REPORT on AMUCWMA activities

2009-2017

Executive Summary

The African Mathematical Union Commission on Women in Mathematics in Africa (AMUCWMA), established in 1986, works to promote women's participation in mathematical sciences across Africa. Its objectives include encouraging girls to study mathematics, supporting women's careers, and creating resources for African women mathematicians.

Between 2009 and 2017, AMUCWMA organized regional workshops and networking initiatives to address the severe underrepresentation of women in mathematics. These workshops revealed persistent challenges such as socio-cultural barriers, lack of role models, and limited institutional support. A major outcome of these discussions was the recognition that a **formal, continent-wide organization was needed to unify efforts, provide visibility, and advocate for African women mathematicians**. Also an autonomous association, governed by its own rules, can more readily seek funding and establish collaborations with similar organizations. In contrast, a commission operating under the umbrella of a larger body faces greater complexity, as it must adhere to the overarching regulations of that organization.

As a result, the **African Women in Mathematics Association (AWMA)** was created during the 2013 Cape Town workshop. AWMA was established to:

- Coordinate activities promoting women in mathematics across Africa.
- Serve as a platform for networking, mentorship, and collaboration.
- Link African women mathematicians to global organizations such as IMU and EWM.
- Advocate for gender equity and provide role models for young girls.

Since its creation, AWMA has launched national associations in several countries, developed a database of over 300 women mathematicians, and actively participated in international forums. It collaborates with organizations like IMU, CIMPA, UNESCO, and AIMS to organize workshops, outreach programs, and research initiatives.

Despite progress, challenges remain: financial constraints, cultural barriers, lack of institutional support, and gender discrimination. AWMA's future plans include expanding its database, publishing role-model booklets, and organizing more scientific events to inspire and support women in mathematics.

The creation of AWMA marked a turning point in the movement to promote African women mathematicians, transforming isolated efforts into a structured, continent-wide network with global recognition.

Introduction

The African Mathematical Union Commission on Women in Mathematics in Africa (AMUCWMA) is a commission of the African Mathematical Union (AMU) and was founded in 1986. Its aims and objectives are:

1. To create activities and programs to encourage women to study and engage a career in Mathematical Sciences.
2. To encourage young girls all over Africa to gain more interest in Mathematics.
3. To create a directory of African Women in Mathematics and to regularly update it.
4. To commission studies on various topics on Women in Mathematics in Africa.
5. To partner with other organizations with similar objectives.

The Members of AMUCWMA in 1986 were

- Prof. Grace Alele Williams, Nigeria , AMUCWMA Chairperson,
- Dr Verdiana Masanja ,Tanzania, AMUCWMA secretary,
- Prof. Josephine Guidy-Wandja, Ivory Coast, member,
- Prof. Noufissa Mikou, Morocco, member,
- Prof. Laila Abdel-Lai, Tunisia, member,
- Dr. Pauline Fotso, Cameroon, member.

This commission organized a symposium entitled: “Mathematics Education of Women in Africa - Problems and Prospects”. This symposium took place at the University of Benin, Benin City, Nigeria in November from the 27^{th} to the 30^{th} , 1990.

Since AMUCWMA is a commission of AMU, its executive board is renewed every four years during the General Assembly meeting of the Pan African Congress Of Mathematicians (PACOM).

- In 2009, AMU General Assembly meeting took place in Yamoussoukro, Ivory Coast, on August 2, 2009 during PACOM 2009 and elected Prof. Marie Françoise Ouedraogo from Burkina Faso as chairperson of AMUCWMA and Prof. Sibusisu Moyo from Zambia as secretary for the period of time 2009-2013.
- In 2013, AMU General Assembly meeting took place in Abuja, Nigeria, on the 30th June 2013. Several delegates from various countries in Africa participated to this meeting. During this meeting Prof. Marie Françoise Ouedraogo and Prof. Sibusisu Moyo mandates were renewed for the period of time 2013-2017.

I. Program of AMUCWMA from 2009 to 2017

During their two mandates, 2009-2013 and 2013-2017, the executive board of AMUCWMA enlisted some activities to promote African women mathematicians. These are

1. The organization of a two-days workshop for African women mathematicians in each region of Africa (North Africa, West Africa, Central Africa, East Africa, Southern Africa). The idea is to provide an opportunity for African women mathematicians (including female PhD students) to meet regularly.
2. The creation of a mailing-list of all African women mathematicians. The goal is to keep in touch with them and to regularly bring them together to discuss and exchange information and ideas, and also to be able to organize scientific activities together.
3. The setting up of a brochure of role models of African women mathematicians to encourage not only girls to engage a career in mathematics, but also those who are already mathematicians and who need to progress by learning from others female colleagues experiences.

II. The Organization of Workshops in Various Parts of Africa

In view of the small percentage of women mathematicians in Africa, particularly in Sub-Saharan Africa, it was very important and even urgent to initiate actions to help redress the gender balance in the region. Within the framework of promoting mathematics and women mathematicians in Africa, the African Mathematical Union, through its commission on women and mathematics in Africa (AMUCWMA), and the International Centre of Pure and Applied Mathematics (CIMPA) have initiated several scientific projects. Their goal is to organize a workshop for women each year right before a CIMPA School. This kind of workshop has many objectives among them, to

give an opportunity to African women mathematicians (including female PhD students) to meet regularly and to allow them to attend the CIMPA School in the hope that this will improve the rate of participation of women and girls to CIMPA Schools.

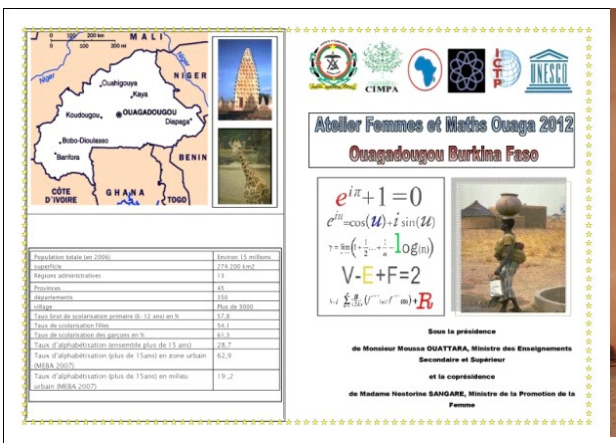
1.First workshop of AMUCWMA: Women in Mathematics Ouaga 2012, Burkina Faso

The first workshop in the series of workshops jointly organized by AMUCWMA and CIMPA, was held at the University of Ouagadougou, Burkina Faso (West Africa) between October 26 and October 27, 2012. It took place two days before the CIMPA School which held at the University of Bobo Dioulasso, Burkina Faso, from October 29 to November 9, 2012. The theme of the CIMPA school was : “Discrete mathematics, combinatorics, dynamic and algorithmic aspects”.

More than seventy (70) people attended this workshop with at least forty (40) of them being women from Benin, Burkina Faso, Congo Brazzaville, Congo Kinshasa, Ethiopia, France, Ghana, Ivory Coast, Kenya, Madagascar, Malawi, Mali, Morocco, Mozambique, Nigeria, Peru, Senegal, Tanzania, and Zimbabwe. The activities of the workshop included:

- Five (5) lectures on divers topics.
- Five (5) lectures of young participants presenting their research.
- A panel on the situation of African women mathematicians.

The panel identified many factors hindering the promotion of women in mathematics such as socio-cultural stereotypes and habits, lack of confidence of men in the capacities of women, low number of female students in mathematics, lack of opportunities in Africa after mathematical studies and lack of role models. Some possible ways to improve this situation were also suggested.



2.Second Workshop of AMUCWMA: Mathematics of the Planet Earth and Network Activities, 17th to 19th July, Cape Town 2013, South Africa

This workshop was a follow-up workshop to the one held at the University of Ouagadougou on October 2012, under the auspices of AMUCWMA and CIMPA. It hold in the fringe of the CIMPA school "Evolutionary equations with applications in natural sciences" from July 22 to August 02, 2013 at AIMS Cape Town.

The main objective of this workshop was to bring together women from many countries within the African continent to a workshop on Mathematics with the possibility of presenting their research work, discuss the situation and status of women in mathematics in their respective countries and to form a 'Round Table' discussion on the creation of the Association of African Women Mathematicians as well as updating the data on African Women in Mathematical Sciences as recommandated at the workshop of Ouagadougou. The workshop attracted 42 attendees from at least 17 African countries: Algeria, Benin, Burkina Faso, Cameroon, Ivory Coast, DRC Congo, Ethiopia, France, Ghana, Kenya, Malawi, Morocco, Mozambique, Nigeria, Senegal, Sudan, South Africa, Tanzania, Uganda, and Zimbabwe.

The activities of this workshop include:

- Ten (10) lectures on divers topics.
- Fourteen (14) talks of young participants about their research.
- Two (2) panels discussion on the creation of African Women in Mathematics Association.

During the Round Table discussion the African Women in Mathematics Association (AWMA) constitution was adopted to form the AWMA 2013 with the main purpose: "*The promotion of women in mathematics in Africa and Promotion of mathematics among young girls and women in Africa*". The following category of members have been elected as officers of AWMA:
President: Marie-Francoise Ouedraogo (Burkina Faso)
Vice President - West Africa: Joséphine Guigy-Wandja (Côte D'Ivoire)
Vice President - Central Africa: Rebecca Walo Omana (D.R. Congo)
Vice President - North Africa: Schehrazad Selmane (Algeria)
Vice President - East Africa : Yirgalem Tsegaye (Ethiopia)
Vice President - Southern Africa - (To be co-opted)
Secretary: Senelani Dorothy Hove-Musekwa (Zimbabwe)
Vice Secretary: Winniefred Mutuku (South Africa/Kenya)
Treasurer: Fagueye Ndiaye (Senegal)
Publicist Secrtary: Milaine Sergine Seuneu Tchmaga (South Africa – Southern Africa)

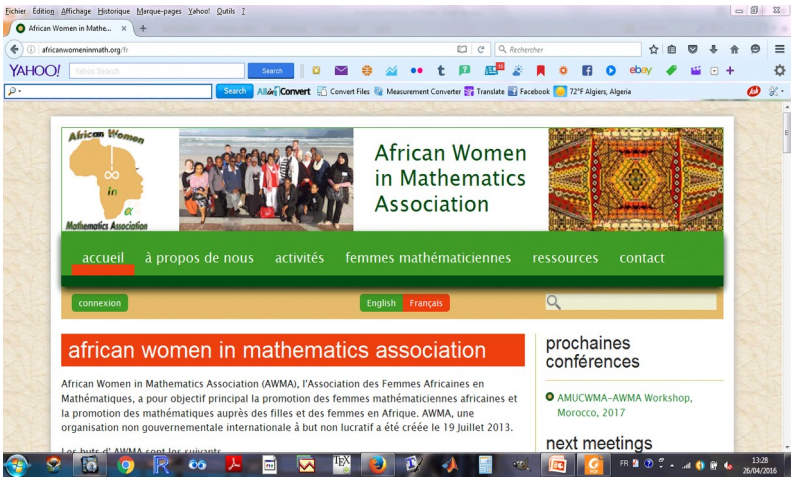
3. Third Workshop of AMUCWMA/AWMA: Naivasha 2015, Kenya,

This workshop of African women mathematicians held on the 16th -18th July 2015 at Lake Naivasha Panorama Park, Naivasha, Kenya with theme “Women in Mathematics for Social Change and Sustainable Livelihoods”. It was a follow-up of the series of workshops jointly organized by AMUCWMA and CIMPA. As already mentioned, the first workshop held in Ouagadougou (Burkina Faso), 26–27 October 2012, and the second took place at the African Institute of Mathematical Sciences (AIMS), Cape Town, 17 – 19 July 2013. It hold in the fringe of the CIMPA School “Mathematical Modeling and analysis of complex systems”, 20-31 July

This workshop was also the first workshop jointly organized by AWMA and AMUCWMA. The main objectives of this workshop was to bring together women from several countries within Africa to a platform where they can present their research work, exchange experiences and discuss initiatives that promote Mathematics with the aim of addressing social changes and creating sustainable livelihoods. The workshop also aimed to advance the association's agenda of first and foremost, promoting mathematics and women mathematicians in Africa, and secondly giving young women in science and mathematics the opportunity to meet role models and other professional women who have successfully pursued scientific and mathematical oriented careers. There were plenary sessions from invited speakers representing various African regions as well as experts from other continents to address and facilitate specific topics of the workshop. The workshop attracted 43 participants from at least 17 African countries: Algeria, Burkina Faso, Cameroon, Ivory coast , DRC Congo, France, Gabon, Ghana, Kenya, Morocco, Nigeria, Senegal, South Africa, Tanzania, Uganda, Tunisia, Zimbabwe. The event had four principal components:

- Scientific lectures by renowned mathematicians in their research area,
- Lectures on women mathematicians situation in Africa,
- Scientific presentations of research works of some participants,
- The first General Assembly of AWMA since its establishment in 2013.

This first General Assembly (GA) of AWMA took place after all the talks. It had multiple aims but the main one was to approve the report of the activities of AWMA in the period 2013-2015 and to adopt the logo and the website of the association. In conformity with the constitution, the General Assembly was announced in the flyer of the workshop few months before the starting of the workshop and the report was sent out to members for electronic vote, some days before the beginning of the workshop. The report was also posted in the website. Since the General Assembly was precedented a day before by a forum discussion and the main points of the agenda being already identified, we focused on the predefined items and addressed them all. Since that day, AWMA has its report and possesses an official logo and a website .



4. Fourth workshop of AMUCWMA/AWMA: W-PACOM 2017, Women in Mathematics for the social development of Africa, Rabat 2017, Morocco

The African Mathematical Union Commission on Women in Mathematics in Africa (AMUCWMA) and the African Women in Mathematics Association (AWMA) organized the AMUCWMA - AWMA Workshop 2017 (W-PACOM 2017) held on the 6th -7th July 2017 at the International university of Rabat (IUR). This Workshop was a satellite conference of the 9th Pan African Congress of Mathematicians which took place also in Rabat, Morocco but from the 3rd to the 7th July 2017. W-PACOM 2017 was based on the theme "Women in Mathematics for the social development of Africa". This workshop follows the series of workshops that we organized previously. That is, as already mentioned, the first one happened at the University of Ouagadougou (Burkina Faso), 26th – 27th October 2012; the second one was at the African Institute of Mathematical Sciences (AIMS), Cape Town, (South Africa), 17 – 19 of July 2013; and the third one held in Naivasha, Kenya, 16 – 18 of July 2015. The workshop had the following main components:

- Scientific lectures by renowned mathematicians in their area of research,
- Scientific presentations of the work of some participants,
- A discussion on AWMA and the Committee of Women in Mathematics (CWM) of the International Mathematician Union (IMU).

It aimed to bring together African women mathematicians from the African continent to advance the association's agenda to promote mathematics and women mathematicians in Africa. The workshop gave young women, as well as men, in science and mathematics the opportunity to meet role models and other professional women who have successfully pursued scientific and mathematical oriented careers. It was intended for

- African women mathematicians;
- Doctoral students;
- Faculty members;
- All those who are interested in mathematics.

The workshop attracted 54 participants from at least 11 African Countries including Algeria, Angola, Benin, Burkina Faso, Cameroon, France, Morocco, Nigeria, Portugal, Senegal, Spain, Tanzania, Tunisia, and Zimbabwe.

III. Creation of AWMA and some National Associations

Among the suggestions pointed out at the first workshop Ouaga2012, some of them include

- ✔ To create an «African Association for Women in Mathematics» and to link it to similar organizations in the world such as the European Women in Mathematics (EWM), the Association for Women in Mathematics in the USA (AWM), the association Women in Mathematics in India, and African institutions such as AMU and the African Union,
- ✔ To set up national or regional coordinators, a mailing list and a website,
- ✔ To print a booklet in several languages promoting African women in mathematics and disseminating their realizations so that they can be used as role models,
- ✔ To advertise the network among the African mathematical community, particularly during the round-table discussion that would be organized during the following PACOM in Nigeria (2013),
- ✔ To organize at least every two years similar workshops to Ouaga2012 in different parts of Africa before other scientific events. For instance, in 2013, the

workshop had taken place in southern Africa before the CIMPA school in South Africa.

- ✔ To set up or reinforce active regional institutions in every part of Africa by, for instance, creating a UNESCO chair «Women and Mathematics» in Ouagadougou in western Africa in coordination with the existing initiatives «gender» in that region.

These recommendations expressed by women mathematicians completed the program of AMUCWMA. Their executions started with the creation of AWMA in 2013 during the workshop of Cape Town with the sole purpose of promoting mathematics and the network of women mathematicians in Africa. Other reasons that contributed to the creation of AWMA include the fact that Also an autonomous association, governed by its own rules, can more readily seek funding and establish collaborations with similar organizations. In contrast, a commission operating under the umbrella of a larger body faces greater complexity, as it must adhere to the overarching regulations of that organization. The activities of AWMA include research workshops, outreach for high school students as well as undergraduate and graduate students. AWMA has a website http://www.africanwomeninmath.org, funded by the IMU Committee on Women In Mathematics and a logo. As already mentioned, they were adopted during the first General Assembly at the workshop of Naivasha in Kenya. Since 2013, AMUCWMA and AWMA jointly conduct the program of activities initiated for African women mathematicians. There is also a network on google: awmassoc https://groups.google.com/forum/?hl=en-GB#!forum/awmassoc

Several national associations have been created since then.

- The Association of Nigerian Women in Mathematics (NWM, 2014).
- The Kenya Women in Mathematical Sciences Association (KWIMSA, 2014).
- The Tunisian Women Mathematicians Association (TWMA, 2015).
- l' Association de Jeunes Filles en Mathématiques (AJFM, 2015) or The Association of Young female students in Mathematics.
- The Senegalese Women In Mathematics Association (SWMA, 2015).
- The Cameroon Women in Mathematics Association (CAWOMA, 2016).
- The Moroccan Association of Women & Mathematics (AMAFEM, 2017)

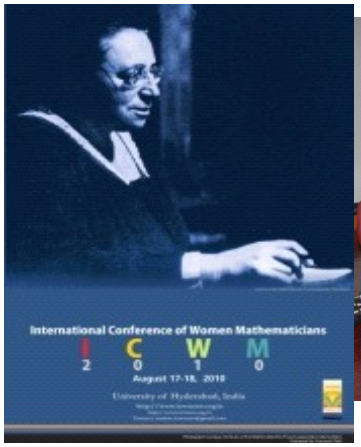
A regional meeting took place in 2016 in Senegal on July from the 8th to the 9th at AIMS-M'Bour, in Senegal. It was organized by the West African branch of AWMA. The

2016 AWMA/West African Forum aimed at bringing together African Women mathematicians from the West Africa region to advance the Association's Agenda of promoting mathematics and women mathematicians in West Africa. There were 28 participants from 9 countries. Among them were three Ph.D students.

IV. Participation in international meetings and committees

African women mathematicians and AWMA, were invited to participate in some events about women mathematicians. We have

2010: Participation in ICWM (International Congress of Women Mathematicians) 2010 panel of women mathematicians around the world.




2013: Participation to the 16th congress of EWM (European Women in Mathematics) which took place at Bonn, Germany from 02 to 06 September 2013. AWMA representatives at this congress were Prof. Josephine Guidy-Wandja, Vice-president of Western Africa and Prof. Yirgalem Tsegaye, Vice-president of the Eastern region.


2014: AWMA was invited to participate in ICWM 2014 held at Seoul, South Korea on the 12th - 14th August 2014. The president of AWMA was a member of the ICWM-forum during the panel session «Mathematics and Women: Different Regions, Similar Struggles». The panel had 8 participants from different parts of the world.

In order to prepare and organize ICWM (International Congress of Women Mathematicians) in 2014, a committee «WiM: Women in Mathematics» was created by IMU (International Mathematical Union). This committee developped a web page http://www.mathunion.org/cwm to promote women mathematicians worldwide, and put together information about all the associations of women mathematicians. After ICWM 2014, IMU Executive Committee established a Committee for Women in Mathematics. The president of AWMA is a member of CWM.

2015: Participation in the day "journée femmes mathématiciennes africaines " organised by the association "femmes et maths" at the Institut Henri Poincaré in Paris on May 30, 2015. The main goal was to gather African women mathematicians working in France.

V. Database of Women Mathematicians and Booklet of Role Models

The second objective of the executive board of AMUCWMA was the creation of a mailing-list of all African women mathematicians in order to keep in touch with them and to regularly bring them together to discuss and exchange information and ideas, and also to be able to organize scientific activities together. By now, this database contains more than 300 mathematicians and this list is available on AWMA website http://africanwomeninmath.org/.

The last objective, the setting up of a brochure of role models of African women mathematicians is still in progress. In collaboration with CWM, we have the project to realize a booklet of portraits of African Women Mathematicians to present during the World Meeting for Women in Mathematics $(WM)^2$ which will be held in the 31th July, 2018 at Rio de Janeiro (Brazil). These portraits will also be included in the

database of role models of African Women Mathematicians of the AWMA website http://africanwomeninmath.org/ and dispatched in many different Universities around Africa in order to publicize relevant African women in mathematics

VI. Problems and Difficulties

i) **Financial difficulties**. At individual levels, most women in Africa have no resources to support their education. They rely on men to move from one level to another, and some of the men are unwiling to give the much needed support. In most of the grants, management by men, males the situation even harder as there is aways a deliberate discrimination and inequity in the distribution of the awards. At the association level, women face the limited financial support they need to advance their agenda. Most organisations rely on international funding as the local institutions have no budget for such activities. This limits the local outreach which plays a key role in encouraging high school girls to choose mathematical sciences subjects in the university hence increasing the gender gap problem.

ii) **Poor representation of women** in the sciences is even more dire in Africa due to a complex mixture of social/cultural/economic barriers women face in Africa. In most science academies and organisations the norm is that there is one (or no) female council member. That is the case also in our institutions of higher learning where the leadership is male dominated thus lacking specific agenda for the minority women in the departments.

iii) **Lack of support** from local institutions in countries of members. Institutional structures, and a persistent lack of support in the workplace, have disadvantaged women in their quest to progress in scientific careers.

iv) **Marginalisation** of women in science is not unique, though, to the continent. It is a pattern around the globe. It has been estimated that, on average, only 30% of science roles throughout the world are held by women. Men, given a chance will always support their own incase of positions that are well paying and highly competitive. Deliberate and persistent, although often hidden, discrimination remains. Women in leadership are often criticized unfairly and looked down upon as lesser performers.

v) **Few role models** and senior women in mathematical sciences. Historically, girls and women have not had the same access to education as their male counterparts have enjoyed in Africa. Women have smaller numbers and

because they are usually concentrated at the lower levels, with little influence, most girls have nothing to admire from them.

vi) **Family obligations** and household chore keep many girls in the kitchen while the male child enjoys doing his thing. This is the leading factor to professional growth in women in mathematics. It reduces the excellence performance in girls thus limiting the few mathematicians in the making. Methods of teaching science have not considered gender equality in teacher education and curriculum development. There is a lingering tradition in some schools of encouraging boys to study physical science and girls to focus on biology and become teachers. In most African societies, women are considered "home builders" and have a higher level of responsibility for their children and homes than their husbands. This makes it difficult for them to leave their children for extended periods of time for further education or training courses, something that limits their career growth.

vii) **Sexual Harassment and Sexual Violence** Sexual harassment happens to women in mathematics due to the enviroment in the departments that are men dorminated. They vary from use of suggestive or derogatory language by male professors and/or students to actual physical demands for sex. Since the definition is so broad, it is sometimes difficult to establish exactly what constitutes sexual harassment. We have examples of girls being abused by lecturers in exchange for better grades, and sometimes, even the female staff being bullied into sex to get the promotion in the departments. In Kenya many male academics often hesitate to mentor or work collaboratively with female colleagues for fear of being seen as having a sexual relationship with them. This keeps women out of the much needed research collaborations resulting to poor research and publications, and delayed career

viii) **Promotion of Women into Senior Academic Positions**; Many women face obstacles in the pursuit of academic careers and in achieving promotion once they have been hired. female candidates for academic positions sometimes endure harassment from senior male faculty members who are hostile to women. In Kenya it is common to find men are promoted more quickly than women, especially in public universities even when they had joined the university at the same time and at the same rank. To some extent, the concentration of women in the lower academic ranks can be explained by the fact that they tend to take longer to complete their PhDs, spend less time on research and often have fewer publications. Some have argued that where

there is competition for resources, women are less likely to have access to research tools such as computers. Work-related travel, including fieldwork or participation in conferences, may also be problematic, especially for women with young families.

Overall, these and many other factors ensure that women remain the minority in mathematical sciences in Africa.

VII . Future Works

The program of future activities of AWMA includes

- To continue to update the database of women with doctorate degree in Africa,
- To make booklets with women mathematicians as role model for young girls,
- To organize scientific workshops, schools or conferences in specific area of mathematics,
- To have a meeting in a central African country in the near future.

VII. Supports and Collaborations

African women mathematicians collaborate with some institutions including

- AMU : African Mathematical Union
- CIMPA : Centre International de Mathématiques Pures et Appliquées
- EWM : European Women in Mathematics
- IMU : International Mathematical Union
- CWM for IMU : Committee for Women in Mathematics of IMU
- AMMSI/LMS: African Mathematics Millennium Science Initiative (AMMSI) / London mathematical Society.

For their activities, they are supported by some institutions:

- CDC for IMU : Committee for Developing Countries of IMU
- CDC for EMS : Committee for Developing Countries of European Mathematical Society
- LMS-AMMSI : London Mathematical Society and African Mathematics Millennium Science Initiative

- UEMOA : Union Economique et Monétaire Ouest Africaine
- UNESCO : United Nations Educational Scientific and Cultural Organization
- AIMS : African Institute for Mathematical Sciences
- ICTP : International Centre for Theoretical Physics
- Facilitator of two African Mathematical Project from Simons's Foundation

VIII. Conclusion

It has been a big challenge to chair this committee AMUCWMA for 8 years and to work to promote the African woman mathematicians. Beside the problems cited above and other difficulties, we arrived to attract women, working sometimes alone in their institution to gather and to work together. Also, they begin to organise themselves in national associations of women mathematicians. Also the creation of AWMA highlighted the african women mathematicians at the level of similar organisations in the world. Nevertheless, a lot of work remain to be done in order to reduce the gender gap in Mathematics in Africa and to motivate young girls and women to choose mathematics for studies and careers. But we can take advantage of these opportunities to continue to work of promotion African women mathematicians.