



Mathematics in Africa:

Project Proposals



Commission for Developing Countries,
International Mathematical Union

Mathematics in Africa 2014

Proposals

AFRICAN DIASPORA MATHEMATICIANS PROJECT (ADMP)

Name of the project: African Diaspora Mathematicians Project (ADMP)

Main aim of the project:

The project aims to strengthen understanding and development of mathematics, particularly at the postgraduate level, by utilising the expertise of African Diaspora mathematicians, whilst at the same time encouraging collaboration in research by mathematicians in Africa and those in the African Diaspora, through the partnerships established in the project.

Location of the project:

The project involves partnerships between African Diaspora mathematicians and mathematics academic units at any universities in Africa.

Target group:

The project targets African Diaspora mathematicians who may be academics at any point in their career. Within African universities, the project targets postgraduate students for training through lectures, examinations, supervision and design or improvement of postgraduate curricula; it also targets staff in African universities who are willing to establish research collaborations with the African Diaspora mathematicians.

Mathematical Field: All fields of mathematics and its applications are covered.

Current funding (if any): The project has no current funding.

Necessary funding:

For each established partnership, the African Diaspora mathematician will be granted Euros 5,000 (USD 6,800) annually to cover airfare, travel insurance, visa processing, and accommodation for 3 to 4 weeks at the partner university in Africa. In addition, the partner university will be granted Euros 1,000 (USD 1,400) per year for software, literature and other learning material. Taking into account a 10% charge for project administration, each partnership will cost Euros 6,600 (USD 9,000) annually. The partner university is expected to provide boarding for the African Diaspora mathematician while the home institution of the African Diaspora mathematician is requested to offer leave with pay during the latter's 3-4 week absence.

The necessary funding depends on the scenario used to implement the project, as described hereunder.

(a) Scenario 1: Support 3 partnerships for 3 years.

The annual cost is Euros 19,800 (USD 27,000), hence the total cost is Euros 59,400 (USD 81,000). This is the minimum realistic option but the waiting period of 3 years for new partnerships may make interest in the project to wane.

(b) Scenario 2: Support 6 partnerships (one for each AMMSI Region, where possible) for 3 years

The annual cost is Euros 39,600 (USD 54,000), hence the total cost is Euros 118,800 (USD162,000). This is a favourable option as it allows more regions in Africa to participate in the project but the waiting period of 3 years for new partnerships may make interest in the project to wane.

(d) Scenario 3: Support 6 new partnerships every year, each for 3 years

The 1st year cost is Euros 39,600 (USD 54,000), the 2nd year cost is Euros 79,200 (108,000) and the 3rd year cost is Euros 118,800 (USD 162,000), hence the total cost is Euros 237,000 (USD 324,000). This is the ideal option which also enables interest to be maintained in the project. If the project is funded beyond the 3rd year then the annual cost will remain at Euros 237,000 (USD 324,000) but if the last grant is awarded in the 3rd year then the costs in the 4th and 5th years will decrease accordingly

If sufficient funds are available then Scenario 3 would be the preferred choice, otherwise preference would be for Scenarios 2 and 1, in that order.

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Description:

(a) Background

University mathematics education in Africa is characterized by a number of factors, including: small numbers of mathematics faculty and postgraduate students; geographical and professional isolation of individuals and departments; lack of expertise in certain areas of the subject; inadequacy of facilities for teaching and research; limited opportunities to participate in regional or international conferences in order to disseminate research findings; poor working conditions; weak infrastructure; lack of access to current journals, relevant software and equipment; low levels of government support for postgraduate training. Due to funding limitations, these shortcomings cannot be completely eliminated through efforts by government and private universities in Africa. Consequently, some non-governmental initiatives have emerged that attempt to address some of these issues, in particular, lack of expertise in certain areas of the subject, research collaborations, training of postgraduate students, conference attendance, among others. These initiatives are general and so do not specifically target expertise in the Diaspora. Consequently, it is necessary to commence an initiative which targets the expertise of African Diaspora mathematicians.

(b) African Diaspora Scientists

The African Diaspora refers to communities that have migrated from Africa over the years, including modern times. The process is ongoing and every year, thousands migrate from Africa in search of educational opportunities and better intellectual environments, among other factors. The African Diaspora contains many scientists and mathematicians, some of whom have distinguished themselves and are engaged in universities, research laboratories, industry and international organizations. There exists reason to believe that, given an opportunity, many of these individuals would be willing to share their expertise with scientists and students in Africa. For instance, African Diaspora mathematicians have been involved in activities in Africa that include: conference organization, training schools, and teaching and supervision of postgraduate students. These activities have been undertaken largely through the personal drive and interest of the individuals involved.

(c) Establishment of Partnerships

We propose, therefore, to have a project that enables African Diaspora mathematicians to initiate partnerships with African universities that can result in longer-term contact, mentoring and collaboration. In order to provide the longer-term contact and give guidance to a cohort of students, it is proposed that a partnership be designed to last three years, renewable if funds become available. In the Diaspora, a pool of mathematicians willing to participate in the partnerships will be identified, with their areas of expertise. In Africa will be identified a pool of universities that require expertise in particular areas of mathematics and its applications. After response to advertisements, partnerships will be established taking into consideration the needs of the African universities and the expertise available. Partnerships may also be established based on one-to-one prior contacts. If funding is available, it is proposed to start initially with 6 partnerships distributed across different regions of Africa. A smaller number of initial partnerships can be considered, if the situation dictates.

(d) Activities of Partnerships

The African Diaspora mathematician shall visit the partner university in Africa, once a year for 3 – 4 weeks during a mutually agreed period, in order to undertake the following activities, among others: (1) Postgraduate teaching and examination (2) Postgraduate supervision (3) Curriculum design or improvement (4) Research collaboration (5) Mentorship of young staff members and postgraduate students through various activities, including brainstorming sessions and workshops on research and proposal writing (5) Advice on acquisition of software, literature and other educational materials. Each partnership shall be funded to last for 3 years, as indicated in the section on “Necessary Funding” above.

If funds are available, the partnership shall be renewable on the basis of its success, which shall be measured by the following outputs: (1) Number of courses taught and examined (2) Number of postgraduate students supervised (3) Research collaborations initiated (4) Mentorships undertaken (5) Number of publications produced in collaboration with researchers in the host university (6) Software, literature and learning material acquired.

(e) Collaborators

The project will be undertaken by the African Mathematics Millennium Science Initiative (AMMSI) in collaboration with the African Mathematical Union (AMU) and any other organizations and universities that are willing to participate or contribute.

AFRICAN MATHEMATICS MILLENNIUM SCIENCE INITIATIVE (AMMSI)

Name of the project: African Mathematics Millennium Science Initiative (AMMSI)

Main aim of the project:

The project aims to promote mathematics in Africa by strengthening the teaching and learning of mathematics, supporting research in mathematics and its applications, enhancing capacity in mathematics through linkages and networks, and enhancing the use of ICT in the teaching and learning of mathematics.

Location of the project:

The project involves participation by individuals and institutions throughout Africa.

Target group:

AMMSI targets postgraduate students and academics and at any point in their career. It also targets African universities that need support in postgraduate lectures or supervision in areas where they are deficient or in the development of postgraduate programmes. Also targeted are research groups interested in undertaking multidisciplinary research, through several regions in Africa that involves mathematics and its applications.

Mathematical Field:

All fields of mathematics and its applications are covered.

Current funding (if any):

The project currently awards annual postgraduate scholarships that provide partial support of about Euro 1,000 each to 15 students who undertake their education in universities in Africa. The total funding of Euro 20,000 is being provided by the Commission for Developing Countries (CDC) a commission of the International Mathematical Union (IMU). Funding of £40,000 is also provided to the project Mentoring African research in Mathematics (MARM), which is run jointly by IMU, the London Mathematical Society (LMS) and AMMSI. There is also funding averaging about £8,000 per year for a joint LMS-AMMSI conference grant that enables postgraduate students to participate in mathematical conferences organized in Africa. The last two sources of funding are disbursed directly from the LMS and only the African administrative component is sent to AMMSI.

Necessary funding:

In order to achieve its goals, AMMSI requires annual funding for the following activities:

Award of 20 to 30 partial postgraduate scholarships (Euro 30,000).

Award of 5 Research/Visiting fellowships (Euro 25,000).

Support for 2 regional multidisciplinary research projects involving mathematics and/or its applications (Euro 60,000).

Support for one regional conference (Euro 30,000).

Support for participation at conferences by academic staff and postgraduate students (Euro 20,000).

Mentorships and linkages (Euro 20,000).

Appropriate administrative support for 10-15% of project funds.

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Description: (one page)

In Africa, university education is characterized by a number of factors, including: small numbers of mathematics faculty and postgraduate students; geographical and professional isolation of individuals mathematics departments and researchers; inadequacy of facilities for teaching and research; poor working conditions and weak infrastructure; lack of access to current journals, relevant software and equipment; low levels of government support for postgraduate training. Since these factors have not been satisfactorily addressed through established government and private universities, a number of initiatives have emerged in Africa to supplement the efforts. One such initiative is the African Mathematics Millennium Science Initiative (AMMSI) which was established in 2004. AMMSI is a distributed network of mathematics research, training and promotion in Africa, with a Programme Office and six regional offices (for details, see www.ammsi.org).

AMMSI is currently involved in the following activities which have been ongoing since 2005:

(a) Postgraduate Scholarships

These are partial scholarships, each up to Euro 1,000, awarded annually to African students to enable them pursue postgraduate studies in mathematics and its applications, at any university in Africa. To date this project has supported over 250 students who have completed their MSc or PhD degrees and, in some cases, published their research findings in reputable journals.

(b) Mentoring African Research in Mathematics (MARM)

This project is a collaboration between AMMSI, the International Mathematical Union (IMU), and the London Mathematical Society (LMS). MARM is designed to promote mentoring relationships between mathematicians in other continents and African colleagues, together with their students. It aims to promote collaboration in mathematical research, create joint research projects and cultivate longer-term partnerships between institutions in Africa and those elsewhere. To date 18 partnerships have been established.

(c) LMS-AMMSI Conference Grant

This project is a collaboration between AMMSI and the London Mathematical Society (LMS). It provides GBP 2,000, for each mathematics meeting in Africa, to cover travel expenses by postgraduate students to those meetings. The aim is to provide postgraduate students with opportunities to interact with their academic seniors, meet potential mentors and gain experience in making scientific presentations. The grant supports several meetings every year and to date over 100 postgraduate students have benefited.

The following activities, organized in the past, have been suspended due to reduced funding support:

(d) Research/Visiting Scientist Fellowships

This project ran from 2005 to 2008 and involved fellowships awarded annually to academics and researchers in mathematics and its applications. They were designed to support university staff, from African universities, to travel to other institutions in Africa in order to interact with other experts in their areas of research and participate in postgraduate training at the host institutions. A total of 23 fellowships were awarded and some of the awardees continue to be prominently involved in mathematics research and promotion in Africa.

(e) Conferences

From 2005 to 2009, AMMSI sponsored four conferences in different regions of Africa. In addition, in 2006, AMMSI organized the International Mathematical Biology Workshop, in Nairobi, Kenya and, in 2008, it organized the Symposium on the African Woman and Mathematics, in Maputo, Mozambique.

Financial support for the various AMMSI activities has been provided by the following organizations: International Mathematical Union (IMU); Leverhulme Trust; London Mathematical Society (LMS); Mellon Foundation; National Science Foundation (NSF), USA; Nuffield Foundation; and the US National Committee on Mathematics. Other support has been provided by: African Academy of Sciences (AAS); Marien Ngouabi University, Congo; University Mohammed V - Agdal, Morocco; Science Initiative Group (SIG), Princeton, USA; Université Gaston Berger, Senegal; University of Botswana, Botswana; University of Dar es Salaam, Tanzania; University of Ibadan, Nigeria; University of Nairobi, Kenya; University of Ngaoundere, Cameroon; University of Ouagadougou, Burkina Faso; University of Yaounde I, Cameroon.

AMMSI seeks new sponsors to enable it fulfil its mission of nurturing the next generation of African mathematicians and mathematical leadership by enhancing capacity through diverse activities.

Name of the project: Doctoral School of Pure Mathematics

Main aim of the project: Training of 10 PhD in Pure Mathematics in 4 years

Location of the project: Marien NGOUABI University, Faculty of Sciences (Brazzaville Congo)

Target group: Student holds a Master in Mathematics, of Congo Brazzaville and Democratic Republic of Congo.

Mathematical Field: Geometry, topology, algebra, dynamical systems

Current funding (if any):

Local funding

Support teachers (stays of foreign teachers, salaries, airline tickets) provided by the university management ;

3000 Euros for the operation of the graduate school;

MARM (Mentoring African Research in Mathematics) funding : 5000 £ per year (2014 and 2015).

Necessary funding: 15.000 Euros per year

Student travel abroad for three months a year: 12.000 Euros

Books and scientific equipment: 3000 Euros

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Project Description:

Africa in general and the Congo in particular, have a very small number of teachers and researchers in mathematics. In Department of Mathematics of our university and those of most countries of the sub-region, lack teachers in the field of pure mathematics, including geometry, algebra and topology.

Thus, with the support of the European Union through the project EDULINK, twenty students were trained DEA level (2010, 2011, 2012), in the areas of geometry, algebra, the numerical analysis and statistics. This training was conducted in the framework of a joint master between universities Marien NGOUABI Brazzaville (Congo) and those of Kinshasa (DR Congo). These two cities are the capitals of the world closer together and separated by a river (Congo River).

The first phase of this project (consisting of training Master) is completed; a second phase of this project was launched: the creation of a doctoral program in Pure Mathematics for the formation of at least 10 PHD in 4 years. This second phase takes place without the support of EDULINK.

Twelve (12) of these students currently preparing their PhD with more or less a lot of difficulties.

Apart from students of both Congo (Congo-Brazzaville and Congo-Kinshasa), the project must also attract students from other countries in the sub - region of Central Africa (Cameroon, Chad, Gabon).

The average annual budget for this project is approximately 15,000 Euros.

We currently have the support of fellow teacher sat the Universities ofPoitiers, Bordeaux and Orleans (France) who agreed to participate in the mutual supervision of students, provided they get a scholarship.

Marien NGOUABI University supports transportation costs and stay guests (missionaries) which are estimated at five per year.

Supplementary Estimates are needed to help the movement and residence of students abroad.

Name of the project

Enhancing Capacity of Master of Science in Mathematical Modelling and Science education (Mathematics) programmes at UDSM (2014/15-2020).

Main aim of the project

The main aim of the project is to strengthen postgraduate training in computational skills in mathematical Modelling and linking them to research topics which are working life relevance.

The project will support the training of some masters and PhD students who will undertake strategic research focusing on innovations and new development through enhancing problem solving skills in the society. This will base on Mathematical research in the new emerging areas of oil and gas, environmental management, natural resource management as well as human population health. The ultimate goal of the project is to use the fund available to help both mathematics students at the level of masters and PhD to link their trainings and research for socio-economic development in the society. It is supported by the fact that mathematics is the bed rock of science technology and innovations which are the keys factors for the development of any society. Furthermore, the financial support from this project will also help us review the masters curriculum as well as develop the taught mathematics PhD programme in the department to be able align them to the current new international, regional and national developments.

Location of the project

In the Department of Mathematics, University of Dar-es-Salaam (UDSM), Tanzania in East Africa. It will run as it was before, it will allow students who are sponsored and private (other source of fund) from other regions to apply and join the programmes.

Target group

The target groups are masters' applicants from East Africa, Southern Africa and other parts of Africa for example West Africa are all welcome. The existing programme is famous has been attracting students from the region and from within up to a number of 40 applicants per a year.

Mathematical field

The following areas will be enhanced; Mathematical modelling knowledge and skills in the field oil and Gas explorations, computational skills, natural resource management, risk management, environmental management, financial mathematics, Computational Fluid Dynamics. Insurance Mathematics, Data assimilation method and its application to weather prediction and other fields. These will be developed and over-emphasized in the existing curricula, in addition a course on real analysis will be taught to all masters and PhD students.

Current funding (if any)

Currently there is no funding from outside for the project, however, the UDSM meets the costs of running the programme through paying the local academic staff. Electricity, water and other utilities. The computer laboratory fully equipped with 40 computers connected to fast internet is available and maintained by the UDSM.

Necessary funding

US \$ 1,004,500 is required for the 3 batches of masters each 10 students (3x10=30 masters) and one batch of 6 PhD allocated as follows; **Scholarships US \$ 735,500**(covers tuition fees, insurances, Travel, monthly stipends, research fund accommodations, books), Conference and publication **support US \$ 30000**, Travel, Teaching & supervision support **US \$ 104,600** and Other collaborative and coordination activities **US \$ 134,400** for the whole project period.

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Description

Background for the project

The Department of Mathematics at UDSM in Tanzania offers Masters Degree and PhD in Mathematics. It also offers services to various Engineering fields, Geology, Education degrees and to the school of law UDSM. The Master of Science in mathematical modelling programme was sponsored by NORAD under NORAD's masters programme (NOMA) since 2008 to 2013. It was a multilateral programme involving five countries (**Zambia, Uganda, Malawi, Mozambique and Tanzania**). It attracted more than 240 applicants but only 183 students managed to register up to November 2013. Out of 120 students who were supposed to graduate by November 2013, 111 (92.5%) students graduated. Most of those who graduated have been employed for the teaching posts in the higher Education Institutions (HEIs) in the region. The major success was contributed by the financial support that attracted several visiting professors from the regional and outside Africa. They participated in teaching and co-supervision of the postgraduate students. But the NORAD's support for MSc Mathematical modelling programme has come to an end in 2013. In addition, the department has since 2012 started MSc in Science Education degree programme majoring mathematics. Unfortunately this programme has not yet got any financial support as result it enrolled only 4 students in 2012 and 4 students in 2013.

A detailed description of the activities, their expected achievements

The activities and items that will be involved in the programme include advertising the programmes and scholarships through website, news papers to the potential applicants, transparent selection of the best students to be awarded the scholarships; selection criteria will be set and announced in advance, successful students will sign the contract. Curriculum review, Teaching/training of students, conducting strategic research which focuses on improving human life. Invitation of visiting professors (up to 5) yearly in the areas that UDSM lacks local expertise. Arrangement of accommodation, health insurance for sponsored students, Supervision process, paying tuition fees, research allowances and stipends to 30 sponsored masters and 6 PhD. Therefore, expected achievements after the end of project period are as follows; UDSM enrolment especially female students in Mathematics, HEIs academic staff in the region, Publication volume increased, international visibility of UDSM, improvement measures on natural resource and environment management through mathematical models, international academic collaborations through co-supervision and increased multidisciplinary research outputs and their uptake will be enhanced.

Justification for support of the project.

Recently there has been an increase of newly established Higher Education and research Institutes in the region (<http://www.tcu.go.tz/>). In order to maintain the quality of the outputs of these HEIs, we need to continue training more human resource in various areas of mathematical applications. Furthermore, there are new developments such as an going oil and gas explorations in the region, need for focusing on strategic research in the field of Science, Technology and innovations (ST&I) aiming at alleviating poverty in the society. The Higher Education Development Programme in Tanzania aims at enhanced relevance access and quality to higher education. The Tanzania development vision aiming at reaching a society of middle income by 2025 through having improved quality and good life for all people who will withstand the global challenges.

Therefore, any support to the existing masters and PhD programmed in mathematics is still highly needed in for sustainability of these programmes.

Name of project: FOUR YEAR DOCTORAL COLLEGE OF MATHEMATICS

FOR UNIVERSITIES IN GHANA

Main aim of the project: To produce the next generation of mathematicians with PhD

Degrees locally.

Location of the project: It will be located in Ghana- Cape Coast.

Target group: MSc/Mphil in mathematics students from Ghana in particular and other African countries in general.

Mathematical field: All fields. Emphasis on Analysis, algebra, pde and modeling.

Current funding: Funding for accommodation and feeding of external supervisors by our Department.

Necessary funding:

1. 1st year teaching allowance for local lecturers

Semester	Number of teachers	remuneration per hour in GHS	Number of hours of teaching per week	Number of weeks per semester	Total amount per semester in GHS
1.	5	150	3	16	36000
2.	5	150	3	16	36000
					Total=72,000
					=\$ 24,000

2. Visit to External supervisor for 3 months

One air ticket per student's visit to external supervisor during the 3 year research period = \$1500

For 5 students = 5 times \$1500 = \$7500.

3. Visit by External supervisor to Ghana

(a) Cost of Two air tickets for two visits by one supervisor during the 4 year period= \$1500 times 2=\$3000

For 5 supervisors = 5 times \$3000 = \$15000.

(b) Accommodation and feeding of external supervisors

To be taken care off by our Department.

4. Remuneration for local supervisor during the research period

\$1000 per supervisor per year for 3 years=\$3000

For 5 supervisor=5 times \$3000=\$15000

5. **Accommodation cost for 5 students**

1 single rooms at GHS 1500 per year per student for 4 years =GHS 6000

For 5 students =5 times 6000=GHS 30,000=\$10000

6. **Feeding allowance of students**

\$100 a month per year per student for four years=\$1200 times 4=\$4800

For 5 students =5 times 4800=\$ 24,000

7. **Stationeries:** \$500 per semester for 2 semesters =\$1000

8. **Total cost for the four years for 5 students=**

$\$(24,000+7500+15000+15000+10000+24000+1000)=\96500.00

This works out to \$19,300.00 per student for four years or

\$4,825.00 per year per student.

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Description:

This program is meant to produce the next generation of mathematicians with PhD degrees. It's been difficult getting the required lecturers with sufficient experience and the necessary academic degrees to teach and supervise PhD students.

It will be run as a regular program for four years. The first year will be dedicated to course work and the other three years to research work leading to the award of the degree.

Over the years students have been sent abroad to pursue PhD degrees through scholarships offered by the Ghana Government. Only a handful of students get this chance, since it is highly competitive due to insufficient funds. This scholarship scheme is virtually non-existent any more due to the economic challenges the country is presently facing.

This proposal seeks to solve this problem by training PhD degree holders for all the universities in Ghana.

Benefits of local training

1. It will reduce the cost of training a PhD student abroad:

Cost of training students will be drastically reduced if training is done locally and the retention rate will be very high. High cost of school fees, boarding and lodging and warm clothing allowance etc. makes training of PhD's abroad very expensive.

2. It will reduce brain drain:

This is because some students have the tendency of remaining abroad after completing their programs thereby defeating the very aim for sending them abroad.

Name of the project: Joint African Conference on the Mathematical Sciences (JACMS)

Main aims of the project

- Establish the largest and most prominent scientific meeting in Africa.
- Provide a forum for fostering links and collaboration among African Mathematical Science researchers, educators and students, and with mathematicians from other parts of the world through the presentation of scientific research, exchange of ideas and the discussion of issues.
- Create deep and sustained systemic interface between African and Global Mathematical Scientists and frontier research.
- Organize and vitalize the broad African Mathematical Sciences communities, celebrate and drive for additional professional accomplishments.
- Bring African Mathematical Sciences to fore, and solidify its role as a linchpin of (regional or global) efforts at developing STEM competencies in Africa.

Location of the project Conference hosting will be rotated by different countries throughout Africa

Target group Mathematical Scientists (researchers, educators and students)

Mathematical field all fields of Mathematics

Current funding (if any) Partial funding being secured for 2016 conference

Necessary funding Estimated budget is \$400,000 per year

Contact Persons

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2) Nkem Khumbah

Founder and Chair, Buea International Conference on the Mathematical Sciences

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Institution and address

(Initial) collaborating partners:

1. The African Mathematical Union (AMU)
2. The Buea International Conference on the Mathematical Sciences
3. The AIMS Network (Next Einstein Initiative)
4. African Mathematics Millennium Science Initiative (AMMSI)
5. National Mathematics Center of Nigeria (NMC)

6. The Association of African Universities (AAU)

7. Association for the Development of Education in Africa (ADEA)

Contact person's address:

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Africa is increasingly and effectively embracing a new era in science and technology, as necessary for developing in-country and continental scientific manpower needed to transform its economies, and enable it contribute to solving the daunting catalogue of internal and trans-border health, energy, development and quality-of-life challenges confronting our globalized society. Indeed, the broad African political leadership has variously situated scientific capacity as a premier continental development priority, and are shifting some of the focus of their development agendas towards improving the continent's Science, Technology, Engineering and Mathematics (STEM) competencies. This shift is reflected in the many in-country specialized scientific research initiatives, regional Centers of Excellence and specialized Universities of Science and Technology, which have been established in the course of the last decade.

The foundation of "STEM" disciplines – indeed, much of 21st century science and engineering-- on

"Mathematical Sciences" means that the boundaries between the mathematical sciences and STEM disciplines are eroding. As that dependence continues to evolve and expand, the mathematical sciences have emerged as the fountainhead for all these disciplines: it underpins and enables advances, both in theory and applications, in these fields. Thus, the long-term success and development impact of STEM initiatives in

Africa –as elsewhere, whatever their specific acronyms and objectives; depend heavily on the vitality of the

African Mathematical Sciences enterprise.

Many mathematical scientists and educators remain unaware of the expanding contours of the contents and role for their field, and this incognizance limits the community's ability to produce broadly trained students, attract more of them to enrich the pool of Africa's mathematical science workforce and conduct frontier research, as well as their ability to advocate and influence impactful development reform.

A 2009 International Mathematical Union (IMU) Report on Mathematics in Africa: Challenges and Opportunities provides detailed and comprehensive overview of the state of the Mathematical Sciences in Africa, with an aim to informing new opportunities for furthering its development. Given the complexities of cross-cutting systemic difficulties, and the commonalities of their operational challenges, the Report concludes that no single individual or institution can offer a solution to these challenges, but that what is needed is more support for those who wish to become mathematical science educators and researchers, and more collaboration amongst institutions and people seeking to make this happen.

Most STEM and Mathematics-specific Initiatives are regional and collaborative in conception and scope, due to the fact that they typically face common funding, material and human

resource challenges; and they ultimately are interdependent and serve the same demographic. While specific African Initiatives enable important concrete developments – at varying levels of impact, the vitality, stature and utility of the enterprise depends on the space it occupies on the regional spectrum of competing interests, policies, respectability, and resource allocation.

Seven leading continental Institutions (above) whose core missions are to advance African Mathematical Science and Higher Education, are coming together to co-organize, co-sponsor and co-own an annual continental Joint African Conference on the Mathematical Sciences series; to collaboratively vitalize and significantly strengthen their enterprise. The conference's conceptual and operational characteristics will be inspired by other major regional conferences, such as the US Joint Mathematics Meetings and Joint Statistical Meetings, the Mathematical Congress of the Americas, the Asian Mathematical Conference, the European Congress of Mathematics.

Each conference will be organized as a major national event in the development of the Mathematical Sciences in the host country. The host organizing committee will further be required and supported to use the two year planning period to conduct an evaluation study, and produce a report on the state of the mathematical Sciences in the country, with specific actionable recommendations for advancing it, within the country's STEM capacity development agenda. The first conference will be hosted by Cameroon in 2015, and the second by Nigeria in 2016.

Name of the project: Malawi Mathematics Capacity Building Strategy

Main aim of the project: To build Malawi human capital in mathematics

Location of the project:

(1) University of Malawi: Chancellor College and Malawi Polytechnic

(2) Mzuzu University

Target group: Undergraduate and MSc (mathematics) students

Mathematical Field: Open to all fields of Mathematics

Current funding (if any): None

Necessary funding:

20.000 Euro per year for 5 years. Of this amount, 10.000 Euro will cater for undergraduate scholarships; 8.000 Euro for postgraduate scholarships and 2.000 Euro will be for career and motivational talks.

Contact person:

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MALAWI

Description: (one page)

The Malawi Mathematics Capacity Building Strategy (MMCBS) is a project designed to build human capital in mathematics in Malawi, thereby developing a cadre of mathematicians who will encourage and promote the study and application of mathematics to solve problems ranging from diseases to hunger.

Malawi faces a challenge in as far as human capital in mathematics is concerned, resulting in students deserting mathematics as a majoring subject. This has inevitably led to a vicious circle in that initiatives to mount postgraduate programmes in mathematics have lacked students. Meanwhile, there is a sudden boom or sprouting of new (public and private) universities who need lecturers or instructors of mathematics, but can't find suitable candidates to recruit. The recently resuscitated MSc (mathematics) programme at Chancellor College for example, has received poor response from would-be students with only 4 students applying in 2012; and 7 in 2013, thanks to IMU through AMMSI for the grant (to the 3 students in the program), that might have encouraged more students to apply. The case is not much different from a similar programme at Mzuzu University, albeit in one area, Cryptography. Project MMCBS aims to encourage excellent students to take and stay in

mathematics as their majoring subject thereby creating a pool of would-be MSc (Mathematics) and MSc (mathematics education) students who, upon graduation, would be ploughed back into the system, with most of them proceeding to do PhDs in Mathematics.

The project will offer scholarships to very promising students from second year on condition that they continue and major in mathematics at third and fourth year. This will take place at the two public universities (University of Malawi and Mzuzu University). The identified students will be tracked and encouraged. Currently, undergraduate students pay subsidized fees of about 1.000 Euro per academic year. This entails that the project will offer 10 undergraduate scholarships per year. Those who will have finished with at least credit passes will be enrolled into the MSc programme at Chancellor College with a possibility of scholarship for those graduating with distinction. Postgraduate (MSc) students pay full fees at about 2.500 Euro per year for two years. The project intends to offer partial scholarships of 2.000 Euro per year. Thus, four MSc scholarships would be offered per year. The project will also involve career and motivational talks to first and second year science students at the above-listed institutions estimated at 2.000 EUR per academic year.

Name of Project: Mathematical Modelling of Biological and Physical Systems.

Main aim of the Project:

Inculcate in our young mathematicians, the art of using mathematics to describe or study real-life systems

Foster mathematical development in Africa by

Arousing the interests in using mathematics to study complex problems in biological and physical systems of African origin

The use of modern techniques such as Mathematica, Mapple, Python, Matlab etc in the study and analysis of complex mathematical expressions

Taking interest in the study of diseases and problems of African interests

Location of the Project:

University of Nigeria, Nsukka, Enugu State, Nigeria (**Nigeria**) or National Mathematical Centre, Federal Capital Territory, Abuja, Nigeria

Target Group: M. Sc. and Ph. D. students of Mathematics and related fields

Mathematical Field:

- Biomathematics
- Mathematical Modelling of physical systems
- Cardiovascular flow-dynamics
- Epidemiological Studies (Models)
- Hydrodynamical flow/Continuum Mechanics

Current Funding (if any): Nil

Necessary funding:

Field studies/ practical surveys	2, 000 Euro
Computers (5), printers(2), printing materials	5,000 Euro
Software packages (Mathematica, Mapple, Python, Matlab, etc)	4, 000 Euro
Instructor's hononarium (about 5 persons for two weeks, including accommodation, transportation and feeding)	7,000 Euro
Feeding and accommodation for the selected candidates For the two weeks duration of the training	2,000 Euro
	Total = 20, 000 Euro

Contact Person:

Professor Godwin Christopher Ezike Mbah (Ph.D) **Leader of the team.**

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Institution and Mailing address:

University of Nigeria, Nsukka, Enugu State, Nigeria

Department of Mathematics, Faculty of Physical Sciences,

University of Nigeria, Nsukka, Enugu State, Nigeria

Description:

Mathematics as we know is the language of Science but not many can readily and easily use it fluently in solving complicated and real-life problems. Many mathematicians are engrossed in solving equations and proving theorems without much attention to the applicability of these theorems and equations to real-life situations. It is intended therefore, that if this project is sponsored and organized for our graduate students, it will to a very large extent expose our young Mathematicians and related disciplines to the current trends in handling many real-life studies using mathematics as the prime tool. The organization of this project will also fulfill the aims of the AMMSI as a distributed network of mathematics research as well as training and promotion of mathematics in Africa.

This program will be expected to last for **two weeks (14 days)**

The scope of distribution of the students will be the entire African continent. However, transportation, which is not included in the estimate, may be problem for students coming from very far countries. Our expectation is that the students will be provided with study materials, given breakfast and then accommodated throughout the training period. The study and instructional materials that will be needed for the training will include softwares like Mathematica, MatLab, MathCard, Python, Mapple etc and other items like projector, Laptop and printers.

For the instructors/ Lecturers, we can readily source them from our Universities in Nigeria and nearby countries. These instructors will be accommodated for their period of involvement in the teaching, fed, paid some honorarium as well as their transportation cost to the venue of the training. We shall require about **Four to five Instructors.**

Possible topics to be covered in the training includes:

Concept of mathematical modeling and functions representing systems

Differential equations: formulations, methods of solutions, stability analysis, numerical and Asymptotic methods of solution. Application of differential equations in system representations.

Homotopy approach to solutions of non-linear differential equations and the subsequent analysis.

Mathematical modeling of real-life biological and physical problems (Practical classes)

Application of fluid dynamics concepts in Cardiovascular flow dynamics and other body fluid flows.

Practical classes to demonstrate the use of the softwares in analyzing results obtained in the modeled problems.

Name of the project (if there is a name): Mentoring African Research in Mathematics (MARM)

Main aim of the project:

The programme aims to help the retention and development of advanced mathematical expertise in Africa by supporting qualified mathematics professionals in situ, whilst at the same time countering a number of problems experienced in Africa including the mathematics 'brain drain', lack of research facilities, small postgraduate classes, limited opportunities for research interaction, and low numbers of qualified staff in different fields of mathematics.

Location of the project:

The project involves partnerships between mathematicians in European universities and mathematicians in African universities. Initially the project was restricted to sub-Saharan Africa, but the most recent round has widened this to include the entire African continent.

Target group:

MARM partners may be academics at any point in their career. Within African universities, the programme is particularly, but not exclusively, focussed on supporting the development of postgraduates, for example through PhD supervision or the development of Masters programmes.

Mathematical Field:

There are no restrictions on the field of mathematics. The programme is willing to consider inter-disciplinary fields, providing there is a strong mathematical content.

Current funding (if any):

The programme recently issued its fourth call for expressions of interest. During this round there is funding available for four partnerships, which will be awarded grants of £10,000 each for a two-year project. The total £40,000 funding is being provided jointly by the London Mathematical Society and the International Mathematical Union as a short-term means of enabling the MARM mentoring partnerships to continue.

Necessary funding:

At present there is no further funding commitment beyond this round. There has been a high level of interest for this round – for the 4 partnerships available 25 UK/European applications and 24 African applications were received – indicating strong demand for further funding. Feedback from the programme has indicated that for partnerships to be most effective the length of partnership should be increased to 3 years and the annual budget to a minimum of £12,000pa or a maximum of £20,000pa. This would allow mentors to spend more time at partner institutions and provide support for further postgraduate scholarships and conferences.

Contact person:

Fiona Nixon, Executive Secretary

fiona.nixon@lms.ac.uk

+4420 7637 3686

Institution and Address:

London Mathematical Society, De Morgan House, 57-58 Russell Square, London, WC1B 4HS, United Kingdom.

Description:

Background

Education in sub-Saharan Africa is characterised by a number of problems, including brain drain, lack of research facilities, small postgraduate classes, limited opportunities for research interaction, and low numbers of qualified staff in different fields. These problems are particularly acute in mathematics. The MARM programme is designed to counter this mathematics 'brain-drain' by supporting qualified mathematics professionals in situ through mentoring relationships between mathematicians in countries with a strong mathematical infrastructure and their African colleagues and students. Its main focus is on cultivating long-term mentoring relations between individual mathematicians and students.

The aim is that these long-term relationships will provide continuing professional links between Africa and centres in the more developed world, providing opportunities and support that will particularly benefit advanced students and young researchers in the mathematical sciences, helping to improve research and graduate education in the longer term. The intention is that the cumulative effect of the support should contribute to the possibility – and relative attractiveness – of contributing one's mathematical expertise at home rather than moving permanently to the developed world.

The programme was set up as a joint venture between the London Mathematical Society (LMS), the International Mathematical Union (IMU), and the African Mathematics Millennium Science Initiative (AMMSI). For the duration the LMS has administered the programme, under a Board of Management comprising representatives from all three organisations plus one mentor. The programme was initially funded by the UK's Nuffield Foundation and Leverhulme Trust, and was originally envisaged as running for two years, from 2006, however the success of the programme has enabled it to continue until the current round, during which funding will be awarded for partnerships starting in 2014.

Programme Achievements

A total of £255,000 has enabled 13 mentoring relationships to have been supported to date through funding for mentoring partnerships and programme administration costs. These partnerships have taken place in 9 countries: Cameroon, Ethiopia, Ghana, Ivory Coast, Kenya, Nigeria, Rwanda, Tanzania and Uganda. Funding from Nuffield and Leverhulme ended in 2012; however the IMU and LMS have each contributed £20,000 to continue the programme for an additional four partnerships while further funding is actively sought.

MARM aims to build infrastructure and networking in mathematics in Africa. Other than requiring partners to undertake visits to each other's institutions, there is no prescribed

definition of what a partnership should entail; rather the programme encourages each side of the partnership to collaborate to define what is needed from the relationship and what can be offered. Applicants may apply to the programme to set up a partnership with a specific institution, or they may express an interest in working in a particular mathematical field or geographical area and be matched to an African institution with similar interests.

As well as the reciprocal visits, the 13 mentoring relationships that have now successfully concluded have undertaken a wide variety of different activities, including: joint research projects, the production of joint papers, the joint supervision of 15 African MSc students and 17 PhD students, funding of graduate student fellowships, redesigned curricula and Masters programmes, improved access to online resources and provision of textbooks, visiting lectureships and workshops, support for mathematical conferences, and improvements to departmental structuring, vision and strategy.

High-level outcomes from the programme have included the first Kenyatta University International Mathematics Conference in 2011, involving 100 participants from 19 different countries, for which MARM played a crucial role (a second conference was held in June 2013), and the formation of the National Institute of Mathematical Sciences (NIMS) at the Kwame Nkrumah University of Science and Technology (KNUST) in Ghana, attracting extensive funding from Petroleum Geo-Services (PGS), an oil resourcing company in Norway, through the involvement of the Norwegian Academy of Science and Letters and the Niels Henrik Abel Memorial Fund in Oslo. This leveraging of sponsorship to fund mathematics facilities at KNUST has been attributed in part to the MARM partnership between KNUST and the University of Leicester.

New sponsors are now sought to expand and develop the current mentoring programme.

MENTORING AFRICAN YOUTH IN MATHEMATICS AND MATHEMATICAL SCIENCES (MAYIMMS)

NAME OF THE PROJECT: Mentoring African Youth in Mathematics and Mathematical Sciences (MAYIMMS).

MAIN AIM OF THE PROJECT: Mentor the future generation to take up education, research and careers in Mathematics and Mathematical Sciences through mentoring summer schools.

LOCATION OF THE PROJECT: Uganda

TARGET GROUP: High School children (100 Ugandans, 50 Non-Ugandans of which 75% shall be female and 25% male). The 50 Non-Ugandans will come from Kenya, Tanzania, Rwanda, Burundi and South Sudan.

MATHEMATICAL FIELD: Both Pure and Applied mathematics.

CURRENT FUNDING: None (new project)

NECESSARY FUNDING (indicative): **USD174,360** per summer school [100 locals x \$800=80,000; 50 foreigners x \$1250=62,500; 6 mentors x

\$2850=17,100, Venue \$2,000; Airport transfers \$2,000; Insurance \$3,000;

Gender incentive 113 females x \$20=2,260; Director of school \$3,000; Deputy

\$1,500; Administrator \$1,000]. The indicative figures cover travel, accommodation, meals and insurance. The female participants will be given an extra out of pocket to cater for their special needs.

DURATION: 5 years (USD174,360 x 5=USD871,800)

CONTACT PERSON: Juma Kasozi, PhD

INSTITUTION AND ADDRESS: Department of Mathematics, School of Physical Sciences, College of Natural Sciences, Makerere University, P.O. Box 7062, Kampala, UGANDA.

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PROJECT DESCRIPTION:

Summer Schools have been so instrumental in popularizing and demystifying Mathematics and Mathematical Sciences in the world. We therefore intend to use the same mode to increase on the number of students joining Mathematics and Mathematical Sciences at the University. There is increased shortage of students doing Mathematics and Mathematical Sciences disciplines at University. This challenge is not only faced at Makerere University but in the region that comprises Uganda, Kenya, Tanzania, Rwanda, South Sudan and Burundi. There are more countries faced with this challenge but for the start, it is proposed that countries within affordable travelling costs to Makerere University, Uganda would be included in the start with possibilities of self financing from other countries which can afford to send the youth to Uganda. The students from outside Uganda will be identified by project contact persons in those countries. The full proposal will have the names and details.

I have had the opportunity to be part of the East African Universities Mathematics Programme, South Africa Mathematical Sciences Association, Uganda Mathematical Society, NOMA MSc programme based at University of Dar es Salaam and other initiatives. In many of the meetings in these initiatives, this challenge has been echoed but no steps have been taken to address it. Several researches continue to lament the decreasing number of students joining mathematics and science at university. To mention, the NOMA MSc programme wanted to recruit 50% female and 50% male students but this was not possible because the women in mathematics and science were not available to match the demand. Also, at Makerere University, there is a female scholarship project where the scholarships are 75% for female in science disciplines but on many occasions, the female are not there to take up the scholarships. Uganda

Mathematical Society organizes the annual Mathematics contest at all levels of education in Uganda. Many students have excelled in the contest but a follow up of these talented children reveals that most of them do not continue with Mathematics or mathematical sciences disciplines. When interviewed, they claim that there are no applications of mathematics and hence, end up in other careers. They realize later that they should have taken up studies in Mathematics and Mathematical Sciences.

We can no longer sit in our offices at the university and wait, hoping that a miracle will happen. We therefore propose a project in which we will mentor the youth to undertake mathematics since it is the building block of Science, Technology and Innovations. We will identify, recruit, mentor and follow up talented/gifted/outstanding youth with an aim of helping them to exploit their gift to the full. The recruited children shall attend the annual mentoring summer schools at which various activities will be undertaken for example: mentoring talks, current affairs, applications of mathematics in industry and real life, careers for mathematics students, mathematical modeling projects. We shall maintain a 75% female youth and 25% male youth at each 10 day annual mentoring school. The mentors will be provided by the funders and others shall be carefully identified within Africa and only those who qualify as role models in Mathematics and Science shall be utilised. We shall also use this opportunity to promote international linkage between like individuals with the mentored youth in Uganda.

Name of the project: Promoting Mathematics among African Girls and Women

Main aim of the project:

The project is intended to address the aforementioned problem by helping to bridge the gender gap in mathematics within the continent of Africa.

The objectives of this initiative are:

1. to encourage and empower girls and women to study, and to have active careers in, the mathematical sciences
2. to promote equal opportunity for girls and women in the mathematical sciences
3. to promote equal treatment of girls and women in the mathematical sciences
4. to nurture/accelerate the growth of world-class female mathematicians in Africa

Location of the project: THROUGHOUT AFRICA

Target group: African girls and women

Mathematical field: Gender gap in mathematics within the continent of Africa.

Current funding (if any): No fund available currently

Necessary funding:

· Grand Total for the three Years (2015, 2016, 2017): \$1,550,000

To cover the expenses for 40 participating countries (people, international travel, accommodation and Meals, scholarships, other expenses) for a period of 20 days per year (Arrival and departure: 2 days, Training Camp:14 days of training, Pan African Mathematics Olympiad for Girls (PAMOG): 4 days)

· Details:

Year 2015: \$350,000.

Year 2016: \$600,000 (including 50 scholarships for top Grade 12 students: \$5,000 x 50=\$250,000)

Year 2017: \$600,000 (including 50 scholarships for top Grade 12 students: \$5,000 x 50=\$250,000)

· Deliverables (2015-2017)

1. Produce 480 well-trained and well-motivated high school girls in mathematics
2. Give 100 undergraduate scholarships to talented high school (Grade 12) girls
3. Organize 3 Pan African Mathematics Olympiad for Girls (PAMOG2015, PAMOG2016, PAMOG2017)
4. Organize 10 training and career development workshops for girls
5. Organize 4 undergraduate and graduate research conferences for females
6. Support 200 females to attend research conferences

7. Conduct 10 outreach activities to high schools in Africa
8. Mentor 100 girls in mathematics programs in universities leading to the award of PhD
9. Produce 100 female graduates of mathematics

Contact Person : Prof. Adewale Solarin, Project leader , African Mathematical Union President, Director of the National Mathematical Centre NMC, Abuja, Nigeria

Email address: director@nmcabuja.org or asolarin2002@yahoo.com Tel: +234(0)8172234901

Institution and address : National Mathematical Centre (NMC), Abuja, Nigeria.

Description :

Background :The continent of Africa, blessed with enormous natural and human resources, is currently striving to achieve the much-needed socio-economic growth via excellence in science and technology. At the heart of science and technology is mathematics. Without effective training and research in the mathematical sciences, Africa will be unable to build the knowledge-base and capacity needed to help the continent achieve the much-needed sustainable socio-economic growth. Unfortunately, however, women, who constitute at least half of the African population, are grossly under-represented in the study (and careers) in mathematics. It is estimated that less than 20% of undergraduate students that enrol into African universities every year are women (and only a small percentage of this choose mathematics as a major). There is also the problem of substantial drop out among girls at the secondary school level, due to factors such as socio-cultural (e.g., early marriage), financial reasons, institutional barriers and poor performance of girls. These constitute an urgent problem, which clearly poses a threat to Africa's quest for sustainable socio-economic growth.

This proposal, is intended to address the aforementioned problem by helping to bridge the gender gap in mathematics within the continent of Africa.

Objectives: The objectives of this initiative are:

- to encourage and empower girls and women to study, and to have active careers in, the mathematical sciences
- to promote equal opportunity for girls and women in the mathematical sciences
- to promote equal treatment of girls and women in the mathematical sciences
- to nurture/accelerate the growth of world-class female mathematicians in Africa

Strategies for success: In order to achieve the above objectives, the African Mathematical Union (AMU) should establish a Committee on Enhancing the Enrolment of African Girls and Women into Mathematics programs at schools and universities. The Committee shall be tasked, primarily, with organizing and administering the training, research and outreach programs like:

- Training camps for high school girls (in Grades 10, 11 and 12), for a two-week period annually. Top students will be given prizes. In particular, the top Grades 10 and 11 students will be invited for the next year's training camp, and the best Grade 12 girls will be given scholarships to study mathematics at an African university.
- Workshops for high school girls and undergraduate students to share ideas on undergraduate mathematics and how to prepare for such
- Research workshops and conferences for women in mathematics. As well as Seminar series for top women mathematicians to inspire girls and women in African high schools and universities.
- Workshops on careers in mathematics (aimed at providing an effective career guidance/counselling to female mathematicians).

The Committee shall be tasked also in Conducting outreach activities to primary and secondary schools to encourage girls to study mathematics and to partake in prestigious competitions, such as PAMO (Pan African Mathematics Olympiad), IMO (International Mathematical Olympiad) , and in Assisting high school girls to find suitable universities for postgraduate programs.

Justification for support of the project:

Activities : The breakdown of main activities, over a 3-year period, is itemized below:

Year 1: i) Summer-August 2015: First training camp (First Group) & 1st PAMOG (Pan-African Mathematics Olympiad for Girls). Number of participants: 160 high school students (80 Grade 10; 80 Grade 11)

ii) Research workshops and outreach/mentoring activities

Year 2: i) April, July 2016: PAMO/IMO 2016 (for PAMO 2016, the schedule depends on the host country)

ii) August 2016: Second training camp and 2nd PAMOG. Number of participants: 160 (40 new students from Grade 10; 60 Grade 11 students selected from TC 2015; 60 Grade 12 students selected from TC 2015)

iii) September 2016: Enrolment into undergraduate programs in universities for the Grade 11 students who participated in the second training camp

iv) Research workshops (for undergraduate and postgraduate students) and outreach activities

Year 3: i) June/July 2017: PAMO/IMO 2017 (PAMO 2017 will be held in conjunction with PACOM 2017) ii) August 2017: Third training camp and 3rd PAMOG. Number of participants: 160 (60 new Grade 10 students; 40 students selected from TC 2016 Grade 10; 60 students selected from TC 2016 Grade 11)

iii) September 2017: Enrolment for successful girls into undergraduate programs for the Grade 10 girls who attended the first, second and third training camps, and the Grade 11 girls who attended the second and third training camps.

Name of the project: Reinforcing Mathematics PhD training in Burkina.

Main aim of the project: Foster mathematical capacity building in Burkina, by PhD training of Students. Activities are focused on sustaining doctoral courses and making fellowships available for PhD students.

The overall objective of this project is to strengthen existing local research groups and create a critical mass of active researchers necessary to the development of mathematical research related to development issues in Burkina.

This is to establish a program of research training through fellowships, masters' internships, sustain scientific visits in PhD training and support doctoral training in Bobo Dioulasso and Ouagadougou University.

Location of the Project: Département de Mathématiques, UFR Sciences Exactes et Appliquées ; Université de Ouagadougou, BURKINA FASO.

Target group: Master and PhD Students in Mathematics from Bobo Dioulasso and Ouagadougou universities in Burkina Faso.

Mathematical Field: Open to all fields of Mathematics

Current funding (if any): This is a new project not actually funded.

Necessary funding: 20.000 Euro per year

South-South teaching mission: duration of the stay 14 days, hosting 35,000 F CFA / d (supported by the host university), daily allowance 35 000 F CFA / d and 450 000 FCFA Francs for travelling. This makes a total of 940 000 FCFA or approximately € 1,400 per teaching mission, 3 times giving a total amount of 4200€ .

North-South teaching mission: stay 14 days, hosting 35,000 F CFA / d (supported by the host university), daily allowance 35 000 F CFA /d is a total of 490 000 FCFA, 700 000 CFA Francs for travelling. This makes a total of 1,190,000 FCFA or approximately 1800 € by educational mission, 3 times giving a total amount of 5400 €.

South-South research visits for PhD student: stay two month, scholarship 300 000 CFA francs per month, transportation 450 000 CFA francs, which makes a total of 1050 000 CFA francs. This is approximately 1 600 € by PhD student visit within the region, 2 times giving a total amount of 3200 €.

Three (3) fellowships will be awarded to PhD students especially to women, to support their PhD training. An annual scholarships is about 2500€ times giving a total amount of 7500 €.

Person to contact: Pr Hamidou TOURE, toureh98@gmail.com

Institution and Address: UFR/SEA Sciences Exactes et Appliquées

Université de Ouagadougou, 03 BP 7021 Ouagadougou 03, Burkina Faso.

Description:

The project aims to achieve the following specific objectives:

- Develop relationships between researchers in mathematics from Burkina and those of the region, working in the application of mathematics to development issues and maintaining close links with the international scientific community.
- Establish a program of research training through fellowships, masters' internships and scientific visits from the region and outside.
- Build PhD students capacity by supporting doctoral course and increasing doctoral programs;
- Support the organization of regular doctoral involving all PhD students in mathematics from the country.

The ultimate goal of this program is to create a critical mass of researchers in the field of mathematics. These researchers will contribute with their training and research activities to provide policy makers, men and women endowed with scientific expertise in their areas, as well as decision support tools that enable them to base their decisions on science.

Students will be trained to master and doctoral level in different areas of mathematics, mainly in Algebra, Differential Geometry, Probability and Statistics, Convex Analysis, Partial differential equations and Mathematical Modeling. Scientific publications of international standard will be produced by researchers and graduate students. They will be available to the scientific community in specialized journals.

This mobility will involve doctoral training courses and research activities in the context of co-supervision PhD. The aim is to train PhD students in Sandwich programs with co-supervisor from the region or from Europe. It will also enable doctoral students to visit their supervisor abroad during research visits. It will organize teaching and research visits from experts in various fields in Burkina universities.

The expected outcome of the project is an increase in the number of PhD theses, an increased mobility of PhD students and scientific production, scientific promotion of mathematicians from Burkina universities.

Concept Paper for Fostering Pure and Applied Mathematics in Sub-Sahara Africa

Name of the project: Research and Graduate Studies in Mathematics and its

Applications: A Network Approach

Main Aim of the project: The aim of the project is, in general, to promote Mathematics Education and, in particular, to enhance the quality of teaching and learning, and high quality research in all areas of Mathematics in Sub-Sahara Africa.

Location of the project: Our project is centred at the University of Botswana, Department of Mathematics, with training nodes at the universities of Stellenbosch (South Africa), Namibia, Zambia, Malawi, Kwazulu Natal (South Africa), Addis Ababa (Ethiopia) and NUST (Zimbabwe).

Target Group: The project will provide a platform for experienced teachers and researchers in Sub-Sahara Africa region to coordinate their efforts in training PhD candidates in Pure and Applied Mathematics.

Currently funding: Our project is supported by the Simmons Foundation. The Foundation provides \$80,000.00 per year for 5 years (from Jan 2013-Dec 2017) which will be extended for some more years based upon our achievement. This level of funding allows for four students to be enrolled in 2013 and supported up to the year 2017. It lacks continuity in enrolment.

Necessary funding: An increase of \$80,000 per year would enable us to have a continuous enrolment PhD program where two PhD students will be enrolled each year.

Contact Person: Prof Edward M. Lungu, Department of Mathematics, University of Botswana, Pvt. Bag, 00704, email: lunguliz@gmail.com Telephones: +267 3552132 (Office), +267 395 6697 (Home), +267 71216767 (Mobile)

Brief description: Sub-Sahara Africa faces many challenges among them economic poverty, knowledge poverty, human diseases such as HIV/AIDS, Malaria, diarrhoea, plant and animal diseases. Malaria and diarrhoea are responsible for over 50% of children deaths under the age of five, while plant diseases compounded by frequent droughts have resulted in low crop yields and consequently poor nutrition for many residents of sub-Sahara Africa.

Sub-Sahara Africa Universities lack skilled human resource to train candidates at Msc and Ph.D level who can teach at higher institutions and conduct research on the existing problems of Africa. Most of the staff of sub-Sahara universities are master's degree holders but they are forced to teach courses at master's level. The staffing situation will continue to be bad for the foreseeable future, a situation which has resulted in teaching a narrow range of courses. To increase the pool of skilled human resource and reduce the brain drain, we believe that the candidates should be trained within the region where their skills are already scarce.

A group of universities in Southern Africa, under the auspice of the Southern Africa Mathematical Sciences Association (SAMSA) are working hard to address the shortage of skilled human resource and low research output in the Mathematical Sciences through a regional network approach which optimizes the sharing and use of available skilled human and physical resources to sustain the limited training programs.

The first training program in Southern Africa was a joint initiative between SAMSA and NUFU, a Norwegian funding agency. This regional program in Mathematical modelling ran from 1996 to 2004 and produced 150 MSC graduates and 25 PhD graduates, all of whom are professors in the various universities of Southern Africa.

The current program, "Research and Graduate Studies in Mathematics and its Applications: A Network Approach", centred at the University of Botswana, is a joint initiative between the Simmons Foundation and a number of researchers in Southern Africa. The program is designed to train students in many Sub-Saharan Africa universities at PhD level who can teach at higher institutions and conduct research related to social problems in the region. This program has enrolled 4 PhD full time students and three MSC students. The first phase of the program (2013-2018) has targeted to produce 8-10 PhD and 12-15 MSC graduates. These targets have been determined by the current level of funding and may not alter the staff shortages as this number only replaces the retirees.

The problem of upgrading many university teachers currently at MSC level to PhD level remains a daunting task requiring external assistance. The upgrade project would have the effect of improving the quality and effectiveness of teaching and learning, and research. The infrastructure at the University of Botswana and the other training nodes has the capacity to enrol 10 PhD and 20 MSC students each year. Our project in its envisaged form will make a significant contribution towards fulfilling this goal.

This potential has not been fully realized because funding for student training at MSC and PhD levels receives low priority from governments in the region. Yet with increased funding for graduate training and research a number of activities planned under the Bill/Melinda Gates Foundation initiative such as malaria and HIV/AIDS treatment benefits and the NEPAD initiative on Science and Technology etc for sub-Sahara Africa can be undertaken by the local institutions. Analyzing large data sets for HIV/AIDS agencies in the region can be implemented at lower cost and at the same time make a contribution to the development of necessary skills for these countries. To undertake this task, a multi-disciplinary approach involving Pure and Applied Mathematics especially the use of new developments in Pure Mathematics would be required.

If we were to prioritize the needs of our region, we would place PhD. trainings under active research groups first as this would have the dual effect of enhancing quality of teaching and learning, research, and increasing the number of researchers and professors.