UNIVERSIDAD MAYOR DE SAN SIMÓN
VICERRECTORADO
DIRECCIÓN DE INVESTIGACIÓN CIENTÍFICA Y TECNOLOGICA

Concept note

For Research Cooperation between UMSS and SIDA

2013 - 2017

DICyT's Team
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CONTENTS

1. INTRODUCTION

This document has been prepared by Universidad Mayor de San Simón (UMSS) in response to the letter of invitation to submit a concept note for the period 2013-2017 received from the Swedish International Development Cooperation Agency (SIDA).

The document outlines the main areas of co-operation that UMSS foresees for the next agreement period, based on the aims and objectives for research defined by the institution, considering the objectives set by SIDA for continuing support to research capacity building and, most importantly, focusing on the national and regional requirements for development.

Bolivia has experienced some stability and economic growth in the last five years; nevertheless, the sharp contrast in performance remains between a low-productivity sector, accountable for 83 percent of employment but only for 25 percent of GDP and a high-productivity sector contributing with 65 percent of GDP and only 9 percent of employment[1]. The social situation has shown some improvement in this period, especially in terms of access to electricity and sanitary services. However, the level of extreme poverty remains high striking as many as 38 percent of households in 2007, according to the latest available data.

The government of Evo Morales (first ruling period started in January 2006 and reelected in December, 2009) is leading an ambitious agenda of economic, social and political changes. These are expressed in at least two official documents: The National Development Plan for 2006-2011 and the new Political Constitution.

The National Development Plan (NDP) for 2006-2011 sets the foremost aim of: "well living" (or "wellbeing") as the foundation for the new paradigm of development which is structured based on four policy areas: *dignity*, so as to eradicate poverty and inequality; *democracy*, so as to create an inclusive pluri-national and socio-communitarian Estate; *productivity*, aimed at a thorough transformation and diversification of the productive matrix; and *sovereignty*, which intends to build up an independent, self-determined Estate in the international arena.

The NDP, is explicit in acknowledging science, technology and innovation (STI) as a key instruments for promoting development across all sectors of the Bolivian economy, thus playing a significant role in all four policy areas that make up the official strategy for development as described in this document.

The new Political Constitution of the State (2009), which is one of the major accomplishments of Evo Morales' first ruling period, includes a special section on Science, Technology and Research and declares that "*The Estate guarantees the development of scientific, technical and technological research for the benefit of all. (…)* " (article 103th, first paragraph).

All of the above shows that the social and economic conditions in Bolivia need to be improved, that the government is committed to inducing deep transformation processes in the economy and in society at large, that the development of science, technology and innovation is among the highest functions of the Estate, while simultaneously recognizing STI, as provided in the NDP drafted by the current government, as a key resource to boost the social and economic development of the country. Several factors converge to establish a fertile ground achieve the maximum social value out of research endeavors: the commitment of the Pluri-national Estate to eradicate poverty, the increased

[1] Weisbrot, Ray and Johnston, *Bolivia: La economía bajo el gobierno de Morales* in Ensayos de Economía Nº 36, June, 2010.

availability of local resources coming from the Direct Hydrocarbon Tax (Impuesto Directo a los Hidrocarburos, IDH) and the decision of SIDA and other funding agencies to continue cooperating with UMSS.

Without any doubts, UMSS has the challenge and conditions to enhance further its research capacities focusing on priority areas in order to meaningfully contribute to development and wellbeing in Cochabamba and Bolivia, and in doing so fulfilling its mission.

It is expected that the following sections provide a solid basis aim at a new agreement program for research cooperation between UMSS and SIDA to contribute significantly to poverty reduction and development of Bolivia.

2. BACKGROUND

2.1. Higher education: country perspective

In Bolivia, the following institutions provide education in Universities: 11 National Autonomic Universities, 4 universities under a especial regimen within CEUB[2] that, on the whole, constitute The System of the Bolivian Universities, 3 Native Universities and 39 private universities (the last under tuition of the Ministry of Education), being a total of 58 universities[3]. The total number of students for undergraduate studies for 2005 was 324.985 students; 76 % of these students correspond to the Universities of SUB and 24 % to private universities. The public universities in La Paz (UMSA), Cochabamba (UMSS) and Santa Cruz (UAGRM) oar the largest in terms in the number of students for undergraduate and postgraduate studies.

Graduate education is offered by both public and private universities in a wide range of disciplines consisting mainly in professional, master (very few are research oriented) and specialization programs. The number of programs offered has increased tremendously over the years; by 2004 it was estimated that the universities at SUB offered 112 master programs, 54 specialization programs and 3 doctoral programs with an overall enrollment of 6.129 students.

It should be noted that doctoral training programs have been offered at some of the public universities and at private universities as well, even though there is no research capacity to support this kind of training. Since 2009, Bolivia's Vice President is leading the Program COUNIT (University Cooperation and Specialized Technical Training), with financial support from the Spanish cooperation, which consists of a training program on research management and four doctoral training programs in the following areas: a) forestry systems and wood products, b) natural resources and environment, c) hydrology and water management, d) textile and paper. Involved in this initiative are the Vice Ministry for Higher Education, the Vice Ministry for Science and Technology, the Plurinational School for Public Management, the Executive Committee of the Bolivian University (CEUB), the National Association of Private Universities and four public universities (UMSA, UMSS, UTO and UAGR). Some 120 students are enrolled in these doctoral programs. There is some concern as to where the research activities will be conducted.

[2] CEUB: Executive Committee of the Bolivian University. Institution that represents to the Universities that conform the System of the Bolivian Universities, i.e. SUB in Spanish.

[3] According to the Low in Education No. 070, given on December 20th of 2010, higher education corresponds to: a) Education of teachers, b) Education on Technics and Technology, c) Artistic education, d) Education at Universities.

Historically Bolivia has lacked a national accrediting body and quality assurance regulations to uphold quality and standards in universities both at undergraduate and graduate levels. Law 3009 passed in 2005, which creates the National Council for Accreditation of Higher Education (CONAES), was never put into force. The new Constitution mandates that the entire educational system is subject to monitoring, measurement, evaluation and accreditation of educational quality; all of which shall be performed by an independent, specialized public institution (Article 89º). The recently passed Education Law 070 creates the Plurinational Agency for Evaluation and Accreditation of the University Higher Education (APEAESU) as a decentralized entity to be regulated by a supreme decree (Article 68º). This instrument is yet to be drafted.

In the past years, the CEUB and the Vice Ministry for Higher Education (each on its own account) have been assisted by institutions in the region to implement evaluation and accreditation processes. Public universities have had most of their experiences of evaluation and accreditation focused on undergraduate programs under the Experimental Mechanism for Accreditation for countries belonging to MERCOSUR (MEXA-MERCOSUR). Private universities, both the institutions and their academic programs, are required to satisfy basic minimum standards of quality before they start operating. The fulfillment of these standards is evaluated and accredited with the assistance of regional institutions as determined by the Vice Ministry for Higher Education.

In 2008, by means of a Ministerial Resolution, a transitory mechanism (the National Commission for Accreditation of undergraduate programs, CNACU) has been created under the tuition of the Ministry of Education to carry out the accreditation processes under the ARCUSUR system that now replaces MEXA.

As to the graduate programs offered in Bolivia, these have not been required to meet any standards to ensure quality. In addition, there have been very few linkages between graduate training offered by graduate schools and research centers. The end result of this situation is the uneven quality and doubtful social relevance of graduate education and, at the same time, the underutilization of the resources available at research centers.

2.2. Research: country perspective

Scientific and technological research is conducted mainly at public universities. In Bolivia some 200 research centers have been reported out of which around 80% are run by public universities, especially the ones of La Paz, Cochabamba and Santa Cruz. These institutions and research units are very diverse in size and capacity; many are very small and poorly resourced.

During the term in office of president Evo Morales, some policies have been approved to promote national development by enhancing the generation and use of science and technology as well as by revitalizing indigenous lore and ancestral knowledge. Some initiatives have been launched in the energy and agriculture sectors, with results that are yet to become apparent. Meanwhile the bulk of research activity continues to be concentrated in public universities, some of which are carried out under coordination schemes with government organizations.

The scientific community in Bolivia is small but has experienced some growth. By 2001 there were around 1.250 scientists working in R+D (i.e. Research and Technological Development), that is 1.050[4] in full time equivalent (FTE). In 2009 the number of scientists was 1.479, this is 680 FTE and 799

[4] Data taken from RICyT, i.e. Indicators Network on Science and Technology in Ibero-American countries.

partial time researchers[5]. Most of the researchers work in public universities, with the highest concentrations at UMSA in La Paz and UMSS in Cochabamba; a modest percentage of the researchers have been awarded a masters degree and very few hold a PhD degree. The density of scientists in Bolivia is low. In 2001 there were 148 scientists per million inhabitants while at same year Argentina had 711, Perú 229 and the United States 4.103 scientists per million inhabitants. The agenda of actions that remains to be undertaken in order to improve the quantity, quality and productivity of researchers in Bolivia is very extensive.

The Vice Ministry for Science and Technology has implemented some initiatives oriented towards the constitution of the national system of innovation; a number of workshops with universities on STI indicators, national S&T potential among many others have been organized. UMSS has actively participated in these initiatives. Some of the DICyT's and UMSS' researchers/lecturers have been supporting the Vice Ministry in these activities as well as in areas related to innovation (leather clusters and business incubators).

Traditionally, S&T activities in Bolivia have been financed mainly by international cooperation agencies. The National funding for R&D in Bolivia has been poor, contrasting to the official declarations. Research activities have not been a priority at country and institutional levels, especially when competing with other important sectors for the always scarce domestic resources available at the Treasury. So, for many years, public universities' funds (coming from the National Treasury), have covered primarily the salaries for staff and some infrastructure. It has been only with the enforcement of supreme decrees 28223 and 28421 passed in October 2005 that public universities benefit with a share of the IDH collected by the government, which, by same mandate, must be allocated to the provision of academic and scientific infrastructure and facilities, as well as to finance STI activities and projects. So, currently, the sources of funding for research in Bolivia are the allocation from the central government to public universities, the international cooperation and the share of the IDH allocated to this end by the mandate of the law.

2.3. UMSS: Institutional background

Undergraduate and graduate education

Universidad Mayor de San Simón (UMSS), founded in 1832 and located in the City of Cochabamba, is part of the System of the Bolivian University (SUB) and is the second largest university in Bolivia in terms of student population. In 2010, the undergraduate enrollment was 57.522 students.

UMSS' main activities are focused on undergraduate education. Teaching activities are spread over a range of about 82 undergraduate courses offered by eleven faculties and one technical school.

Graduate training is also offered. Graduate education is regulated by means of the *Regulations for the Graduate School* (version revised on November, 2010). According to this document the Graduate School is an academic entity which comprises:

- The Governing Council for Graduate Studies chaired by the Vice-rector and composed by the heads of the four university directorates, including the Directorate for Research (DICyT) and representatives of the University Council. This body is vested with consultative, advisory and decision-making capabilities;

[5] Data by the Ministry of Science and Technology "Scientific and technological Bolivian potential 2009"

- the Academic Committee of the Graduate School chaired by the head of the Graduate School and constituted by the heads of the graduate offices. This instance is in charge of decisions concerning authorization of graduate programs, issuing guidelines for drafting graduate programs documents, of promoting evaluation and accreditation of graduate programs in coordination with the University Directorate for Evaluation and Accreditation (DUEA);
- the Directorate of the Graduate School, which is an administrative office in charge of the management, planning, coordination, monitoring and evaluation of the graduate programs implemented by the graduate offices of faculties and centers;
- graduate offices of faculties and centers are responsible of the design and implementation of graduate programs previously approved by the Academic Committee. The heads of these offices are part of the Academic Committee.

Graduate programs, mostly specialization and master programs, are primarily oriented at training professionals for the local and national markets. Students are usually people already in the labor market wishing to improve their skills in order to enhance their performance at their jobs and/or increase their chances when competing in the labor market. Unlike under-graduate education, which is fully funded by the government, graduate training requires students to pay for their full tuition. Only graduate programs (research based) implemented with the support of international cooperation offer scholarships or some other special treatment.

The supply of graduate training programs has increased considerably over time. By 2000 some 23 masters programs, 23 specialization and 1 PhD were implemented (total 47 programs), with an overall enrollment of 600 students. During 2010-2011 the number of master programs in progress rose to 51 and the specialization courses were 11 respectively (and also 101 *diplomados*[6]). The enrollment figures reported for 2010 are 493 students in the master programs, 129 students in specialization courses and 1.423 in *diplomados.* It has to be noted that the PhD program has been discontinued. Currently, a joint initiative between CESU (University Center for Higher Studies) and the Faculty of Technology is the doctoral program on energy with a strong professional orientation (similar to the professional master). Difficulties are expected to arise at the research stage since it is foreseen that there is not institutional capacity to support doctoral thesis.

Despite the fact that it is clearly provided, in reality, quality assurance standards and mechanisms for graduate education have not been designed nor established at UMSS. It is not surprising, therefore, that graduate programs are entirely relieved from having to undergo evaluation and accreditation processes. No question that in this essential area of institutional development everything remains yet to be done and, therefore, it is vital that UMSS starts by setting an agenda of key interventions.

Research activities

Research is one of the three core functions of UMSS, together with education (training of professionals) and (community) outreach. The development of capacities for research at UMSS has been historically associated to international cooperation. These links have allowed the creation of scientific competences and physical infrastructure as well as the acquisition of scientific equipment. Yet, the absence of institutional strategies and priorities to support research resulted in a scattered landscape of research at UMSS and, to some extent, a loss in efficiency and/or effectiveness of the initiatives undertaken in the area.

[6] This is a Diploma that students are awarded at the conclusion of their studies. These *Diplomados* consist in a series of courses comprising a total of 800 academic hours equivalent to 20 credits. The diploma does not confer an academic degree.

In the last decade, the most prominent cooperating organizations came from Sweden, Belgium, Holland, Switzerland, Germany, Spain and Canada. As well as some international organizations such as CYTED, FAO, OEA, WB and non- governmental organizations engaged into cooperation schemes with UMSS counterparts. The most relevant international agreements in support for research that are currently being implemented are with Sweden (SIDA) and with Belgium (CIUF), this one concluding by 2013. Other important cooperation programs, not as sizeable but likely to be extended in the future, have been signed with the European Union, ONU, Italy and the United States, among others.

Research has received special institutional attention since -in December, 2000- the first cooperation agreement with Sida was signed to support the development of research at UMSS. Throughout this period, Swedish resources have been allocated to strengthen research management capabilities at the Directorate for Scientific and Technological Research (DICyT) and to the strengthen the scientific competence of selected research centers by providing high-quality training of researchers at PhD and masters levels, by enhancing research facilities of the selected centers and by funding research activities and projects at said centers. In addition from 2003 onwards, Sida provided financial resources to initiate the Research Fund that made funding available, on a competitive basis, for research-related activities to all the scientific community at UMSS. In 2008 additional initiatives were supported in the areas of ICT and library development and innovation.

The overall impact of this cooperation program on the development of research at UMSS has been very significant. Before 2000, the main features of research were *heterogeneity*, in terms of uneven support to research units and the number and quality of projects undertaken, *volunteering-like*, since projects undertaken came from individual initiatives, *disarticulated*, for each research unit sets its own objectives on its own or, sometimes, coordinating with their partners, and *precarious*, since research units without sustainable conditions appeared and vanished and, often, researchers were not granted any job stability. These conditions were the consequence of a lack of institutional policies for promoting research.

Thanks to Sida cooperation it became possible to work out an institution-wide research policy document, the *Plan of Action for the development of Research,* which, along the years, has been gradually implemented allowing considerable improvements in the quantity and quality of the research community, enhancing a number of research facilities, strengthening the management of research, the overall execution of research activities and creating a positive research environment and culture by the adoption of appropriate routines and practices. It should be noted here the importance of having external advise for the preparation of this Plan and, later on, for the implementation of some specific components.

Within the training component of the cooperation program 20 researchers have completed their training (19 PhD and 1 Master degree). Currently, there are 30 researchers being trained abroad (25 PhD, 2 MSc and 3 Post doc).

There has been a substantial improvement in the quality of research infrastructure and facilities available to researchers, being the most relevant the laboratories for food processing, industrial biotechnology and natural chemistry and, in the last phase, energy, nutrition and non-metallic materials. Social research, although with fewer needs, has also improved access to equipment. Institutional funds, coming from the share of IDH have contributed to make this benefit extensive to other research centers not supported by Swedish funds.

At present, as many other research institutions in Bolivia, UMSS has access to electronic scientific journals from well-known editorials and libraries through the Program for the Enhancement of Research Information (PERI) thanks to the support of Sida.

Finally, the Research Fund supported by Sida has been a most valuable means to further improve research management and the overall research environment at UMSS. DICyT was able to design and implement a procedure for promptly and transparently selecting and financing research proposals following international standards: applying the principle of programming, complying with institutional priorities, open calls and competition, promoting team work and collaborations, subject to external assessment. Likewise, the so called *horizontal program for fomenting research* was designed and implemented, containing a number of grants for scientific events, mobilization of researchers, publication of scientific articles, amongst others, have allowed the offer of further training to researchers and quality improvements of research-related activities within the institution.

To the date, 117 locally selected research projects were carried out (96 concluded and 21 underway), 22 workshops and seminars were organized by the research centers organized, 123 researchers attended international scientific events. In addition grants were awarded for short stays: 13 for UMSS researchers to stay at research centers abroad and 11 for visiting researchers from abroad. Support for publication of 36 books.

The implementation of the described initiatives conferred to research an increasing visibility, strengthened the role and position of DICYT as an indisputable advocate for research within the academic and research community and placed research higher in the institutional development agenda for the coming years.

The above assessment of research shows that UMSS has been able to take advantage of the cooperation schemes thus developing basic capacities for research in terms of scientific expertise, research facilities and management skills. Nevertheless there is still an important way to go in terms of strengthening research capacities before the institution is fully capable of performing quality and socially relevant research as well as to be able to pass useful knowledge on to society.

ICT and libraries

Information and communication technologies have been developed at UMSS thanks to the financial support received from NUFFIC (The Netherlands Organisation for International Cooperation on Higher Education) during the late 1990s and early 2000.

All faculties and administrative offices at the main campus are interconnected through optic fiber and so are the Rector's offices (including the Directorate for Administration and Finances, DAF) and other academic units located at other remote areas (the campuses of the Faculty of Medicine, Biochemistry and Odontology and of Agronomy). There are several intranet services that are gradually being used by the administrative staff, the faculty members and the students.

On the other hand, some academic units are not integrated to the university intranet; these are: the new building of the Graduate School of Economics (located some 15 blocks away from the main campus), the Forestry Technical School, the Veterinary school (located at around 15 Km from the city) and the experimental station at Valle del Sajta (some 140 km from Cochabamba city).

These units are all connected to the Internet backbone. Nevertheless, there is an increasing concern with the bandwidth related to the access to Internet. Given the huge load that the undergraduate students represent, the speed is slow, making it very difficult for faculty members and research staff to obtain benefit from this service.

There are several libraries at UMSS (one central and several facultative ones, mainly for under-graduate students). In general, the organization and services delivered are poor and the material is not updated. Many research centers have small-specialized libraries, few of them well organized. Nevertheless, most of the university libraries can be accessed through the BIBLIOWEB, service of UMSS Web page http://www.umss.edu.bo.

This bibliographic consulting system has been developed during the year 2004 by the DICyT staff following the UNESCO standards. Currently, this is the only Bolivian site linked to the UNESCO Observatory (http://www.unesco.org/ webworld/observatory/). At the same time, DICyT has also conducted a series of training courses for the UMSS' librarians in the use of ISIS.

3. OBJECTIVES

The institutional overall objective of research, as a substantive function of the University, is stated as follows:

> *Research at UMSS is a significant activity aimed primarily at contributing to the regional and national development processes through the generation of useful knowledge and analytical capacity. This activity also intends to contribute to the universal progress of scientific knowledge.*

The general objective established for research springs out of the institutional commitment to make research a true instrument for development. The entire research system ought to be oriented to the solution of problems that make it possible for Bolivians and, with precedence, for Cochabamba residents in urban and rural areas, to have a good life. This means that every undertaking shall tend, as a priority, to find better ways to meet basic needs of the individuals settled in the region and in the country: to eat (with adequate nutrition), having a roof to be sheltered (in a non-degraded environment), access to health care (from prevention to healing) and having opportunities to participate as citizen and to integrally evolve as human beings.

In order for the above objective to be attained, UMSS has set the following specific objectives:

- *High quality research of regional and national interest is carried out by a robust, motivated and highly trained community of scientists; their outcomes are well recognized by their peers at the national and international scientific arena and are routinely passed on to economic and social actors through well-established mechanisms for transfer and innovation.*

- *A science, technology and innovation supportive environment prevails at UMSS assisted by an efficient management system.*

These specific objectives have been established considering the current strengths and also the areas to be further reinforced at the institution in order to best contribute to the national policies for socioeconomic development.

UMSS has carried on important efforts to define priority areas to create capacities on scientific research and development of technology for socioeconomic objectives. From this definition, on one hand it is sought strengthen the existing capacities and on the other to develop capacities on priority areas to achieve the development objectives. For both cases, it is need to create critical masses of researchers.

Given the close convergence of the objectives of research at UMSS, the positive evolution throughout the previous years of the cooperation program with SIDA, the progress yet to be accomplished and the objectives of SIDA with the support to research capacity building in Bolivia, it is expected that SIDA will commit its support to the attainment of the expected results and the plan of action described in the following sections of this document.

4. EXPECTED RESULTS

In general terms, it is expected that during the first five years of the agreement the instruments for the articulation and strengthening of the University Research System should have been generated and consolidated. The following five years should allow all research and management units to be integrated themselves as part of the system playing their designated roles and maintaining clear relationships. By the end of the ten years, the system ought to be running harmoniously with all the constituting parts contributing to the attainment of the main objective.
Ten years:

- Effective incidence of UMSS' research in the achievement of social and economic goals for development
- Research environment at UMSS suitable for the development of research activities
- Highly trained research teams working on prioritized areas produce/adapt useful knowledge and pass the results on to society through well-established channels.
- Quality teaching at master and PhD levels is delivered locally under collaboration schemes with Swedish institutions and other national and international higher education institutions.

Five years:

- A renovated research development plan for 2013-2022 approved and its proposed initiatives are being implemented.
- Research/training/innovation capabilities in 8 prioritized thematic areas have been improved in terms of:
    - Building a critical mass of highly trained research staff: 42 Phd holders trained in Swedish institutions (sandwich model)
    - Upgraded research infrastructure
    - Improved granting mechanisms for undertaking research activities and knowledge transfer (research fund)
    - Local training: at least 15 masters programs designed and implemented at UMSS, applying international quality standards.
- The University Unit for Innovation and Technology Transfer works according to the strategic plan.
- The unit for metrology and maintenance has been set up and is fully operative.
- ICT and internet services fully implemented according to an ICT master plan, an enhanced collection of electronic scientific journals and databases are readily available and accessible to all scientific community and graduate students. Existing channels and continuing communication and information flows amongst researchers, research centers and DICyT. End users are aware and trained in the use of these services.
- Statistical data related to STI at UMSS routinely collected, compiled and communicated according to a well defined methodology.
- The quality assurance and accreditation system for graduate programs thoroughly designed and the local graduate programs supported by SIDA are being planned and delivered in accordance to the standards and regulations established.

- Regulations and procedures related to the constitution, functioning and relations among research and management units are fully designed and gradually adopted
- The research fund is smoothly conveying institutional policies for research into effective support to projects and other relevant STI activities within prioritized programs, applying internationally accepted procedures and standards.
- A redesigned financial management system for the administration of funding coming from international agencies to support research at UMSS operating in an agile, transparent and efficient way.
- The System for Management of Research Projects (SIGESPI) fully operative.

5. ACTION PLAN

The actions proposed for the attainment of each specific objective are described in this section considering the two areas of intervention: a) capacity building and research activities and b) research environment. To a great extent, these intend to give continuity to those components of the previous program that proved to be key factors for the progress achieved and, therefore, are expected to be developed to their best in the coming period. At the same time, it focuses on those areas that are most relevant to foster development and reduce poverty.

5.1. Capacity building in research and posgraduate training

For Objective 1. *The community of scientists highly capacitated, solid and motivated carries on research with quality relevant to regional and national development. Their outcomes are well recognized by their counterparts at the national and international scientific arena, and are routinely passed on to economic and social actors through well-established mechanisms of technological transference and innovation.*

Rationale

In order for UMSS' research to actually fulfill its mission to contribute to the regional and national development processes it is necessary that along with the creation of a favorable environment for research and innovation, the system of research be sourced with highly trained research staff since, ultimately, it is them who are the fabric of which the system is made up. In addition, there should be available scientific facilities, as well as the necessary means for the research projects to be carried out.

Accordingly, considering the existing capacities developed the last years both in terms of staff and facilities, thematic areas that need to be further strengthened have been prioritized so that in a cross sectional manner and applying an interdisciplinary and problem-solving approach, greater incidence can be made on the attainment of socioeconomic objectives established by UMSS. These are:

- Agronomy and Plant biology
- Soil and land
- Integrated management of hydrological resources
- Food technology, Biotechnological and technological processes
- Energy
- Health
- Human settlements and habitat
- Economics and social sciences and humanities

5.1.1. Research and capacity building on agronomy and plant biology

Rationale

UMSS has determined to build research capacities on agronomy and plant biology for its key contribution to conservation and sustainable use of agro-biodiversity. Enhancing the knowledge base on plant genetics, crop protection, plant physiology and nutrition, control of biotic and abiotic factors, climate changes, post-harvest technologies, among others, is vital to develop a sustainable agriculture while ensuring environment protection.

Building capabilities on this thematic area would significantly contribute to food security and sovereignty, which is among the top priorities for the Pluri-national state. The agricultural sector is closely linked to food security. A large portion of the ever-increasing population, especially those who live in rural areas require that at least their basic needs for food and nutrition be guaranteed. Agriculture is an important economic sector in Bolivia for its contribution to employment and to the GDP.

Activities

The objective is to launch a research and training program in collaboration and partnership with UMSA and Swedish partners since the subject can be addressed by coordinated and complementary actions.

Activities within the program include research training (both local and abroad), strengthening of research facilities and execution of research projects. Four research strands will be strengthened; these are:

- Agrobiodiversity
- Plant protection
- Cultivation systems
- Post-harvest technologies

The training component of the program for the next 5 years involves training of 5 doctors (sandwich modality) in Swedish universities on the following disciplines:

- 1 PhD on etnobotanics
- 2 PhD on genetic resources (flora and fauna)
- 2 PhD on cultivation systems (different mentions)
- 2 PhD on Plant health
- 2 PhD on post-harvest technologies

By the end of the first five years of the cooperation agreement with SIDA the following master programs shall be implemented locally in collaboration with the above-mentioned partners:

- Msc on plant protection and environment
- Msc on ecophysiology and conservation of plant diversity

In the next 10 years, it is expected that at least 3 versions of each masters program will be offered.

With regards to research infrastructure, there are some facilities already available especially at the Faculty of Agronomy, although there is much room for improvement. There will be the need to set

up special facilities, both at greenhouse and open field, for quarantine, entomopathogenic breeding, physiology trials, fencing of experimental areas. Participating laboratories and research units that will need to be equipped and/or upgraded are: the laboratories of the Phitotechnic research unit (laboratory for plant protection and laboratory for plant morphology, genetics and physiology), the laboratories of the research unit on fodder and the laboratories of the research unit on biodiversity and genetics.

5.1.2. Research and capacity building on soil and land

Rationale

Soil is a strategic resource in Bolivia since natural resources and ecosystems depend upon it; soil also plays a preponderant role in the socio-economic development of the country. Yet, there is a chronic deficiency of edaphologic and agrologic information; very little is known on the condition of soils, its qualities and related characteristics, the ecological relationship of soil with plants as well as land cultivation practices and land use. This limited knowledge has resulted in inadequate cultivation practices and soil contamination preventing further agricultural use.

UMSS has, comparatively, little research capacities in the area of soil and land, which was disregarded in the last years. Building capabilities in this area is crucial for its potential contribution to enhancing agricultural production and so to the attainment of food security and sovereignty.

Activities

UMSS intends to set up a program on soil and land. The objective of the program is to develop the area of research on soil and land at UMSS by assembling a highly trained research team, engaging in strategic partnerships with other research centers. The aim is to contribute to the generation of edaphologic, pedologic and agrologic information knowledge to be used on planning and intervention processes.

The research strands of the soil and land program that will initially be supported are:

- Characterization and evaluation of soils
- Soil management and conservation
- Soil remediation and rehabilitation

The program strategy is to develop a critical mass of researchers starting with four PhD sandwich training (two PhD on Edaphology, one Phd on soil management and conservation and one Phd on soil remediation, rehabilitation and recovery) at Swedish universities in the next 5 years (different strands). This will be followed by the design of local research training at masters level with the collaboration of Swedish faculty and the participation of other UMSS' research units. Design and implementation of masters level training will be initiated by the end of the 5 year period.

The program also involves the provision of research facilities, such as physical infrastructure (with local funding) as well as equipment and field instruments for the soil laboratory.

5.1.3. Research and capacity building on integrated management of hydrological resources

Rationale

Water is a multidimensional and strategic resource in Bolivia. It is essential to the conservation of life-support ecosystems and biodiversity; it also plays a preponderant role in the well-being and

survival of current and coming generations. Increasing pressures on water resources coming from a variety of human interventions coupled with an insufficient knowledge base and inadequate management policies result in severe problems (growing scarcity and pollution, increasing risk of hazards). Interventions in water systems are necessary to meet the needs of society in the broadest sense.

In the last 10 years UMSS has developed competences for research in hydrological resources, much of these with the contribution of external parties (from Belgium, Spain and others). At the present, there is a pool of competent researchers, facilities and basic equipment, experience in basic and applied research as well as in implementing local research training at master level. Still, there is the need for broadening the thematic orientation of the staff by including/reinforcing competences on specific research areas. Graduate training locally delivered should be improved. Laboratories need to be modernized.

The aim is to consolidate a university research system on hydrological resources working in an integrated, interactive and complementary way on the strategic and most urgent water-related issues.

Activities

In the next 10 years UMSS expects to have developed a critical mass of researchers fully competent to address the management of hydrological resources in an integral manner. Also, UMSS has launched a number of renovated high quality master programs and has upgraded research infrastructure.

The following research strands will be strengthened:

- Water quality
- Watershed management

The planned activities for the next five years include:

- Research staff training to conduct quality research and teaching activities:
    - 2 PhD in integrated management of hydrological resources in Sweden (sandwich modality)
    - 2 PhD in water pollution (water quality and environmental management of water) in Sweden (sandwich modality)
- Local implementation of graduate programs at the beginning of third year: curriculum development and delivery of the masters program.
- Upgrading of laboratory infrastructure and acquisition of additional equipment according to assessment and recommendations.

5.1.4. Research and capacity building on food technology, chemical technology and bioprocessing technology

Rationale

In Bolivia there are important deficiencies in health and nutrition. The technological development has been limited in these areas. Biotechnological and chemical transformations of natural resources into food products, pharmaceuticals, biocides, drug delivery systems and others have made important progress worldwide. The pharmaceutical market of new generations of antibiotics is huge.

Chemical and biotechnological synthesis of these alternatives is opening new areas for research. Bolivia has a vast diversity of natural resources still to be chemically characterized and eventually exploited; to this advantage has been added the scientific capacity created at UMSS' research units in terms of transformation methods and process development using chemical and biotechnological synthesis.

During the previous years of cooperation with SIDA, the research centers on Food, Agroindustrial Technology and Biotechnology have been supported and, as a result, scientific research undertaken at these research units is highly recognized by scientist in other countries. However, the number of researchers and areas of expertise is still insufficient to undertake local graduate training, to meet the demands from society and to efficiently contribute to mitigate the deficiencies in health and nutrition. This is why it is necessary to develop a critical mass of researchers by further training additional doctors at Swedish universities.

Three research units at UMSS will combine scientific efforts to develop the proposed thematic area of research.

- The Food and Natural Products Center (CAPN) is focused on molecular characterization and physical chemistry of food quality-related polysaccharids. It has some facilities for rheological characterization, texture and microstructure of diverse foods. Three researchers and one doctoral student (with SIDA support) make up the research staff.

- The Biotechnology Center (CBT) studies the development of new bioprocesses related to the production of biodegradable plastics, natural moisturizers such as ectoine and bioremediation of contaminated soils. The center facilities include a laboratory, a pilot plant and systems for chemical analysis. Four researchers and one PhD candidate (at Swedish institution) make up the research staff.

- The Center for Agroindustrial Technology (CTA) focuses on processing technologies to obtain essential oils, medicinal active principles, biocides, cosmetics and food applications. Its aim is to add value to vegetal resources in Bolivia. The Center has laboratories for processing, extraction, separation and chemical and structural identification of natural resources. Currently six researchers and two PhD students compose the center's staff under the agreement with SIDA.

Activities

In the next 10 years, the research centers involved in this research area will be leaders in training human resources and the generation of scientific and technological knowledge on chemical and biotechnological transformations and food processing.

The planned activities and outcomes for the next 5 years include:

- Research staff training to conduct quality research and teaching activities:
    - 2 PhD on food technology in Sweden (sandwich modality, different strands))
    - 1 PhD on biotechnology and industrial bioprocessing in Sweden (sandwich modality)
    - 1 PhD on chemical synthesis and hemisynthesis of natural resources in Sweden (sandwich modality)
    - 1 PhD on Biocatalysis in Sweden (sandwhich modality)
- Implementation of local graduate training program:

- Starting year two implementation of a Master program on chemical technology and bioprocessing – strands on food technology, natural products and bioprocessing

- Upgrading of laboratory infrastructure and acquisition of additional equipment according to assessment and recommendations.

- Execution of research projects on the following research strands:
  - Development of bioprocessing and biotechnological products
  - Food technology: food conservation and industrialization
  - Natural products: extraction, separation, structures, synthesis, hemisynthesis and biological activities

5.1.5. Research and capacity building on Energy

Rationale

Increasing electricity access rates both in urban and rural areas is another of the government's priorities as stated in the National Development Plan 2006-2011. Among the strategies to attain this end, generation of electricity through renewable energies is considered. In addition, this policy document proposes the development of a legal body related to the use of renewable energies, fostering the development and exploitation of these resources and so guarantying the energetic independence of the country.

Alternative energies may be generated either by a combination of renewable resources with their respective technologies or by combining renewable with conventional non-renewable resources, such gas resources, all these depending on the intended use.

Bolivia, with its three ecological strata, has a very high potential to develop technologies for the production of renewable and alternative energies. The highlands receive high levels of solar radiation, the valleys have high wind velocities and the lowlands have abundant biomass.

UMSS and UMSA have developed research capacities in the area of renewable energy in the last three years in the framework of a joint training project supported by SIDA. Yet, the area requires important back-up in terms of expertise and facilities before it can produce and transfer useful knowledge and technologies on these alternative energies.

Activities

Within 10 years, the Research Center for Renewable and Alternative Energies has been consolidated and is capable of undertaking research and postgraduate training.

The planned activities and outcomes for the next 5 years include:

- Training of research staff to conduct quality research and teaching activities:
  - 3 PhD on renewable energy different strands (sandwich modality)
  - 2 PhD on nonrenewable energy (sandwich modality)
  - 1 PhD on energy management (sandwich modality)
- Implementation of local graduate training programs:
  - Curriculum development with external institutions and UMSA and, starting year three, delivery of masters program on renewable energies
- Upgrading of laboratory infrastructure and acquisition of additional equipment according to assessment and recommendations.

- Execution of research projects on the following research strands:
    - Alternative energies: renewable and non-renewable environmentally friendly energy.
    - Energetic efficiency and rational use of energy

In order to implement the doctoral training abroad and the local masters program, UMSS will require the technical asistance from an external institution from Sweden or another country with similar experience in the area.

Participating research and academic units are: Department of Physics, Department of Electric and Electronic Engineering, Department of Chemical Engineering, Center for Agroindustrial Technology (CTA), Department of Mechanical Engineering, Program on Energy, Sustainability and Energetic Efficiency (PESEE).

5.1.6. Research and capacity building on Immunity, Nutrition and Human Health in Endemic diseases

Rationale

Infectious diseases affecting the Bolivian population have experienced changes during the last few years. Some diseases are in the process of disappearing while new ones emerge and yet others are reemerging. Research developed by the Medicine Research Institute, IIBISMED in the last 10 years have allowed the disentanglement of many aspects related to the distribution of endemic diseases in the Department of Cochabamba, especially those related with tropical and infectious diseases. Endemic diseases in Cochabamba such as Leishmaniasis and Chagas have been studied focusing on the vector, the infectious agent and the clinical-therapeutic management of affected patients. Likewise, studies have been undertaken on Tuberculosis, focusing on early diagnostic, treatment, monitoring of negative reactions or resistances to the medication. IIBISMED has also made some progress on research on children malnutrition, with best results on immunity in undernourished children and immunonutritional recovery.

Patients affected by Leishmaniasis, Tuberculosis and HIV usually develop important nutritional alterations that may condition the evolution and success of treatment. Yet, this relationship has not been deeply studied in adult populations and it is necessary to document evidences with respect to the relationship between nutritional status, immunologic status and therapeutic response of affected patients. This relationship should be addressed from the point of view of the areas of immunology and molecular biology which will allow the identification of changes at molecular and cellular levels which, in turn, will provide a clear basis to adequate clinical and nutritional handling of detected cases.

Current capacities at UMSS for the development of research in these areas include research centers and laboratories working under the coordination of the facultative institute for research, IIBISMED. These are: The University Center for Tropical Medicine (CUMETROP) with experience in tropical pathology, the Center for Research and Treatment of Tropical Diseases (CIAET) located in the tropical town of Villa Tunari (200 Km away from Cochabamba city); the Laboratories of Molecular Biology and Cellular Biology with experience in applied and basic research and the laboratories of Parasitology and Microbiology.

Activities

Activities and expected results for the next 5 years are:

- 4 PhD holders trained (1 in cellular biology, 1 in molecular biology and 2 in immunology) in Swedish universities (sandwich modality).
- Curriculum development for local master on infectious and non transmissible diseases and starting year three, implementation of the local masters program in collaboration with Swedish counterparts and UMSA.
- 10 short training courses delivered
- Upgrading of laboratory infrastructure and acquisition of additional equipment according to assessment and recommendations.
- Research projects on Leishmaniasis, Tuberculosis and HIV

5.1.7. Research and capacity building on habitat and environment

The metropolitan[7] area of the Department of Cochabamba has become a space in which uncontrolled economic and social forces exercise pressure over land and natural resources and so generate all kinds of negative effects on the human habitat and the natural ecosystems. Increasing pollution and waste left unmanaged, depletion of natural resources, among others, transform the metropolitan area of Cochabamba into an unsafe place for inhabitants and into a threatening presence for the surrounding ecosystems and rural areas. Poor families living in the metropolitan area are the most affected by environmental problems as they have no choice but to settle on those areas presenting highest risks. Socioeconomic inequalities are evident at this spatial dimension.

The departmental Government of Cochabamba has recently drafted the Plan for Territorial Development of the Department 2011-2015. This plan seeks to attain for the region: access to goods, affective and spiritual fulfillment, community balance, harmony with nature. In this context the local territory and its management is the basis on which to build sustainable relationships amongst the different social groups and between society and its environment. One important environmental problem that needs a multidisciplinary approach to be solved is the management of *Rio Rocha*. This river, which runs across the metropolitan area of the Department, has been subject of inadequate use; contamination levels are very high exposing people living in the community to a wide variety of health problems.

Under this comprehensive understanding of territorial management, there is a need to develop and enshrine diverse and complementary scientific disciplines to approach the specific problems related to habitat and environment that territorial management comprises.

There are research units at UMSS which have developed some capabilities. Nevertheless, in order to tackle this broad thematic area, it is necessary to create additional strengths by training human resources and improving research infrastructure. The research units that will be involved in this thematic area are: the Institute for architectural research, the Center for Biodiversity, the Department of Physics, Center for Research on Planning and Management (CEPLAG), the Center for Water and Environmental Sanitation (CASA) and the Center for Spatial Information Technology (CLASS).

Activities

The planned activities and outcomes for the next 5 years include:

- Training of research staff to conduct quality research and teaching activities:
    - 2 PhD on risk management in Sweden (sandwich modality)

[7] So is referred the urban area composed by the city of Cochabamba, the city of Quillacollo and the city of Sacaba which are no longer separated cities but together make up a continuous urban area.

    - 2 PhD on sustainability, planning and urban design in Sweden (sandwich modality)
    - 1 PhD on environmental quality and conservation in Sweden (sandwich modality)
- Implementation of two local graduate training programs:
    - Masters programs curriculum development
    - Starting year three, delivery of masters programs
- Upgrading of laboratory infrastructure and acquisition of additional equipment according to assessment and recommendations.
- Execution of research projects on the following areas of research:
    - Environmental control and prevention
    - Urban transformation
    - Risk management
    - Land use and occupancy
    - Conservation of natural resources

5.1.8. Research and capability building on economic, social and humanities sciences

Rationale

Bolivia is a country affected by several deficits. There are important shortcomings in the economic sphere and significant inadequacies in the systems of justice, democracy, social equity and tolerance. The current government has adopted the approach of unfolding the rich potential the country has to meet these economic and social needs. In the last years, some novel public policies directed towards promoting wellbeing (or well living), have been implemented.

UMSS has already developed some research capacities in economic, social and humanities sciences; some of these with the financial support of SIDA. Nevertheless, given the extensive variety of subjects and approaches that can be addressed by these disciplines, currently these capacities are scattered over a number of sub disciplines, thematic interests and research centers.

UMSS acknowledges the crucial incidence that economic and social sciences may have in the promotion of wellbeing and the attainment of development goals. Therefore, it is an imperative to build strong research teams with solid disciplinary background to work around the key issues for wellbeing to become a reality for the neediest.

Activities

UMSS proposes a two-step process to approach research capacity building in economics, social and humanities sciences consisting in the following:

a) A planning phase in: a) assessing current thematic interests, disciplinary strengths and quality of outputs delivered by researchers in the last 5 years; b) on this basis, establishing preliminary research fields on which to focus existing capacities; c) identifying deficiencies in key thematic/disciplinary areas that need to be addressed d) designing a set of strategies and initiatives to comprehensively support capacity building. The main output will be an assessment and recommendations report that will be used to initiate capacity building in this area. It is expected that recommendations include special management measures to undertake a research capability building program in these areas.

   Among the research units that will participate in this phase are: the Institute for Economic and Social Sciences (IESE), the Research Institute on Social Sciences (INCISO), the University Center for Higher Studies (CESU), the Center for Population Studies (CEP), the Institute for

Anthropological Studies and Museum (INIAM), the Center for Planning and Management (CEPLAG) and the Institute Humanities and Education Sciences.

b) Capability building. Following the phase of assessment and recommendations, and with the agreement of SIDA, UMSS will initiate a special program that will include at least the following activities:

- Training of research staff at PhD level to conduct quality research and teaching activities. At least 5 Phd will be initiated in this agreement period.
- Implementation of local graduate training programs.
- Acquisition and upgrading of relevant equipment according to assessment and recommendations
- Execution of research projects according to assessment and recommendations

It is expected that the first phase will be implemented within the first eight months of the agreement and that capability building will initiate immediately following the receipt of SIDA's approval of the plan of action proposed by UMSS.

In order to undertake this initiative, UMSS will require the technical assistance of external experts and the financial support of SIDA.

5.2. Research environment

For objective 2 - A science, technology and innovation supportive environment prevails at UMSS assisted by an efficient management system.

Rationale
The various initiatives implemented at UMSS under the leadership of DICYT with SIDA funding have allowed considerable progress in building up a research-supportive environment at UMSS.

Yet, there is plenty of room to improve quality of research results and social impact. Many research projects have not produced useful products and/or have not published their results. There continues to be a need to remove organic and bureaucratic hurdles, to improve efficiency in the provision of key services and supporting facilities to research centers and to fully develop institutional capabilities for knowledge and technology transfer as well as to foster innovation in the regional and national innovation systems. The design and implementation of a research quality assurance scheme is also critical in the agenda of actions to be undertaken in the new period of the cooperation with SIDA.
The identified actions are grouped into the following components:

5.2.1. University Unit for Innovation and Technology Transfer

Within the 2007-2010 phase of the cooperation program, UMSS implemented the project INNOVA-UMSS with the assistance of VINNOVA and Blekinge Institute for Technology (BTH). The aim of the project was to strengthen institutional capabilities to participate in innovation processes and networks based on the competences developed and scientific knowledge produced at UMSS.

The project has laid the foundations for the operation, on a pilot basis, of the Unit for Technology Transfer (UTT). Some positive outcomes are: a) a small team of researchers with initial training and competences in innovation issues; b) basic facilities; c) mobilization of the scientific community and research centers at UMSS in the initiatives organized by UTT; d) two clusters, the food cluster and the

leather cluster, assembled with the participation of producers, representatives from the central and local government as well as the municipality.

Considering the above context, the overall goal set by UMSS for the period 2013-2022 is formulated in the following manner: *UMSS develops institutional competences for studying, promoting and actively participating in systems and processes of innovation both at local and national levels. The Unit for Innovation becomes a national reference on theoretical and action oriented research that contributes to the development of systems of innovation in Bolivia.*

Given the positive experience from the previous work, in the coming period UMSS wishes to continue collaboration with Swedish institutions.

For the attainment of the stated objective, the Innovation Unit will initially fulfill at least three functions: a) it becomes the link between the scientific community, producers (sectors and associations), the government (national, departmental and locals) and civil society; b) it provides scientific and technological foresight to provide feedback into the priorities set for research; c) it manages legal issues such as intellectual property rights and contracts.

Other actions that will be executed in the coming five years are:

- Training of 2 PhD at Swedish universities (sandwich modality).
- Design of a masters program on innovation in collaboration with Swedish counterparts, which should be ready to be implemented locally at the beginning of the fourth year of the agreement.
- Enhance the performance of the existing clusters by facilitating opportunities for further collaboration and networking and extend the knowhow to the organization of new clusters with funding coming from non-Swedish sources.
- Reinforcing and expanding relationships with public and private institutions.

5.2.2. Provision of Scientific and Technological Services (STS)

Scientific and Technological Services (STS) cover a mix of activities which collect, store, process, package, and disseminate scientific and technological information or provide other auxiliary services in support of research, experimental development, and technological innovation. UMSS should have a supporting strategy for delivering these services to ensure optimal performance of research units. The following services are expected to be organized and provided in the coming years with the financial support of SIDA and local funding from IDH:

a) Setting up a unit for metrology and maintenance in charge of providing quality testing, instrument calibration, standards application and quality control services to research units and laboratories. Infrastructure will be financed with IDH resources and SIDA funding shall be allocated to acquire equipment and training of technicians. This facility should be fully operative by 2017.

   UMSS will require the advice of a Swedish institution for planning and executing this component.

b) ICT, scientific information and libraries. Improving *ICT infrastructure* and specially Internet bandwidth issues for research centers and researchers so as to ensure good intra-net and Internet connectivity is imperative. As stated above, currently, undergraduate requirements

place a very heavy load on the university network making connectivity unstable and slowing down Internet speed for all users.

This component will start with a diagnostic and a comprehensive master plan for the development of ICT at UMSS as supporting infrastructure of research. Therefore, it will be important that the team in charge of ICT development is clear on the objective of this component: it is intended for research centers and researchers to be able to use ICT facilities and, most importantly, for them and graduate students to get full access to electronic scientific journals and other scientific information.

It is foreseen that the plan will contain actions for improving ICT support infrastructure (such as infrastructure for intranet and internet services, wireless networks, servers, to name a few), training for ICT staff and for researchers in order to enable them in the use of these facilities and services.

Involved in the activities of this component are the Unit for Provision of Information Services (UPSI), the DICyT's Department for Scientific and Technological Information and the Center for Enhancing Mathematics and Informatics (MEMI).

UMSS considers necessary that the ICT Master Plan is worked out with the technical assistance of a Swedish institution.

On the other hand, with respect to *scientific information*, special attention will be given to ensure that researchers at UMSS have access to, and are aware of, the availability of electronic journals as this is how researchers world-wide communicate their findings to the scientific community. In addition, measures will be taken to expand the number of electronic collections of scientific journals available to researchers over the already existing access to scientific journals through the INASP/PERI program.

Library development at faculties will continue to be supported. The goal is to articulate all the documentation centers and small libraries at UMSS into a well-functioning library system that allows permanent access to updated information to the bibliographic material available.

To undertake this endeavor UMSS whishes to have the assistance of an experienced institution that helps in establishing a clear institutional vision of the university library and also in devising the corresponding strategies and agenda of actions.

c) Dissemination and communication of research. DICyT will work out a comprehensive agenda of actions for ensuring the dissemination and communication of scientific and technological information generated at UMSS to different audiences. This will include implementation of web services for publication of research information on web sites, organization of research seminars and other scientific events, edition and publication of a scientific journal and other types of printed material. In addition, communication of relevant information through mass media (TV) will be considered. It may be necessary to consider training some young journalists working at UMSS on science journalism by having them attend a number of short courses abroad.

d) General-purposes data collection and statistical compilation. This activity should be implemented routinely; the frequency, methodology and survey instruments and techniques ought to comply with national and international standards so that data collected is reliable and comparable across the years and with data collections from other institutions and

countries. UMSS would require some small funds from Sida to undertake this on a yearly basis.

5.2.3. Research Fund

The research fund implemented in 2003 with the financial support of SIDA has made a tremendous impact on the scientific life at UMSS. For the first time resources were available to support research priorities defined at institutional level and awarded through a competitive process based on scientific quality and social relevance criteria. This has meant a learning opportunity for policymakers, managers as well as for researchers.

Continuing support to the research fund is considered essential, being the main objectives of its implementation within the new cooperation agreement with SIDA: a) to consolidate and reinforce a research culture at UMSS internalizing management principles and good practices; b) to further stimulate and improve scientific quality and social relevance of research activities undertaken at UMSS; c) to attract and retain researchers trained with the support of SIDA and other cooperating agencies, getting the most benefit for UMSS out of their expertise.

Within this framework, the research fund will be managed by UMSS according to the following:

- ***Competitive funds for research projects***. Research grants will be awarded to research projects aimed at making a contribution to the socioeconomic objectives and relying on the research infrastructure and growing expertise of research staff. Calls will be directed to three categories of research groups based on qualifications and experience of the project leader (i.e. PhD holders, master degree holders, etc.). The amount and conditions of grants to be awarded will differ amongst these categories.

  Research grants will be awarded under a competitive scheme. Projects will be selected, on a two-step cycle, through a peer-reviewed process that will begin with a call for preliminary proposals followed by invitations to submit full proposals to the shortlisted proposals. Preliminary proposals will be assessed by an internal advisory council against scientific merits, societal relevance, feasibility and contribution in building up research capacity at UMSS. Pre-proposals that are deemed appropriate for support will be invited to submit full proposals. At least three external peers and the advisory council will rigorously review these. Grants will be used to pay small equipment, consumables, allowance for field work, local travel (including travel tickets and subsistence) and literature.

  Winner projects will be monitored by DICYT to assess progress and external evaluation will be conducted following standard procedures. Progress will be reported periodically to SIDA.

- ***Funding of post doctoral activities***. Fellowships and grants will be awarded to recently graduated PhD holders, especially those trained under the SIDA cooperation program. For this purpose UMSS will carefully draft and submit to SIDA for approval a document that will clearly specify the activities to be funded as well as the process for awarding these funds, including the evaluation criteria. Among the activities subject to funded will be, at least, research, participation in innovation activities, creation of master courses, lecturing on master courses, workshops for enhancing articles writing skills, books, application to other sources of funding.

- ***Funding of graduate students***. The Research Fund will offer small grants for theses to those students enrolled in graduate programs delivered within the cooperation agreement with Sida. The criteria and conditions will be designed and communicated to SIDA for approval.

- ***Funding of induced projects/activities***. Part of the Research Fund will be used to fund (induce) certain initiatives or projects that may be considered important for the development of research at the institution. UMSS will request SIDA's authorization before using these funds.

- ***Funding of research-related activities***. UMSS will continue to allocate a percentage of the resources to further stimulate participation in research-related activities according to previsions in the *Horizontal Program for Fomenting Research at UMS,* which promotes participation of research staff in scientific communities and internationalization of research, and by means of open calls posted every year. These will include attendance to national or international scientific events (both as participant or lecturer) organization of international and national scientific events by UMSS centers, short training courses or stages at other institutions, translation of research articles for publication in international scientific journals, among the most relevant.

5.2.4. Quality assurance and accreditation of postgraduate programs

Since it is expected that, at some point, locally developed MSc and PhD programs with the support from SIDA will become one of the major components of the future cooperation agreement, it is imperative that, as a pre-condition, a strong system for quality assurance be developed at UMSS to ensure the high quality of these training programs. Succeeding in this endeavor will be a great challenge and a most valuable achievement for the institution, both as a result of the complexity of the commitment as well as of the high academic and social impact it may eventually have.

Given the state of affairs on the subject at national and institutional levels in this regard, UMSS propose developing, at an institutional level, a system for quality assurance for postgraduate research training aligned with the existing national legislation.

It is vital that UMSS receives assistance from external experts with substantial experience on the subject coming from a) a Swedish institution and b) an Ibero-american institution. The following approach is proposed:

- Set up a special task-group, which will be in charge of devising a plan of action for the development of the system for quality assurance of postgraduate research training at UMSS. This group will respond directly to DICyT.

- The task-group should work closely under the advice of the above-mentioned external experts. It should be stressed the importance of having the assistance of a well-connected and experienced expert from the region for it will facilitate both to UMSS and to the Swedish mission the integration into such networks as it is foreseen that the implementation of such system will have to rely, to a considerable extent, on collaborations schemes and/or strategic partnerships that may be needed to establish with institutions and/or key persons in the region.

- There should be a strategy to integrate the devised system for quality assurance of graduate training into the existing institutional graduate framework (School for Graduate Education).

UMSS requires that Sida collaborate to identify a Swedish Institution adequate for this endeavor.

5.2.5. To strengthen the institutional system of research management

In the last years, research management has improved but there is still a need to further strengthen the role played by DICyT as the central unit responsible for planning and supporting research.

Access to funding will allow allocation of resources to monitor progress of projects and assess quality of research results, among others. Also, some administrative processes, especially those related to processing requisition of funds, accounting and reporting financial execution of the projects, need to be improved in order for the system be able to perform smoothly.

Under these premises, the following actions will be carried out within the program:

- To formulate a renovated research development plan for the period 2013-2022 and undertake all the necessary actions to obtain backing from the scientific community and acceptance by all relevant stakeholders at the university. By 2017, most of R&D activities are conducted along the lines set in this Plan. By year 2022 all research centers and administrative units are expected to be working according to the plan lines, embracing the plan as their own and are committed to contribute to its renovation and development.

- To elaborate, approve and put into effect the set of regulations and procedures related to constitution, functioning and relations amongst the different units within the system so that each one fulfills their corresponding role. It is expected that by 2017 the majority of research units and all administrative units are working according to their role and that by 2022 all and each one of the units have adjusted their functioning to the prevailing rules and regulations; at this point the organic structure that supports the plan has been thoroughly consolidated.

- To fully implement the System for Management of Research Projects (SIGESPI) so that monitoring and evaluation of funded projects are performed routinely and thoroughly and reliable information is continuously updated.

- Audit and re-engineering of the financial administration system and procedures for an efficient and transparent financial administration of funds coming from all international cooperation in support to research. A system audit will be carried out in order to identify bottlenecks in the financial administration of these programs and have recommendations to adopt new, more efficient, financial administration system (that may eventually include software development) and procedures for the provision of funds as well as for timely reporting to all different donors supporting research. The way in which the central government's acquisition, contracting and control system has been introduced to UMSS, overlapping the existing institutional procedures, have resulted in multiple controls and bureaucratic practices unnecessarily delaying the disbursement of funds to research units. In addition, the financial administration system implemented by DICYT at the beginning of the first cooperation agreement for the allocation, accounting and administration of resources on a project-budget basis, is no longer in use due to the excessive work demanded by the mixed system of the government and central administration of UMSS. It is expected that the re-engineering process and, eventually, the design and adoption of a new system, will allow that by 2017 the administrative processes will turn as agile, unfussy and transparent as the norms allow.

  Training staff on administrative procedures in order for UMSS to have trained administrative staff capable of undertaking all the necessary paperwork, process requisitions and properly back up the expenses so sparing to scientific personnel from having to waste their time on administrative duties. These training events will be carried out after the re-engineering is completed.

UMSS considers necessary to have the assistance of an external expert to plan and execute some of the initiatives described in this section (especially for the elaboration of the research

development plan and implementation of some of its key actions). Given that during the initial years of the cooperation with Sida, the external advice and guidance received was so valuable, we would like Sida to provide funding for continuing hiring this kind of expertise.

5.3. Time framework

The activities proposed will be executed according to the timetable in Appendix D.

5.4. Action plan fulfillment

The following factors may have an influence in the implementation of the cooperation program:

Internal factors:

- Faculties continue to consider themselves as separate from the rest of the institution which leads them to put pressure to obtain the largest possible share of the available resources. This may reduce the possibility to allocate resources, especially those from IDH, based on institutional objectives and plans. Having the research development plan approved and assumed as own by the University Council will reduce this risk.
- Resistance from the part of administrative staff (at central level) to simplify paperwork and eliminate unnecessary controls and documents may be expected. Participation of external consultants in the audit and re-engineering process will reduce this risk.

External factors:

- Changes in the orientation of the central government may alter socio-economic priorities and the corresponding allocation of resources. In addition, resources coming from IDH may be reduced due to variations in either hydrocarbon prices or exported volumes. Diversifying sources of funding and/or resizing institutional priorities may help to counter this risk.

6. QUALITY ASSURANCE

UMSS will take measures to implement continuous quality improvement (CQI) processes. The aim is to ensure that activities carried out within the Research cooperation program with SIDA, which widely supports the Research Development Plan, produce the intended outcomes. Developing a culture of improvement and assessment at UMSS by applying CQI processes will contribute to develop research into a fully integrated system.

CQI will focus on critical processes that make up the system of research at UMSS. At a conceptual level, some of the focal areas of application of CQI are:

- research processes: planning, selection, monitoring and evaluation of research projects; researchers recruitment, training and retention

- graduate training processes: curricula development, evaluation and accreditation of graduate programs, implementation.

- research infrastructures and facilities: adequacy to norms

- research management and support: administration of financial resources, improved administrative procedures, information databases on research projects and outputs

- research results: quantity, valorization, knowledge transfer and dissemination

7. BUDGET

The estimated budget for research activities at UMSS for the period 2013-2017 is presented below, including the sources of funding.

COMPONENTS	STRATEGIES	Period 2013 -2017			
		TGU*	IDH	SIDA	Other agencies**
Research management	Update research plan and legal framework			850.000	300.000
	Administrative audit and reengineering of financial administration system			500.000	
	Evaluation of quality and relevance of research			400.000	
	Training of research management staff			2.500.000	
Support services	Centerfor metrology and maintenance		2.000.000	5.000.000	
	ICT and electronic libraries			5.000.000	
	STI data collection, compilation, communication			200.000	
	Program for dissemination of research			600.000	
Research staff training	PhD sandwich training for researchers/lecturers			58.500.000	10.920.000
	Short training for technicians		1.000.000		
Local graduate training	Design a system for evaluation and Accreditation of graduate programs			1.700.000	
	Graduate research training programs: master and Phd			9.350.000	4.000.000
Upgrading physical infrastructure and facilities	Supplementary scientific equipment research centers (program)		10.000.000	5.000.000	2.220.000
	Facilities and equipment for prioritized areas (PhD training)			14.000.000	2.500.000
	Program for quality assurance of facilities			3.900.000	
Research Fund	Research projects (SIGESPI)		10.000.000	13.000.000	5.000.000
	Post-doctoral activities			5.000.000	2.000.000
	Horizontal program		1.500.000	3.500.000	
Transfer and Innovation	University Centerfor Innovation (INNOVA UMSS) (includes PhD training)			3.000.000	
FUNDING SOURCES TOTALS (SEK)		332.500.000	24.500.000	132.000.000	26.940.000

* University Treasury: Comprises salaries of S&T personnel (researchers, technicians and support staff), basic services (water, energy, communications) and maintenance of physical infrastructure.
** Other international agencies currently supporting research activities at UMSS.

8. COORDINATION

The program will be coordinated by DICyT that will have responsibility for its overall execution.

DICyT has also been coordinating support coming from other international donors such as the European Union, Spain, CIUF/Belgium, Vlir/Belgium, Italy, United States and United Nations, among others. Apart from CIUF/Belgium, which includes a comprehensive support to various research units, most of these institutions have been funding specific research projects and activities.

Being SIDA's the largest program centrally coordinated by DICyT, administrative support for the management of the program was set up at DICyT at the beginning of the cooperation agreement (2001). The successive inclusion of other cooperating institutions into centrally coordinating schemes has placed some additional workload on the administrative staff which has reinforced the administrative structures along the years.

Since DICyT will undertake an audit and re-engineering of the financial administration system and, eventually, will adopt new administration instruments, DICYT will make sure that needs and requirements from all different funding agencies are taken into account.

9. ASSESSMENT

This concept note has been assessed internally with regard to various aspects. The main conclusions are:

- Scientific relevance: the program is most relevant from the scientific perspective since it is oriented towards comprehensively building research capacity at UMSS while emphasizing the adoption of quality assurance mechanisms.

- Social relevance: the overall goal of the program is to contribute to the socio-economic advance of the Cochabamba region and the country. To this end, the note clearly proposes priority areas of intervention that, aligned with the national development plan, may have most impact on development and poverty reduction. Competences developed around those priorities allow for UMSS to make contributions in the form of expertise and advice collaborating with various organizations, ministries and private enterprises and also in the form of useful research results produced and transferred to different social and economic actors.

- Sustainability: academic sustainability is specially considered in this concept note since special attention is given to develop local capabilities for delivering high quality graduate training that will ensure that, in the future, new lecturer researchers will be produced both to fulfill the needs of the institution and eventually of other universities at national level.

  Institutional sustainability of research has been strengthened in the years of the cooperation program with SIDA. Given that implementation of the program relied on the existing organic structures at UMSS, we gained the additional effect of reinforcing and enhancing the functioning of such existing structures and thus gained more recognition and respectability from the part of the academic community at UMSS. Proposed actions in this concept note follow the same institutional approach.

  Financial sustainability; the budget for the research plan is realistic, exhibiting slightly increasing income and expenses in accordance with past trends and with the current institutional administrative competences. In addition, the diversified funding sources reduce vulnerability. The institutional decision to allocate up to 25 percent of IDH resources to research is commendable.

- Environmental impact: Currently, research proposals include a responsible reflection on the positive and negative effects that the activities that should be performed during the development of the project or the results that may be implemented could have on the natural environment or human health. Implementing CQI processes will allow an assessment to the declared achievements.

- Gender aspects: currently, there is an imbalance in the gender composition of the research staff since 62 percent of the 252 researchers are male. The students enrolled in training under SIDA cooperation have been predominantly men. For future enrollments the institutional policy will be *positive discrimination*, meaning that, *given similar qualifications for research or directive positions and training opportunities, women candidates will have precedence over male candidates*.

- Ethical approval issues: Here, the following ethical issues have been assessed:
    - Biomedical research. Some of the research activities funded by SIDA may involve human subjects or laboratory animals.
    - Property rights over genetic resources and intellectual property-related provisions. Some of the research activities funded by SIDA may involve genetic resources and related intellectual property rights.

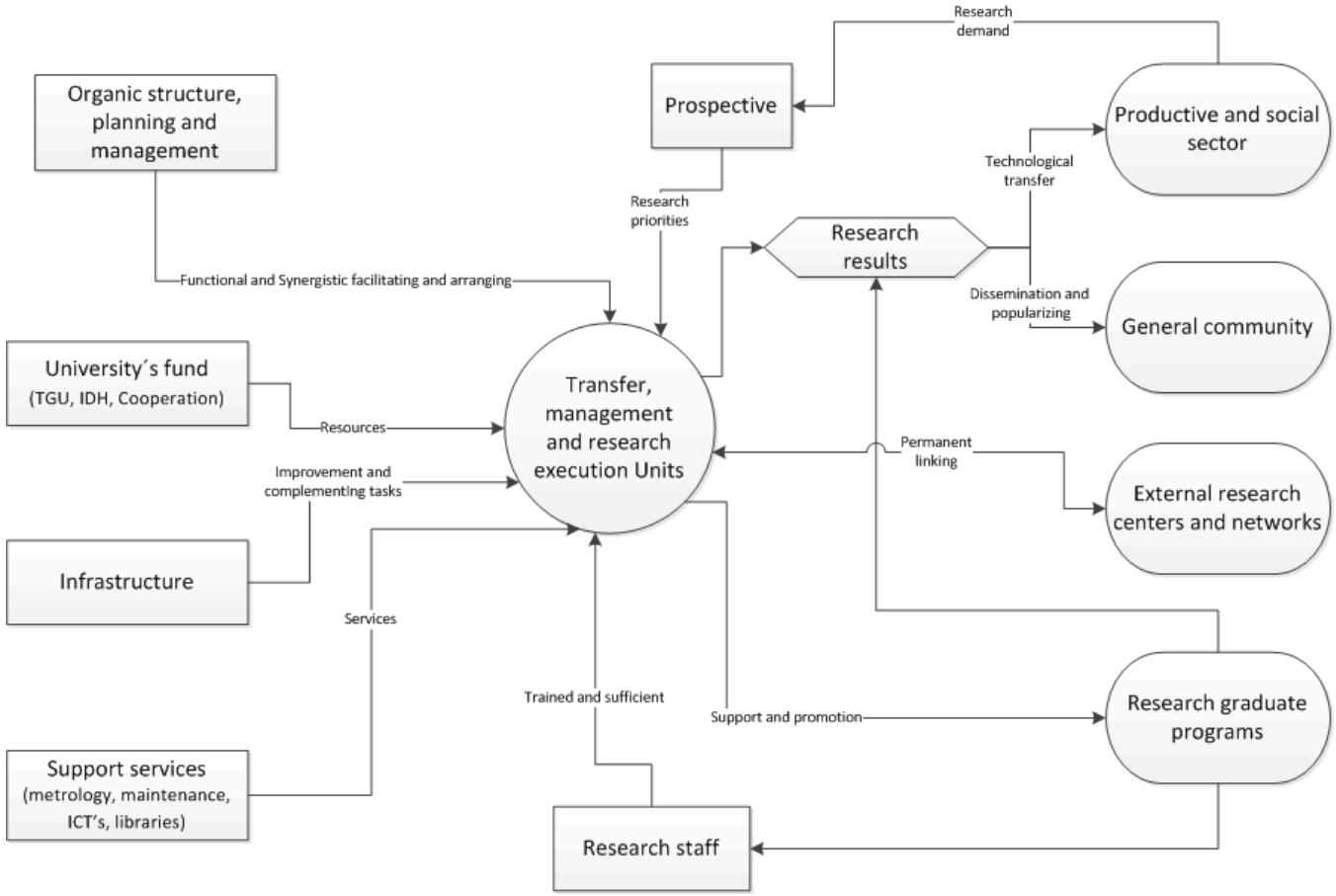
  Both issues are subject to special country regulations and compliant of international agreements. UMSS will see that special previsions are taken to ensure that research proposals and projects duly comply with these norms. This may include establishing a special ethical review Committee.

- Internal and external risks. Internal risks are associated with political struggles to control power since these may interfere with the process of approval of the research development plan and its implementation. Also, excessive bureaucracy may delay the funds requisition process obstructing the execution of research projects and activities. Both risks shall be overcome when the University Research Plan is approved by the university council, as this is legal strength needed to be recognized within the institution.

  On the external side, a government intervention overlooking the principle of university autonomy would alter the socioeconomic priorities of the plan and the corresponding allocation of resources. Gaining social legitimacy with the implication of research with the social actors may be reflected in greater confidence and support from the community to the social mission of UMSS.

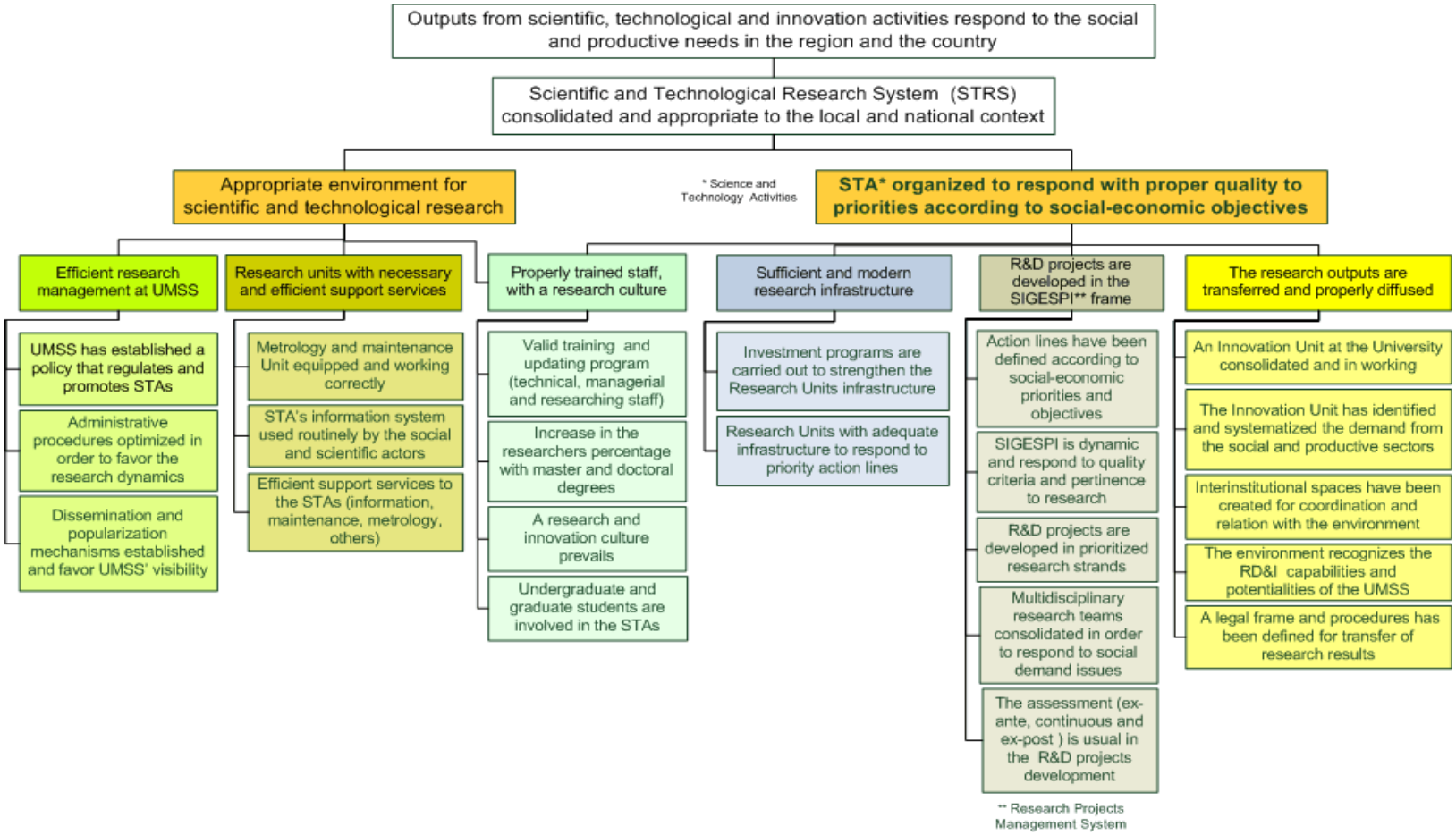
APPENDIX A

System of Scientific and Technological Research at UMSS



APPENDIX B

Objectives tree for Scientific and Technological Activities (2022)



APPENDIX C

Training Program 2013-2017

THEMATIC AREA	RESEARCH STRANDS	EXITING CAPACITIES		PhD TRAINING sandwich modality (number of trainees		LOCAL TRAINING (number of MSc. Programs)	
		Nº MSc. holders	Nº PhD holders				
AGRONOMY AND PLANT BIOLOGY	1. Agrobiodivesity 2. Plant protection 3. Breeding systems 4. Post-harvesting technology	25	10	1 2 2 2 2	Ethobotanics Genetic resources (flora and fauna) Cultivation systems (different strands) Plant health Post-harvesting technology	1 1	Plant proteccion and environment Ecophisiology and plant conservation
SOIL AND LAND	1. Soil characterization and valorization 2. Management and soil conservation 3. Soil remediation and rehabilitation	16	7	2 1 1	Edafology (different strands) Management and soil conservation Soil remediation and rehabilitation	1	Soil and land
INTEGRATED MANAGEMENT OF WATER RESOURCES	1. Water quality 2. Water management	10	8	2 2	Integrate management of water resources (different strands) Water contamination (water quality and environmental management)	1 1	Environmental engineering Geoinformation sciences – assessment of hydrological resources
FOOD TECHNOLOGY, CHEMICAL TECHNOLOGY AND BIOPROCESSING TECHNOLOGY	1. Development of bioprocesses and biotechnological products 2. Food technology: conservation and industrialization 3. Natural products: extraction, separation, structures, synthesis, hemi synthesis and biological activities	13	17	2 1 1 1	Food technology (different strands) Biotechnology and industrial bioprocesses Chemical synthesis and hemi synthesis of natural products Biocatalysis	1	Chemical technology and bioprocessing (strands on food technology, natural products and bioprocessing)
ENERGY	1. Alternative energies: Renewable energies and environment-friendly non-renewable energies	1	6	5 1	3 Renewables energies and 2 non renewables energies (different strands) Energy management	1	Renewables energies
HEALTH	1. Immunology and endemic diseases 2. Nutrition and endemic diseases	14	4	1 1 2	Celular biology Molecular biology Immunology	1	Masters on infectious and transmissible diseases
HABITAT AND HUMAN SETTLEMENTS	1. Control and protection of environment 2. Risks management 3. Territorial management 4. Conservation of natural resources	31	7	2 2 1	Risks management Sustainability, planning and urban design (different strands) Environmental quality and conservation	1 1 1 1	Environmental impact assessment Risk management and land use Urban Transformation Conservation of natural resources and landscape management
ECONOMIC AND SOCIAL SCIENCES	To be determined	12	22	5	To be determined	2	To be determined
SUBTOTAL RESEARCH CAPACITY BUILDING				42		14	
RESEARCH MANAGEMENT AND INNOVATION	1. Reinforcing capacities of ICT staff 2. Innovation and technology transfer			 2	To be determined Study and development of innovation systems (different strands)	 1	 Innovation and development of productive clusters
TOTAL RESEARCH AND RESEARCH MANAGEMENT				44		15	

APPENDIX D

TIMETABLE

No.	ACTIVITIES	RESPONSIBLE UNIT	Years		
			2013	2014	2015-2017
AREA I. RESEARCH MANAGEMENT					
	STRENGTHENING RESEARCH MANAGEMENT				
1	Update UMSS' plan for research development	DICYT	XX		
2	Audit and re-engineering of financial system and procedures	DICYT	XXXX		
3	Full implementation of SIGESPI (includes evaluation)	DICYT	XXX		
	PROVISION OF SCIENTIFIC AND TECHNOLOGICAL SERVICES				
4	Establish Center for metrology and maintenance	DICYT	XX	XX	
5	ICT and electronic library for researchers and graduate students	DICYT-Infocyt/UPSI/ MEMI	XXXX	XXX	
6	Programme for dissemination of scientific information	DICYT-Infocyt	XXXX	XXXX	XXXX
7	Data collection and statistical compilation (routinely)	DICYT-Infocyt	X	X	X
	RESEARCH FUND				
8	Updating criteria, procedures and awarding process	DICYT	XX		
9	Design special conditions for post-doc activities	DICYT (SIDA approval)	X		
10	Operate the research fund	DICYT	XXXX	XXXX	XXXX
	QUALITY ASSURANCE AND ACREDITATION POST-GRADUATE PROGRAMS				
11	Constitution of the task team – appoint a team coordinator	DICYT	X		
12	Contracts with external experts (Swedish – Iberoamerican)	DICYT	X		
13	Working according to advisors	Team coordinator	XXXX	XXXX	
14	Approval of QAA and communication to research centres	DICYT		X	X
	UNIVERSITY CENTER FOR INNOVATION				
15	Foundation and legal/strategic plan preparation	DICYT/UTT	XX		
16	Implementation of strategic plan	DICYT/UTT	XX	XXXX	XXXX
AREA II: RESEARCH AND CAPACITY BUILDING					
	TRAINING OF RESEARCH STAFF (SANDWICH MODEL)				
17	Establishing contacts and agreements with Swedish universities	Heads of Research units	X		
18	Selection of candidates for PhD training abroad	Heads of Research units	XX		
19	Signing commitment contracts with UMSS	DICYT	X		
20	Enrollment of PhD students (sandwich model)	Heads of Research units/DICyT	XX		
21	Students training in Swedish universities	Heads of Research units/DICyT	XX	XX	XXXX
22	Students training activities at UMSS (sandwich model)	Heads of Research units/DICyT		XX	XXXX
23	Thesis dissertations	Heads of Research units/DICyT			
	LOCAL GRADUATE TRAINING				
24	Curricula development for research master programs	DICyT-EPG			XXXX
25	Master programmes approval process	Research units/DICyT			XXXX
26	Implementation of master programmes	Research units			XXXX
	UPGRADING PHYSICAL INFRAESTRUCTURE AND EQUIPMENT				
27	Upgrading research facilities and scientific equipment according to need's assessment	Research units	XX	XXXX	XXXX
28	Establishing/upgrading teaching facilities as needed	Research units			XXXX