evaluation for the phases 1 and 2 will then be subject to a posterior consideration at this document.

The definition of the methodology and criteria for the monitoring (phase 3) and evaluation (phase 4) so that they meet the needs of the STI policies and represent the viable and transparent references will become one of the prior conditions for an always increased participation of the actors of the research and innovation system and its success, thereafter.

2. Goals

As we have just indicated, this part focuses on the definition of MODEL OF MONITORING AND EVALUATION OF THE STRATEGY AND ACTION PLAN 2014-2018 which refers to two specific steps (3 and 4) of the general process of evaluation described here below.

The MONITRING of the whole of actions provided in the logic framework and the ones of the EVALUATION of the results and the impact of the Plan – then the adopted strategy- have got a goal and a different scope, which will have consequences in the selection of methodology and organizational system to set in place.

It is important to highlight the differences of approach; the monitoring, an essential element in the process of evaluation and the cycle of design and implementation of the STI policies, mainly focuses on the actions, while the evaluation notably targets the results and impacts (PREST, 2006).

Being the end of both of them, monitoring and evaluation, to have necessary information in order to know to what extent the development of a strategy or action plan allowed reaching the goals identified by the policy on science and technology, there is a prior condition to be met in any case: having an STI INFORMATION SYSTEM capable of providing the data that we will need to 1) have a framework for the description of aggregate dimensions of the system (researchers, financial resources) compared to other countries and which gives milestones on its evolution and its relation to the indicators of macroeconomic development, 2) Establishing on solid bases and the appreciations of achievement of main or specific objectives as well as the recommendations made by the evaluator's process.

The goals for the Plan MONITORING are the following:

Concerning the EVALUATION of the Strategy and Action Plan, its objectives intend to establish a whole of quantitative and qualitative overviews on:

- The degree of achievement of the purposes and goals pursued and the compliance with the disposals and goals established by the indicators (effectiveness)
- The resources, tools, management procedures and mechanisms used (efficiency)
- The progress in the resolution of the issues and needs targeted by the strategy and action research and innovation of the Plan (relevance)
- The movement of factors which cause difficulties for the achievement of specific goals planned in the logic framework, allowing its future evolution (sustainability)

The multi-sectoral character and at the same time specialized per areas and goals of the Plan advises to base the evaluation on the deep analysis of:

- The institutional and organizational coordination;
- The management mechanisms and procedures and project funding;
- The development of specific goals for each area;
- The strategic axes such as training of researchers, creation of infrastructures, the transfer and

dissemination of knowledge, international cooperation and increase of interest on different sectors in Burundi for science and its social and economic role.

The evaluation will also have to identify the cases of good practices and teaching which shows on the surface the implementation of the Plan, as well as to draw conclusions and suggestions of improvement which serve for decision making by the institutional managers of the program, notably at the level of term evaluation.

Based on the principle of the STI policy presented in the document of the Government if Burundi of 2011, the evaluation must comprise referential STI political guidelines for the review of policies and strategies as well as for the future design of other plans to support and promote research and innovation.

3. Design of the monitoring and evaluation model

The setting in place of a system for monitoring and evaluation will need a prior consideration of accessible data as well as the governance of processes, which will also allow defining the steps of its future evolution as a system of information capture on science and technology in Burundi which presents once again some gaps in terms of quantity and /or quality.

The definition of the model will therefore depart from the criteria related to the career opportunities to request from the information system on science and innovation according to the standards routinely used in the international environment.

The approach adopted shows that the model of monitoring and evaluation is focused on the activities which are part of the logic framework of the policy and procedure of building up the policy on science and technology. Thus, it is possible to evaluate some aspects of the policy in all its steps, from the beginning till the completion of its implementation (Avellar, 2007).

The model proposed for monitoring and evaluation is a combined approach with different methods, both quantitative and qualitative methods, which highlight the measurement of the results of the scientific and technical action plan and also the economic and social consequences of the described policies.

The construction of the model is based on a series of measures to set in place in relation with the implementation of the STI policies:

a. The creation of GOVERNANCE INSTRUMENTS of the STI system including the creation of professional teams in charge of the plan management and notably the monitoring and evaluation, which comprises the training of required specialists, well internal to the system or external experts

b. The creation and IMPLEMENTATION OF THE INFORMATION SYSTEM on the science, technology and innovation, which implies the definition of the framework of indicators, the data sources and methodologies and mechanisms of collection, as well as the setting in place of data bases and their accessibility.

c. The ACTION PLAN MONITORING in compliance with the « Logic Framework » will be produced continuously, resulting in an annual report on monitoring, as already indicated in the document of the STI policy of the Government of Burundi, and it will notably target the more remarkable spreads of actions in relation with the plan and the budget planned, as well as the effectiveness of the functioning of devices of coordination and management of the plan.

d. The EVALUATION OF THE ACTION PLAN AND STRATEGY to undertake in the medium term and at the end of the established planning period. The result to produce is different in each of the two types of evaluation reports: 1) the medium term report (2-3 years) will notably target the identification of the effects of political choices on the results achieved, as the training of new researchers, scientific publications, deposited patents, the creation of networks and the collaboration between the

university and the industry, 2) the report at the completion of the plan of 4-5 years should focus on the effects of all considered strategic measures, notably the consolidation of research groups/units, the functioning of developed institutions or infrastructures and the impacts in the economic sectors and civil society, as well as the exploration of the better practices in research, the innovation and management which will contribute for the future improvement of policies on science and innovation.

It is important to note that the long term effect of the STI policies on the structural economic variables such as the qualified job creation or innovative changes in the productive sectors will be appreciated when the STI policies reach a certain level of sustainability. This evaluation of the impact on economy and the society will be then one of the main objectives to consider in relation with the evaluation final report which will have to produce milestones for the review of policies and strategies, as it was reminded here above while talking about ex-ante evaluation of the coming 5 year period.

e. The DISSEMINATION OF RESULTS of monitoring and evaluation will be essentially assured by 1) the creation of a virtual space of the Plan by the DGSTR where there is an access to STI indicators of the system as well as public results of projects and actions funded by the Plan, and 2) the publication of the reports of monitoring and evaluation, whose public presentation by the authorities will be done in the framework of activities of mobilization targeting the actors of research and innovation as well as the public in general.

4. Governance

The draft law governing the Science, technology and Innovation in Burundi stipulates the need to set in place a system of monitoring and evaluation of the quality of the scientific research based on a periodic appreciation both on the resources, programs, and results whose specific aspects of its implementation were be defined by a decree.

The processes of monitoring and evaluation therefore comes under the research policy on research and innovation and the system of governance established, which adopts an approach of centralized management in the Ministry of High Education and Scientific Research (MESRS) through the General Directorate of Science, Technology and Research (DGSTR).

The DGSTR will equipped with an internal management team, the management and monitoring of the STI plan, which will have to count on the external experts in the prioritized scientific areas, as well as a structure for the coordination with the other ministers having competence in science and technology.

The management of MESRS will count on the support of the National Commission for Science, Technology and Innovation (CNSTI), advisory body of consultation with the research actors which will also have the responsibility of prior analysis of methods and evaluation criteria to be set in place.

The recommendations of the CNSTI will also be extensible to the criteria to use in the evaluation of the projects and actions funded by the Plan as well as to conventions established by the Government with public institutions and private entities with a scientific and technological character for their funding. As already said here above, this topic will not be discussed in this document.

For an effective coordination of the process of monitoring and evaluation, the General Directorate of Science , technology and research will cater for :

- Establish necessary agreements with the institutions which assure the information system and periodic production of STI indicators, notably the Institute of Statistics and Economic Studies of Burundi – ISTEEBU ;
- The training and directorate of the team in charge of monitoring of the action plan which will be composed of experts internal to the ministry involved in the management of programs;
- Concerning the evaluation, we will have to generally resort to the external evaluators, experts or

researchers with the experience and autonomy necessary to draft objective evaluation reports. The CNSTI will act as advisory body in the selection of those evaluators, who will implement his mission according to the terms of reference and coordination of the responsible of the DGSTR ;

- Facilitating to the evaluation teams the access to decision makers of the different ministries as well as the implementers and beneficiaries of the actions described in the Plan.

5. Information system STI

As sine qua none condition to reach an analysis of the impacts of STI policies, we must count with an information system likely to help to have a vision of the situation and dynamics of the STI activities in Burundi and a national comparative perspective as well.

We have an immediate need of indicators on:

1. Human resources and R&D investment/expenditures;
2. The results of the research activities (publications, patents) ;
3. The basic macro-economic and sectoral indicators (population, GDP) ;
4. The administrative data in relation with the government budget (research expenditures, investment) and its degree of implementation.

We also need, in the second part of the Plan, to consider systems of data collection notably surveys, indicators targeting:

5. Innovation activities (expenditures in the private sector, new products and enterprises) ;
6. Cooperation in R&D at the national and international levels (projects, networks) ;
7. The penetration of science and technology in the social tissue.

Currently, in Burundi, information and data specifically related to research are limited and resent gaps in terms of quantity, quality and regularity to meet the needs of the users and analysts and must be updated to meet the requirements of new STI policies. Therefore, it will be necessary for the MESRS to create such an information system with qualified human resources, an infrastructure and a budget which assures the production of data and indicators consistent with dimensions of accuracy and timeliness internationally accepted in this regard. The road map to set in place such a system must be determined based on an execution of i- per steps of procedures to collect diverse information evoked before, according to real possibilities.

The MESRS will have to consider the conveyance of this function of the agency of Burundi invested with competence granted by the National Council of Statistical Information, that is the Institute of Statistics and economic Studies in Burundi - ISTEEBU, which is capable of assuring the methodological coherence and stability according to international standards (UNESCO, 2010). We will be able to consider, if necessary, the collaboration with other institutions specialized in economic and scientific information in Burundi with ISTEEBU, in order to expedite the setting in place of critical steps of the information system.

To reach the information on the administrative data and indicators from the research budget, we need to undertake an analysis of the structures of accounts in relation with the STI of the Ministry of Finance and Economic Development Planning to establish an integrated system of STI budget data. Later, a specific survey a posteriori will be conducted among the beneficiaries (university, research centers, etc.) to identify the budgets effectively implemented.

Concerning the definition of indicators of the R&D and innovation process to be used, we are going to follow the approaches of the Frascati Manual (OCDE, 2002) which intends to measure the « inputs » of the R&D,

notably the staff and expenditures of R&D. And in this respect, we propose to immediately begin to build key indicators based on the experience from R&D surveys of African countries, as the ones analyzed by *African Science, Technology and Innovation Indicators Initiative* – ASTII (UA-NEPAD, 2010) whose indicators are presented in following chart (AU-NEPAD, 2010).

Indicators R&D

• Gross domestic expenditure on R&D GERD GERD per million PPP$ capita PPP$ GERD as % of GDP (by financing source and sector of performance: BERD=Business enterprise sector, GOVERD=Government sector, HERD=Higher education sector, PNP=Private non-profit organizations)
• GERD by type of R&D (percentage): Basic research Applied research Experimental research Not elsewhere classified
• R&D personnel by level of formal qualification and occupation, gender, headcount and full-time equivalent R&D personnel Researchers Researchers as a % of R&D personnel Research personnel per million inhabitants Researchers per million inhabitants
• Researchers by gender and field of study/research (headcount and shares of total) Female R&D personnel and researchers Female R&D personnel Female researchers
• Researchers by sector of employment (headcount & percentage shares) Business sector Government sector Higher education sector Private non-profit organizations
• R&D personnel by level of education (headcount & percentage shares) PhD level Theoretically based university studies Other higher education Other
• Researchers by field of science (headcount & percentage shares) Natural Sciences Agricultural Sciences Medicine and Health Engineering and technology Social science Humanities

Source: *African Innovation Outlook 2010* (UA-NEPAD, 2010)

For indicators of the findings of the research, there are a few published documents on the patents and technological balance, as well as criteria on the bibliometrics (OCDE, 2002); it is important to note that some indicators, notably the bibliometrical ones have got an accredited tradition and offer a very good initial vision, in addition to allowing a future analysis, on the research activity (Hanafi & Arvanitis, 2012). We will have to introduce regularly this type of studies and measures in parallel with the development of technical capacity, both in the academic environment and among the ones in charge of managing the STI policy.

An active participation of the Burundian experts in different regional and international initiatives on the STI indicators with different visions, among which we already have examples of very active exchanges (Tumushabe & Mugabe, 2012) will help for its development in the country as well as increasing the level of knowledge and the number of experts who will be necessary, inter alia, for the activities of STI program evaluation.

Concerning the indicators of innovation, we will keep the Oslo Manual (OCDE, 2005), which intends to measure the findings of science and technology through surveys on innovation. The difficulties and costs we need to compare in order to achieve significant results are well known; still, the NEPAD member countries who support the ASTII initiative have agreed to adapt the EU model of surveys on innovation (*Community Innovation Surveys*, CIS) with indicators on innovation of the product, the process, patents, etc. (AU-NEPAD, 2010); an active link with those focus groups are equally commendable.

Given the current characteristics of the STI system in Burundi as well as the real possibilities of accessing information, or the sense of concepts related to innovation in comparison with the ones of more developed countries pose the mostly raised question on the formulation of the Frascati Manual (Gaillard, 2010; OCDE, 2012) in aspects like the use of secondary sources or the differential analysis of STI budgets voted for and granted (in comparison with the ones effectively expended) in order to reach indicators and effective and efficient methods of data collection, which will become a goal for the near future.

There is still other information that can be considered in order to reach an availability of enough data for the objectives that have been mentioned as it is the case with the following ones:

- Inventory of instruments for the STI policy (policy, legal framework, governance and map of the national research system, devices and programs); the GOSPIN model promoted by UNESCO and under preparation by the DGSTR of Burundi offers an effective way of accessing a general vision of STI system and for international comparison.
- Inventory of research capacity, notably the individual profiles of Burundian researchers who can facilitate the identification of collaborators for new projects, the submission of project proposals to the instruments of the STI Plan, etc.

Even if they do not specifically target the monitoring and overview of the Plan, all those information constitute an important part to reach a general overview which serves to supervise the appreciations subject to the monitoring and evaluation model of the Plan and provide necessary milestones for the analysis of its impact.

6. Actions and Logic Framework monitoring

The action plan covers a period of five years 2014-2018 and provides criteria for the implementation of the activities planned according to the guidelines of the STI policy, using the methodology of the Logic Framework.

The Plan presents a summary of the main objectives for each scientific area, the subsequent specific goals, the main activities, the expected results, the directly measurable goals (IOV), the entities responsible of the implementation, the provisional budgets for each year, as well as the correspondences of each activity with the axes and planned strategic measures.

On his side, the responsible or implementer of each activity will have to produce an ACTIVITY CHECKLIST with a more detailed description including an actuation plan, the resources to be used, the deliverable products in each step of the action as well as the users of the planned results and beneficiaries.

The logic framework of the Plan and the production of activity checklist which correspond with the launched and funded activities compose the departure elements for the implementation of the monitoring provisions by the team in charge of monitoring within the DGSTR.

As previously indicated, we do not consider in this document the detailed approaches of monitoring and evaluation of each project or action, which eventually could be set in place by the DGRSIT or the institution in charge. In this case, the monitoring of the action will notably target the scientific or technological aspects as well as the justification of the resources used, according to the specific plans based on the nature of action and the date of activity.

In any case, the responsible of each action will draft their annual reports and will be in charge of describing the state of any incidence or significant change in terms of what has been established in the activity checklist, and send a communication to the person in charge of the DGSTR the relevant area.

The monitoring of the Logic Framework of the Plan will be done at the level of each priority area, based on established indicators (typically IOV or its extensions established in the activity checklist) and will base on the data generated in the monitoring report of each action or individual project.

The PROJECT MONITORING INDICATORS which will be used (CORAF/WECARD, 2009) are designed in order to apply at all levels of the framework of the project:

- indicators « of achievement » concerning the progress of actions or projects, in general measured in terms of physical units;
- indicators « of resources », in monetary units, concerning the budget allotted for each level of action and its annual run in terms of commitment and payments of available funds in comparison with its eligible cost;
- Indicators « of results », representing the direct and immediate effects targeting the measuring of the evolution of the behavior of the direct beneficiaries, normally in units of physical nature.

For the occasion, the people in charge of monitoring the Plan will claim from the people in charge of all actions sufficient information on the development of that action in relation with the projections in the activity checklist and which will be sufficient for the construction of project indicators we have just evoked here above. This information will be produced with an annual frequency within dates indicated by the DGSTR which will mostly be different milestones in the action or project progress.

To establish quality standards of project reports, the DGSTR will also undertake (in general with the experts of each area and sometimes with the support of external experts) the audit of a sample of actions, notably through the reports of the responsible and the interviews in order to establish the state of progress of the project, the human, material and financial means used, the issues and difficulties encountered, as well as the results achieved and impacts observed are imputable to the action. The audit report will be expected to give recommendations for next steps, as it main goal will be to contribute for the preparation of the Plan monitoring annual report.

As an addition to the method of Plan action/ project individual monitoring, the use of SUMMARY INDICATORS for a defined (annual) period will help to obtain, in unequivocal and automatic way quantitative information on the progress of the action plan as well as for each priority action as for the whole of the Plan, which will provide the decision makers a very clear and simple general vision.

To achieve this goal, we are going to build up the first chart with indicators to monitor « the achievement » of each activity. The grouping of all project indicators corresponding with the specific goal or the whole of an area (a weight in percentage proportionate with the significance of the contribution of the project to the achievement of the high level goals, first conveyed to him by the DGSTR and then approved by the CNSTI, in order to facilitate the addition of indicators which correspond with diverse dimensioned projects) will provide an indicator of achievement for a high level group and will help to obtain a quantitative measure of the implementation of the grouping.

The second chart reflecting in an identical structure the indicators of « resources » in monetary aggregates, show the levels of implementation of the provisional budget for each project.

Based on the two charts, we automatically obtain, with a simple division, the levels of efficcacy corresponding with the whole of the program, an area, a specific goal or a project/activity. The summary monitoring indicators are usable for an annual period or for cumulative progress of the action plan.

The use of a system of summary indicators add up the indicators of « achievement » and « resources », by avoiding a double measuring system (physical size of the activity and budget sizes) and help to obtain a collection of comparable indicators of activities and additional indicators which offer a disaggregate or unified vision vis-à-vis the main or specific goals of the Plan.

The annual monitoring report of the action plan produced by the DGSTR will then be composed by the analysis of a series of quantitative and qualitative information produced in a systematic manner, notably:

- Individual monitoring reports produced by the managers of each action;
- The audits of a sample of actions and projects;
- The collection of indicators (achievement, resources used, results) of actions ;
- The summary indicators grouped per specific goals, per area for research priority, including the main action plan monitoring indicator.

In addition to the analysis of the action and project monitoring (progress, spreads, effectiveness) of the action plan, te annual report will introduce the appreciations of the experts on the functioning of the instruments, the management of programs, presenting notably recommendations in terms of introduction of necessary corrections.

7. Evaluation of the Action Plan

A mid-term evaluation of the strategy and action plan 2014-2018 and a final evaluation will be considered, in which we will use quantitative evaluation criteria already mentioned in relation with the plan monitoring, on the effectiveness (progress of the actions of the plan) and the efficiency (progress in comparison with the allotted resources), as well as other qualitative on the relevance of the actions incorporated within the plan, the sustainability and impact obtained in relation with the objectives (Chile, 2003).

The objectives of the evaluation are the acquisition of information in relation with the levels of performance of the results, supplying an analysis of the level of progress of the results, as well as the deviations and incidences and help managers of the plan to make decision concerning the goals and strategies as well as on the management procedures.

These evaluation practices, to be undertaken with the support of experts, will base on the quantitative data (indicators, economic data, bibliometrical studies), the analysis of documentation sources and exploitation of the data base, the conducting of interviews open and focused on actors of the STI systems and the case study and good practices.

7.1. Methodologial Approach

The evaluation of the implementation of STI policies will essentially intend to facilitate the Government of Burundi as well as the national or international institutions which co-finance the research actions, a knowledge strictly close to the level of compliance of the expected results with the intended goals, in order to put the funding bodies in better conditions to appreciate the effects and consequences of any type of actions and funded projects on their beneficiaries and target groups as well as on their institutional and territorial environments; all this in the framework of strategies and policies of science, technology and innovation in Burundi.

Under this premise, the evaluation must be able to observe, document and analyze the extent of progress of the results, the incidents and the technical and financial discrepancies, which take place over a given period, but also verify the functioning of the procedures established management and coordination units of the plan set in place, the degree of participation reached and the commitments agreed with the actors and national implementing entities, the appearance of unexpected effects and the materialization of factors of risk attributable or non attributable to the implementation of evaluated actions.

Therefore, the ultimate purpose and the greater use of the evaluation process will be to supply reliable and useful for the outcropping of the lessons and facilitate the decision making on its future continuity, as well as on the changes and adaptations of the goals, strategies and work methodologies and organization.

Taking into account very diversified characteristics of actions that are part of the Plan and the heterogeneous nature of information to be collected and analyzed (number of projects, expenditures, opinions on the stakeholders). The evaluation must be based on a multi-method approach, capable to use and combine quality, quantitative methods and techniques, and the use of techniques and research tools adapted to the specific needs and thematic content of the priority areas.

It will then necessary to count with analytical methods documentation sources, the exploitation of the data base, the focused and open interviews or case studies, which must count with the support of a well defined framework of criteria of evaluation.

7.2. Criteria of Evaluation

The evaluation method will base on the criteria of efficiency, effectiveness, relevance, impact and sustainability, described for continuation.

The EFFECTIVENESS can be defined as a degree at which interventions, over a given period of time and no matter what costs are involved, are achieved. The effectiveness of achievement is then a measure of the capacity of the implementation of the action planned compared with the goals initially established and given the time actually available for this implementation. Consequently, it is clear that the quantification of the effectiveness of achievement will only be possible if there is a prior estimate of the goals.

The estimation of the effectiveness will be done thanks to the use of indicators included in the logic framework. All along the documentation analysis, the evaluation team will analyze the relevance of the defined indicators (notably the IOV and others included in the activity checklist), as well as the coherence and precision of the defined goals. This will lead to a proposal of new indicators more compliant with the needs and the workflows of information available for the monitoring purpose.

The EFFICIENCY is conceptualized as an optimization of financial and human issues implemented to reach a result. It is measured as comparison between the achieved results and the resources used in order to be able to conclude on the degree of adequacy of resources, results and duration of achievement as well as adequacy of the projections in terms of cost of planned activities.

The evaluation will analyze more closely the level of efficiency in the implementation of the Plan, in the mechanisms of institutional governance and coordination and the modalities of the decision making, management and follow up, the transfer of fund and delays in the launch of projects and actions.

The study of the RELEVANCE of the specific objectives and actions of the logic framework is conducted during the period evaluated to measure the adequacy of the goals and results expected in relation with: 1) Characteristics and evolution of the socio-economic context, 2) needs of scientific, technological and production development of the priority areas as well as the STI strategies and policies.

The relation between the goals and actions, on one hand, and the characteristics of the socio-economic context, on the other, will essentially be established by exercising a comparison between the actions and indicators of the context or other quality estimations of the current needs.

Given that the relevance is not open to precise measures as in the case of effectiveness or efficiency, the comparison must be combined with the achievement of qualitative interviews with the managers of institutions or actions to deepen the study on the implementation of policies.

The IMPACT analysis intends for the estimation of the effects of medium and long term actions. In this regard, the impact produced by the action or plan is analyzed through appreciation of sustainable effects, expected or unexpected, positive or negative and the strategic consequences derived from actions on the institutions, the enterprises or researchers involved in the scenarios where the actions are developed. It is a question of evaluating if the effects registered are oriented to be in line with the adopted goals and strategy.

The impact analysis will have different levels, notably: 1) of the implementation of the STI strategies and policies; which is notably important at the end of the planning period, 2) participant institutions and improvement of research and management capacities of technologies, 3) users, enterprises and civil society and the increase of innovative and productive capacities, 4) of researchers and individual beneficiaries and improvement of the levels of training and specialization.

Based on the effects obtained and the strategic consequences produced by the action plan, we will have to analyze the emergence of the external and internal conditioning, notably in what concerns funding sources, which facilitate and give assurance to future SUSTAINABILITY of actions and evolution of the plan.

The identification and use of the case study on successful stories and good practices become a component of the evaluation, in particular in terms of comparison in the regional or international context, which can contribute to analyze the STI sustainability.

Logic framework – Activity checklist (example) to be completed by the research and innovation centers

KEY AREA:	*Agri-food*
STRATEGIC AXIS:	*2- Establishing a system for governance and infrastructures*
	3- Promouvoir le transfert de connaissances à l'entreprise et la société civile
STRATEGIC GOAL :	*Agri-pastoral integration*
ACTIVITY :	***Setting in place a system of monitoring, control and fight against epidemics and pet animals' diseases***
CODE :	1H1B
RESPONSIBLES :	*IRAZ (100%)*
MINISTRIES / PLANS	*Minagri / PN*IA
COOPERATION	
REG. /INTERN.	European *Commission*
DESCRIPTION AND PLAN	
ACTUATION (WORK-	
PACKAGES, TASKS) :	*Definition of goals and structures, operational rules, incorporation of members, implementation of the action plan. Planned dates*
RESOURCES	
(HUMAN,	
EQUIPMENT, ETC.)	*1 researcher (50%), 3 technicians (30%)*
RESULT :	*A national network of epidemic surveillance established*
INDICATORS (IOV) :	*System of coordination and management, n° of key points and members of the network, services achieved, nº beneficiaries*
USERS / BENE-	
FICIARIES PLANNED IN THE	*XXX farmers of the regions M, N, P*
BUDGET (SOURCE,	
TIME) :	*Minagrie : X (2014), Y (2015), Z (2016), T (Total)*

7.3. Results of the Plan Evaluation

The main results expected from the evaluation are related to the following items:

A. Contribution of the plan actions already achieved, under implementation process as planned in future to achieve goals and intends defined in the logic framework. This result is directely associated with the efficiency analysis. There will then be 1) a consideration of physical achievements and analysis of findings, which means changes generated on the side of beneficiaries of the action after its completion. The essential methodological tool will here be the analysis of documents and progress report of each action.

   The analysis will be done at the level of the individual actions and at the level of areas. Also, we will be able to produce a summary of findings grouped at the level of strategic measures, for instance, the creation of research units.

B. The identification of the actions which have been achieved in the framework of the plan, but which were not planned in its initial design, or which has been drafted in general terms, thanks to their contribution for the goals, i.e., the identification and evaluation of the external effects generated by the plan.

   As the appreciation of these effects will generally be qualitative, the document analysis will not suffice; it will be adjoined by interviews with responsible and beneficiaries of the action.

C. The evaluation of the changes that occurred in the framework of the Plan, in particular what concerns the strategic policies and priorities as well as its effect in the logic framework.

   This aspect is attached to the analysis of the relevance of the Plan, then, we must check the adequacy of the goals and the results intended for the context situation as well the STI and economic policies. In general, those changes will be included in the monitoring reports which would suffice as documentation source for the analysis.

D. The evaluation of the coherence between the goals of the logic framework and the operational design and mechanisms of the implementation and plan management.

   The analysis of the process logic framework preparation and notably the level of participation of the STI actors in the formulation, analysis of the structures of governance and coordination of the Plan, as well as the quality of the process to launch the Plan (the publication, definition of devices to call for proposals and conventions with research institutions) will provide a key information on the content of the Plan's intent and the operational mechanisms.

E. Identification of the discrepancies between the timeline in the instruments for the plan management and the one of implementation of actions and projects, as well as the analysis of causes source of those discrepancies.

   Most often, the discrepancies will be due to the capacity of the implementing agencies, as well as the delays of funding for instance, then, it will just be a question of deeply analyzing the interviews and the case study to reach the result.

F. Identification of unexpected issues and incidences, the response provided to those contingencies and the analysis of its effects and consequences.

   We need that the evaluators focus those issues and factors, very often from institutional origin, in order to provide recommendations adequate related.

G. The evaluation of the relevance of indicators established in the logic framework (IOV), and its corresponding means of verification, to explain the proposed objectives.

   The review of indicators at the level of actions and also the specific objectives or areas will be completed at the level of strategic measures. At the same time, new indicators or changes can be considered in comparison with the ones existing with theire respective verification means.

H. Evaluation of the adequacy of the governance plan, functionality of structures set in place, the financial control and mechanisms of transfer of resources, vis-à-vis the strategic objectives and planning.

   The quality of the model of monitoring and evaluation as well as the capacity of rapid collection of information (periodical reports, communication of incidences) is united with the knowledge and direct contact with the institutions and researchers. The regular use of data bases and of a virtual environment will offer an efficient support.

I. Evaluation of the experience and lessons acquired in terms of functioning both at the level of the Action Plan vis-à-vis the whole of initiatives of science and technology implemented by the Government of Burundi.

The reports of evaluation will have to obtain conclusions of specific validity for each priority area and strategy axes; they must come up with common conclusions for the functions of horizontal applications which appear in the strategy and in addition to one of the areas of the plan, such as the funding of projects, the scientific publication, the systems of support for innovation or capacity building.

The medium term and plan end report, based on a multiple, descriptive, appreciation, and critical approach, with the identification of elements indicating the success or failure in a given action will analyze, based on the indicated criteria, the expected or unexpected effects, the changes or issues occurred, as well as the consideration of indicators and mechanisms of monitoring and evaluation.

In summary, we propose that the mid-term and final evaluation reports, give a synthesis of the conclusions and recommendations on:

- The initial intent of the strategy and the planned or existing devices;
- The logic framework (Action Plan), the Information System STI and indicators;
- The model of governance including the coordination, the model of monitoring and evaluation, mechanisms of administration/transfer of financial resources and publications;
- The case studies and comparisons and benchmarking
- The contribution of the Plan to improve and advance research and innovation in Burundi.

8. Publication of findings

First of all, data collection is one of the elementary steps of the evaluation process. We have discussed in this document about the aspects related to the formal and systematic collection of data, the economic structure, research and innovation; also the data on which the model of monitoring and evaluation and the action plan evaluation will base.

Once the regularity in the basic data collection is established, we will have to undertake the definition of indicators and data collection on other strategic axes such as international cooperation or scientific publication. The use of brief questionnaires via internet [CORAF/WECARD, 2009; 87], applied to institutions and beneficiaries of the STI policies will allow consolidating the data bases for the achievement of an analysis and introduce innovations.

As previously said, the development of virtual space for the public access, in dependence with the management center of the plan will allow for the successive incorporation of the data bases as well as tools supporting for the dissemination of information and participation of researchers and agents of the civil society in the science and technology.

The contents and results of the policies and actions of the Plan shall benefit from this type of virtual structure, notably with the purpose of creating virtual communities and communication of the new developments of the plan as follows:

- **Monitoring/Evaluation**

Data base for indicators

Monitoring report

Plan evaluation report

- **Projects' funding**

National, regional and international competitive funds

Call for proposals of projects

Project evaluation actions

Projects under implementation

Reports of the projects' results

Available technologies / skills

- **Publications and documentation**

Technical and scientific documents

Promotion documents/articles

- **Training**

Training course and workshops

Training materials

- **Communication**

New projects and programs

Events' report

Articles published in press, press stories

Cooperation missions

The setting in place of such a space will be done with time, given the introduction of sections always very close to the needs in terms of science, technology and innovation in Burundi.

CHAPTER 5. GENERAL CONCLUSION

The existence of an Action Plan and Strategies of PNRSIT implementation in Burundi marks the beginning of a process which offers lots of opportunities to strengthen the scientific and technological competence. The implementation of this plan and especially of its priority program enormously contributes to the achievement of the aspirations of the Burundian population and requires a well established institutional system or arrangement to achieve the Millennium Development Goals. This will stimulate investments in Research – Development and technological innovation.

In Burundi as elsewhere, science, technology and research are the heart of a real sustainable economic and social development. In order for the Burundian society to benefit from this, it is worth having tools such as the SAP; the Decree governing creation, organization, and functioning of the National Commission for Science, Technology and Innovation (CNSTI) and the law on Science, Technology and Innovation in Burundi. This will allow for a good apprehension of the complex and diversified processes and sustainability of the development that science, technology and innovation offer.

The present document contains the following main priority areas of intervention traced by the PNRSIT:

- Agri-food technologies ;
- Medical science;
- Energy, mine and transport ;
- Water, desertification and environment ;
- Biotechnology and indigenous knowledge ;
- Materials science, Engineering and industries;
- Information and communication technologies, space science and mathematical science;
- Social and human science.

The promotion of Science, Technology and Innovation for the social and economic development of our country requires the involvement of everybody. It must constitute the top priority of the Government. The document also contains the activities to be undertaken for the effective implementation of the PNRSIT. This one is in straight line with the Vision 2025, the Strategic Framework of Growth and Fight against Poverty, 2nd generation (CSLP II). It aligns with the Consolidated Action Plans on Science and Technology in Africa and the Sectoral Plan for the development of Education and Training (PSDEF).

It will contribute for fair, equitable and sustainable social and economic development of the Burundian population. This meets the numerous concerns of the Government of Burundi formulated in its sector based development policies and programs in order to assure future economic prosperity and improvement of the living conditions for the citizens.

The PNRSIT bases on the following specific axes:

- Assuring a coordination and research centered on the development of Burundi by integrating all the institutions and centers involved in the STR, in the same dynamics;
- Valuing the tools available and cover the existing gaps in all sectors in a bid to promote the STR in Burundi;
- Focusing on the resolution of major issues faced by the Burundian population now and in the future;
- Making of the STR a tool for development of the country and local communities.

The action plan and strategies for the implementation of the National policy for Scientific Research and Technological Innovation intends to give clarification to decision makers and guide the scientific world, relevant stakeholders and partners to achieve the intended socio-economic development goals. It is therefore a viable tool and basis to set up innovation and development of science and technology in Burundi.

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ANNEXES

ANNEX 1 : MINISTRY ORDER N° 610/1232 OF JULY 18 , 2012 GOVERNING THE APPOINTMENT OF MEMBERS OF A COMMISSION IN CHARGE OF PREPARING DRAFT ACTION PLANS, STRATEGY AND LAW ON SCIENCE. TECHNOLOGY AND RESEARCH AND THEIR CONTACTS

République du Burundi

Ministère de l'Enseignement Supérieur et de la Recherche Scientifique

Cabinet du Ministre

ORDONNANCE MINISTERIELLE N°....610/1232....DU 13.../07.../2012 PORTANT NOMINATION DES MEMBRES D'UNE COMMISSION CHARGEE DE PREPARER DES PROJETS DE PLAN D'ACTIONS, DE STRATEGIE ET DE LOI SUR LA SCIENCE, LA TECHNOLOGIE ET LA RECHERCHE

LE MINISTRE DE L'ENSEIGNEMENT SUPERIEUR ET DE LA RECHERCHE SCIENTIFIQUE,

Vu la Constitution de la République du Burundi ;

Vu la Loi n° 1/22 du 30 décembre 2011 portant Réorganisation de l'Enseignement Supérieur au Burundi ;

Vu le Décret-Loi n° 1/025 du 13 juillet 1989 portant Réorganisation de l'Enseignement au Burundi tel que modifié à ce jour ;

Vu le Décret n° 100/12 du 10 janvier 2008 portant Création, Organisation et Fonctionnement de la Commission Nationale de l'Enseignement Supérieur au Burundi ;

Vu le Décret n° 100/251 du 03 octobre 2011 portant Réorganisation du Ministère de l'Enseignement Supérieur et Recherche Scientifique ;

Vu le Décret n° 100/08 du 13 septembre 2010 portant Structure, Fonctionnement et Mission du Gouvernement de la République du Burundi ;

Revu l'Ordonnance Ministérielle n° 610.1/1045 du 24 août 2011 portant Nomination des membres d'une Commission chargée de préparer le plan d'actions, de stratégie et de loi sur la science, la technologie et la recherche ;

ORDONNE :

Article1 : Sont nommés membres de la Commission chargée de préparer des projets de plan d'actions, de stratégie et de loi sur la science, la technologie et la recherche :

1. Dr. Jean NDIMUBANDI, Doyen de la Faculté des Sciences Agronomiques à l'Université du Burundi , Président ;
2. Dr. Tatien MASHARABU, Directeur Général de la Science, la Technologie et la Recherche, Vice-Président ;

Bd de l'Uprona – B.P. 1990 Bujumbura -Tél. : 22 22 4524 -Fax 257 228477

3. Monsieur Jovith NGENDAKURIYO, Directeur de la Promotion de la Science, la Technologie et l'Innovation, Secrétaire ;
4. Dr. Mathias BASHAHU, Professeur à l'Université du Burundi, membre ;
5. Monsieur Benjamin SEZIBERA, Directeur de la Recherche Scientifique, membre ;
6. Madame Béatrice KATIMATARE, Conseiller à la Direction de la Recherche Scientifique, membre ;
7. Monsieur Fidèle HABONIMANA, Conseiller à la Direction Générale de la Science,l a Technologie et la Recherche, membre ;
8. Madame Nadine NAHAYO, Conseiller à la Direction Générale de la Science, la Technologie et la Recherche, membre ;
9. Madame Espérance NDAYIZIGIYE, Conseiller à la Direction de la Promotion de la Science, la Technologie et l'Innovation, membre ;
10. Monsieur Emmanuel NGENDAKUMANA, Conseiller à la Direction de la Recherche Scientifique, membre ;

Article2 : Toutes dispositions antérieures contraires à la présente Ordonnance Ministérielle sont abrogées.

Article 3 : La présente Ordonnance Ministérielle entre en vigueur le jour de sa signature.

Fait à Bujumbura, le 18/7/ 2012

LE MINISTRE DE L'ENSEIGNEMENT SUPERIEUR ET DE LA RECHERCHE SCIENTIFIQUE

Dr. Julien NIMUBONA

ANNEX 2 : EXPERT PANEL

Local Experts

Expert	Tasks
Prof. Balthazar MPAWENAYO University of Burundi	- Energy, wood, water, Desertification and Environnement ; - Biotechnology and indigenous knowledge;
François-Xavier SEZIKEYE, M.A., MSc. Kura Growth Strategies & Prof. Fidèle RURIHOSE University of Burundi	- Material Science, Engineering and Industries; - Energy, Mines and Transport ; - Information and Communication Technologies, Space Science and Mathematics.
Dr. Jean NDIMUBANDI University of Burundi	- Agri-food technologies; - Social and Human Science
Dr. Prosper NIYONGABO National Institute for Public Health	- Medical Sience

International Expert UNESCO-Paris

Arturo MENENDEZ ABELLA

ANNEX 3 : EXISTING RESEARCH CENTERS

« UNIVERSITY OF BURUNDI »

Faculty of Arts and Human Science

- CERAM (management)
- CREDSR (reconstruction companies)
- CELAB (languages)

Faculty of Economic and Management Science

- CURDES (research and development)

Faculty of Agronomy and Bio-Engineering

- CERDA (Agronomic development)
- CERTA Agri-food technology)
- CURPEL (Low sale livestock)
- CRISA (High Institute for Agriculture)

Faculty of Sience

- CRUPHAMET (Codex and traditional medicine)
- CURDIF (Computering)
- CRUST (Soil science)
- CURBA (Applied Biology)
- CRUEA (Alternative energy)
- CRDS (didactics)

Faculty of Medicine

- CEFORMI (Infectious diseases)
- CURSAP (Public Health)
- CNR (AIDS Reference)
- CURMES (medecine)

Faculty of Psychology and Education Science

- CRIDIS (Individual development)

MULTIDISCIPLINARY

- CRUME (environment)

UNIVERSITY OF NGOZI

Faculty of Agronomic Science

- CERADER (selected seeds)

OTHERSS

- ISABU
- IRAZ
- CNTA
- INSP
- IRRI
- IGEBU
- SETIC