



# AAU on the Go

40 Years of Research Cooperation between  
Addis Ababa University and Sweden

Achievements and Challenges





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## FOREWORD

Co-operation in research and capacity-building at graduate level between Addis Ababa University (AAU) and Sweden through the Swedish International Development Cooperation Agency (Sida) started 42 years ago in 1979. It has a long history and is something that we really need to tell you about.<sup>1</sup> Our co-operation has experienced many enduring successes with some challenges, which were settled amicably because of the long-term trust and friendship that developed over the years between the two countries and our universities and institutions.

In 1979, AAU had four PhD programs and the research and capacity programs were in their infancy. Initially the focus was on MSc/MA programs as a recruitment basis for PhD training. PhD research training was carried out in co-operation with Swedish universities following the so-called “sandwich model”. Ethiopian students had Swedish supervisors and graduated from Swedish universities but spent alternating periods in Ethiopia and in Sweden. Research themes reflected what was of great relevance for Ethiopia, and the field work was done there. Two of the larger projects, funded over a long period and which had important impacts, were “Flora of Ethiopia and Eritrea”, published in 10 volumes, and “The Butajira Project”, which opened the door for the establishment of laboratories on campus and field satellite stations elsewhere in Ethiopia.

In 2009 when the Ethiopian Government launched the expansion of higher education in the country the co-operation between AAU and Sida shifted towards supporting “in-house PhD training” at AAU. This involved external supervisors and examiners coming to AAU and possibilities for students to spend shorter periods of time abroad for supervision, conferences etc. In addition to PhD training, support was also given to core functions and to strengthening management aspects of research at AAU – ICT (Information and Communication Technology), library facilities, financial management, procurement, laboratories etc. This was a program called the block grant, that helped AAU manage the project so that the PhD programs, research and university facilities improved in line with the national plan for higher education.

<sup>1</sup> The Swedish cooperation also includes cooperation with the The Armauer Hansen Research Institute (AHRI), that Sweden since 50 years supports jointly with Norway. AHRI is a biomedical and clinical research facility under the Federal Ministry of Health in Ethiopia. Originally it was meant that the jubilee anniversaries would be celebrated jointly, but the pandemic made the arrangement difficult to fulfil. See *ahri.gov.et*.

The current agreement started in 2018, with a continued focus on capacity-development through PhD training, with approximately 100 PhDs estimated to graduate, in four areas – education, business management and economics, biotechnology, and electrical engineering - in institutional co-operation with counterpart universities in Sweden. During this time, Sida support shifted away from the block grant model to thematic areas of PhD training and research that would bring about substantial impact on national development. Linked to the PhD training are joint curriculum development and joint supervisor training comprising an ongoing critical discussion on cross-cultural understanding and reciprocal learning for supervisors from both Ethiopia and Sweden. In addition, support for the research infrastructure has been continued and now also includes quality assurance, university-industry linkage and technology transfer, gender issues etc.

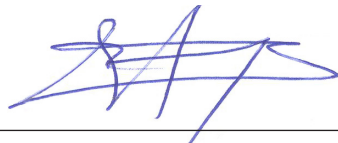
Today, AAU has 106 PhD programs and 65 specialties and subspecialties in medicine, ranks 10th among leading African Universities, and is recognized as the best of the Eastern African universities; an achievement to which the enduring collaboration between the Ethiopian and Swedish governments has contributed.

Today, so many of the outcomes that have emerged from this collaboration have been captured briefly in this small booklet, but it could just as well have been a whole book in its own right.

Both AAU and Sida are set to follow the trail laid down by the fruitful collaborations of their respective governments and plan a future directed towards developing continued research and capacity-building programs which will, hopefully, spill over into regional African universities.

The 40th anniversary of our cooperation was scheduled to be celebrated in 2020, but the pandemic changed that and the result instead is this “booklet” which we hope you will enjoy reading.

Professor Tassew Woldehanna




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President of AAU, Addis Ababa,  
Ethiopia

H.E. Hans Henric Lundquist









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Ambassador of Sweden to Ethiopia



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## INTRODUCTION

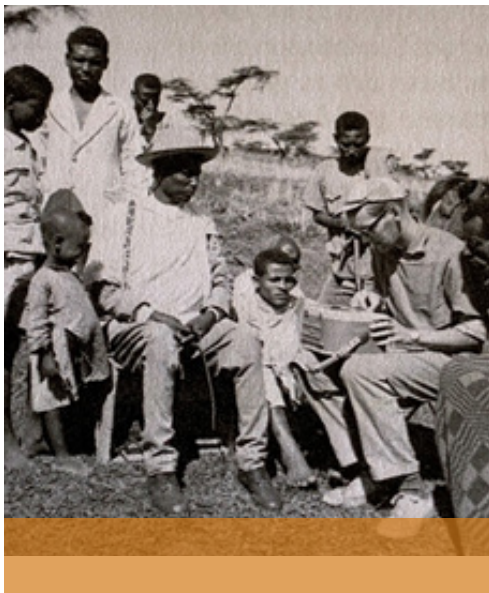
### How it all started

Ethio-Swedish relations began as early as 1866 when the first missionaries landed in Massawa. In 1904 a mission was established in Addis Ababa where a school and a medical clinic were started. In the 1930s and 1940s many Swedes worked for the Ethiopian government as army officers, medical staff, teachers, policemen and lawyers. After World War II, Swedish doctors actively treated wounded Ethiopian barefoot soldiers and militia and those affected by poisonous gas spread from airplanes. After the war, Ethiopia built its air force with Swedish support.

Ethiopia and Pakistan were the first developing countries to receive Swedish government-to-government support. For Ethiopia the first agreement was signed in October 1954 for the construction of a College of Architecture at Haile Selassie University (now Addis Ababa University) to train engineers for, among other things, the construction of primary schools. In the first decades the cooperation focused on health, primary education (more than 6000 primary schools were built), child nutrition and integrated rural development. The Ethio-Swedish Pediatric Clinic was founded in October 1957, initiating Swedish aid to Ethiopia in the field of child health. Documentation of disease patterns, analysis of causation and practical management of illnesses provide the basic data essential for future research on child health in Ethiopia.<sup>1</sup> Research-related support formed part of Sweden's development cooperation from the 1950s onwards, and not only in the field of health.

In 1965 a government commission was formed to investigate Sweden's possible contribution to the development of research capacity in the Third World. Dr. Karl Eric Knutsson from Stockholm University was appointed to lead it. He had lived in Ethiopia while working on his PhD thesis in anthropology, *Authority and Change*. The thesis was based on a study among the Macha Galla in the northern part of the country. When the Swedish Agency for Research Cooperation (Sarec) was established in 1975 Karl Eric Knutsson was appointed as its first Director, a position he held for five years.

Sarec was set up to further research cooperation. Apart from supporting international research it soon gave priority to strengthening national research capacity, particularly in the poorest of countries. In the first 10 years support was mostly given through the national research councils but an evaluation of this period showed that the majority of these bodies were largely unable to prioritize research based on scientific criteria. As a countermeasure the next period saw a



Dr. Karl-Erik Knutsson performing interviews in Northern Ethiopia.

<sup>1</sup> Child Health in Ethiopia. Selected papers from Ethio-Swedish Pediatric Clinic, Addis Ababa. Ethiopian Medical Journal, Vol. 11, No.1.

strengthening of research training using the so-called sandwich model. Over time it became obvious that the training of researchers had to be supplemented with investments in research infrastructures and scientific equipment and, to meet the need for scientific information, support to libraries was included in the approach. It was argued that together these would contribute to the establishment of an enabling research environment that would be attractive work places for the researchers trained in the bilateral programs. These additions led to the support gradually becoming more institutional rather than individual. The beginning of the 1990s saw a further shift in favor of more comprehensive support aimed at inoculating research cultures at national public universities.

Addis Ababa University College was the first higher education institution to be established in the country, in 1950, and its first graduate program was launched in 1978. In 1979, when the research and capacity-building support from Sweden was initiated, the AAU was the only university in the country, with five colleges under it.

### Developments over the years

Sarec's overarching goal for bilateral support was the building of research capacity in the cooperating countries. Sarec's partner in the first agreement periods was the Ethiopian Science and Technology Commission (ESTC) which in turn channeled funds to other research cooperation partners including AAU. In 1979 when support for the Masters Programs in Science at AAU began, it constituted *the first phase* of Sarec's research and capacity-building support which lasted until 1986, when the transition to PhD support was introduced.

*The second phase* focused on PhD training, specifically the sandwich model of collaborative training. *The second phase* of the support was suspended in 1998 with the advent of the war between Ethiopia and Eritrea.

Only towards the end of 2001, when discussions were reopened with the Ethiopian institutions, was a new agreement for the period 2002-2004 signed, effectively initiating *the third phase* of support. This phase lasted up to June 2009. The aim of Sida/SAREC's support during this third phase was to continue to strengthen the AAU and Haramaya University as postgraduate institutions. A further objective was to continue the ongoing process of building capacity at university and faculty level, focusing on PhD training of staff, using a sandwich model, in cooperation with Swedish universities.

During the period 2009-2018, *the fourth phase*, Sida gave a so-called block grant, to support the large expansion of the

” Sarec's overarching goal for bilateral support was the building of research capacity in the cooperating countries.





In 2018 an agreement on continued bilateral research cooperation between AAU and Sweden was signed by the president of AAU, Professor Tassew Woldehanna, and the previous Swedish Ambassador, Torbjörn Pettersson.

in-house PhD programs in nationally prioritized areas. In addition, support was also given to core functions at AAU: strengthening ICT systems, university-industry linkages and technology transfer, training for various administrative and management staff, libraries, the establishment of core laboratories and procurement and maintenance centers as well as administrative and academic reform.

*Phase five*, the current phase, was initiated in 2018 whereby Sida allocated 196 mSEK for the period 2018-2023. The title of the decision “Support to Research Training and Capacity Building at Addis Ababa University 2018-2023” clearly demonstrates that Sweden’s main aim in bilateral research cooperation continues to focus on capacity development. Not all of the current students receiving research training within this cooperation come from or are returning to AAU – several of the current students will return to regional universities and ministries once they have completed their PhDs.

The current program supports the Government of Ethiopia’s position that higher education and research is expected to play a vital role in the economic and social development of the country allowing it to become a middle-income country by 2025. In this vision AAU is expected not only to produce research-trained staff for itself but also for the 44 other universities in the country and perhaps particularly for the 10 universities currently running PhD programs.

The main objective is “*strengthening higher education, research training and research in Ethiopia through support to AAU*”

*“The objective of the intervention is to strengthen the capacities of Ethiopian Higher Education and Research to meet the poverty reduction strategy of the country by supporting PhD program expansion at Addis Ababa University, to develop and offer multidisciplinary graduate programs in all relevant fields that are pertinent to the development goals of the nation.”*

The specific objectives are:

- To launch and execute In-house PhD programs
- To strengthen the existing research capacity at the university
- To automate property, procurement and resource management as well as student records
- To support administrative and academic reports
- To strengthen university-industry linkage and technology transfer
- To improve library services to enhance research facilities commensurate to the existing and envisaged PhD programs

The support is divided into two main parts:

1. Research management and research at AAU – 45.7 mSEK
  - ICT
  - Library
  - Quality Assurance
  - University-industry linkage and technology transfer
  - Gender Office
  - Sida Project Coordination Office
  - AAU graduate programs (visiting professors, supervisors and examiners and also Ethiopian PhD students' visits abroad)
2. Institutional cooperation between AAU and Swedish universities
  - International and Comparative Education in collaboration with Gothenburg University (GU)
  - Business Management and Economics in collaboration with Jönköping Business School (JIBS) and Gothenburg University
  - Biotechnology in collaboration with the Swedish University of Agricultural Sciences (SLU)
  - Electrical Engineering in collaboration with KTH (Royal Institute of Technology) and Chalmers

A new modality included in the cooperation in Electrical Engineering is that in addition to the academic studies PhD students are offered 3 months qualified practical training at ABB in Ludvika/Västerås. It should also be mentioned that one of the students is from the Ethiopian Electric Utility.

The partnerships between AAU and Swedish universities are expected to result in 98 PhD students graduating, jointly supervised by Swedish universities and the AAU. They are also expected to strengthen the academic environments at AAU through mentorship programs, curriculum development, exchange of researchers, co-teaching on courses, supervisor training and cooperation on procurement.

Throughout these periods Sweden's research cooperation with AAU has been a major source of research funding for the university. Over the years the program has focused explicitly on capacity development targeting several components: research training, cooperative partnerships, equipment and other physical facilities, consumables and literature, in a coordinated fashion.

From the start up to the end of the current agreement period 722,169,000 SEK has been allocated for research cooperation between AAU and Sweden.

Finally, all the projects above have been hampered by the global Covid-19 pandemic. AAU and the Embassy of Sweden in Addis Ababa were working to celebrate the 40<sup>th</sup> anniversary of the

722,169,000 SEK has been allocated for research cooperation between AAU and Sweden.

Period	Agreed amount in tSEK
1979-1995	155 000
1994-1997	31 072
1998-2000	47 677
2001	13 800
2002-2011	102 950
2009-2013	102 900
2013-2019	72 770
2018-2023	196 000



Lulu Muhe illustrates the sandwich model: Working at home, in the office and in the field lab. "Home" refers to both his home in Addis and his temporary home in northern Sweden.

partnership in 2020. Unfortunately, this was not possible and it was decided instead to generate a publication to mirror some of the achievements over the last 42 years of research cooperation.

### Research training

Higher education in Ethiopia started in the 1950s with the establishment of Addis Ababa University. The first MSc programs were launched in 1979 and the first PhD program in 1987. In the academic year 2017/2018 AAU had a total of 49,000 students and 1,500 academic staff. Currently AAU is the research hub of Ethiopia and many of the PhD students are enrolled from the regional universities, with the expectation that they will return there as academic staff once their training is completed.

Sweden's support for research training was initiated with support for master's programs as a recruitment base for PhD training and during the first 10 years 255 students at AAU graduated with MScs or MAs. The PhD training of Ethiopian students focused initially on academic staff at the AAU and followed the "sandwich model".

The students had Swedish supervisors, graduated from Swedish

universities but spent alternating periods at their home departments at AAU and Swedish universities throughout their training and conducted research of local relevance. The training represented a capacity-building component tied to a research project in Ethiopia implemented mainly through the collaborative efforts of Ethiopia and Swedish university departments. The candidates carried out research on Ethiopian problems and spent time in Ethiopia doing field and laboratory work. This model has been used since 1979. The photos illustrate the sandwich model from the perspective of Prof. Lulu Muhe who graduated in 1994. When he mentions “home” he is referring to both his home in Addis and his more temporary home in northern Sweden. The photos also illustrate the interaction with PhD students/ friends from other countries.

The sandwich model facilitated the students’ return to AAU after graduation thereby contributing to the development of the academic environment in their departments. This model was increasingly supplemented with institutional support to AAU including support for libraries, laboratories and ICT.

In 2008/2009 continued support for research at AAU was discussed against the background of the Government of Ethiopia’s policy of rapid expansion of the higher education system as a key to meeting the country’s need for highly qualified human researchers. Up to the year 2000, this system encompassed two public universities – Addis Ababa University and Haramaya University, and 17 colleges. Now the goal was to extend the system to 23 public and private universities. To be authorized as a university 30% of the faculty had to be PhDs and AAU was given the main responsibility for providing qualified human resources for all the new universities. The PhD programs at AAU were planned to result in 1,500 on-going and graduate PhDs by 2013. In order to manage this expansion, AAU requested “block grant” support based on “in-house PhD training”.

In the Sida-AAU agreement of 2009-2013 (later extended to 2018), the concept of support for PhD training was to bring external supervisors and examiners to Addis Ababa. Support was provided to launch many in-house PhD programs in several fields and to create an enabling environment in the university by improving the library, the ICT, and the finance and record systems of the university. PhD students were registered from the 36 universities in the country and expatriate staff taught and examined PhD dissertations. Some students were offered short travels to international universities for research and consultations with their external supervisors. The project, known as Research Training and Capacity Building, not only helped AAU to build its in-house PhD programs, but also created an environment at AAU that enabled it to run its PhD programs.

” Now the goal was to extend the system to 23 public and private universities.



### Considerations when organizing international joint PhD supervision

Dealing with cultural boundaries and understandings of knowledge regimes is a characteristic of crosscultural joint supervision, and a source for supervisors' learning.

The supervisor of the home institution has a specific position as a bearer of local knowledge – from both sides.

Supervisory capacity at AAU was strained and in 2010 both AAU and Sida agreed to include Swedish universities in the cooperation. Funds were allocated to include collaboration with Swedish universities in two areas – economics and business management and also veterinary medicine.

With large numbers of students admitted to the in-house PhD programs and limited supervision capacity and facilities for advanced research training, particularly in science, further discussions were held on how to improve the quality of research training in the next agreement phase (2018-2023). AAU and Sida agreed upon the importance of extended collaboration with Swedish universities and the current program includes support for research training based on a more developed sandwich model combined with a smaller contribution to in-house PhD-training.

In the current sandwich model PhD students are jointly supervised by researchers at Swedish universities and at AAU. The model aims to build strong academic environments at AAU through mentorship programs, cooperation on curriculum development, the exchange of researchers, co-teaching on courses, supervisor training and cooperation on procurement. One could label this a “second generation sandwich program”. Professor Gun-Britt Wärvik at the Department of Education and Special Education at Gothenburg University emphasizes the value of ongoing critical discussions and the development of mutual support structures within the group of supervisors for the promotion of new measures for achieving cross-cultural understanding and, thereby, more robust supervisory activity. A doctoral education is always locally rooted but at the same time embedded in international contexts. These features are perhaps even more visible in the current sandwich model because of the joint supervision. Dynamic movements of diverse ideas, knowledge and skills in joint supervision offer a rich source for reciprocal learning for supervisors from both universities, but can also be a source of constraints and uncertainties. The doctoral students may, perhaps, be exposed to unwanted confusion and misunderstanding, sometimes hearing two different voices. The supervisors, therefore, have to regularly step back and organize their own seminars reflecting on how to advance the training of the doctoral students.

### Institutional capacity

Swedish support is also provided for institutional functions such as ICT, laboratories, research management, research communication, quality assurance, gender mainstreaming and financial management. In 2012 Sweden increased its support to strengthen the ICT Center at AAU and improve the ICT services delivered to students by upgrading the hardware and making it accessible via broadband services. This led to the establishment of smart classrooms for PhD candidates where

internet access and communications in real time started to become possible. Virtual desktop infrastructures were set up for students at AAU libraries, student-staff lounges and other areas. Prioritized areas for AAU's ICT development are producing university-wide ICT policies and strategic plans, strengthening advanced data processing facilities, and university-wide ICT governance and management, including professional staff development, modernizing and upgrading desktop computing facilities and upgrading and expanding the university computer network and license fees for research management tools.

The AAU library has expanded to meet the growing number and demands of students. The graduate library has been strengthened by making available electronic databases with a wide range of current and relevant research journals and books. Computers have been acquired and are now utilized in the various branches of the library. Currently the library uses Swedish funds mainly to finance its subscriptions to electronic journals. The resources are accessed by university members through its branch libraries. Access to these resources is not limited to AAU but is open to other universities, research institutions and colleges throughout Ethiopia. This provides access to electronic and current publications, which would otherwise be unaffordable for all universities.

Support for equipment and maintenance of laboratories is an integral part of the budget for research programs, especially in the electrical engineering and biotechnology projects.

Activities related to quality assurance include national tracer studies on in-house PhD programs, a national conference on quality of PhD programs and research, visits to universities abroad to discuss team teaching and cooperative learning as well as developing teaching, supervision, thesis and examination standards for PhD programs.

### Human rights, gender and disability

Throughout the cooperation with AAU, human rights<sup>1</sup> have been a cornerstone in Swedish development cooperation. The current "Strategy for research cooperation and research in development cooperation 2015-2021", like previous strategies, covers a broad range including human rights and groups with special needs. Swedish research cooperation and support for research should be based on, and implemented, in accordance with clear gender equality perspectives, as part of a rights-based approach that cuts across all development cooperation. Sweden also has a feminist foreign policy based on the equal value and rights of everyone. Non-discrimination, which lies at the very core of all human rights, is part of this feminist policy.

<sup>1</sup> The text on human rights was written by Dr. Per Sevastik, Councillor, Deputy Head of Development Cooperation, Embassy of Sweden, Addis Ababa.



The PhD computerlab at AAU main campus.



Dr. Per Sevastik gave an opening speech at the inauguration of the new Center for Special Needs.



Prof. Hirut Woldemariam, Minister of Science and Higher Education and Prof. Tassew WoldeHanna, President of AAU, handing over awards to high achieving female students (above).

The former Gender Office has been renamed the Women, Children and Youth Affairs Directorate (WCYAD)<sup>2</sup> which aspires to be an office where no gender stereotypes exist and where all women and girls are fairly represented in all areas of university activities. The university has introduced a research grant scheme for female academic staff and in 2020 some twenty women were granted funding. A recently conducted AAU Women's Excellence Day, focusing on female leadership, is another example of efforts to empower women in academia by organizing forums and workshops on gender-related issues. The photo shows Prof. Hirut Woldemariam, Minister of Science and Higher Education and Prof. Tassew Woldehanna, President of AAU, handing over awards to high achieving female students.

The Directorate for special needs education provides students appropriate education services based on learning requirements for students with special needs. As a result, the number of students with disabilities attending the university has increased over the years to its current level of about 450. The university's main Special Needs Support Center, located on the main campus, provides inclusive education services. A pilot project was started in 2020/2021 to support, on a competitive basis, the PhD research of six special needs students. The research support will cover two years with a conference at the end and publication of the thesis. On March 25 2021 a new center for special needs was inaugurated, creating facilities for blind students to use computer services for their research.

<sup>2</sup>The text concerning WCYAD was written by Ms Matebie Tarekn and Mr. Berhanu Abesa, AAU.



”Do you agree?”. An absorbing discussion at a training course in Commissioned Education.

In addition to the strategy for research Sida’s bilateral strategy with Ethiopia 2016-2021 channeled further support to human rights in AAU through the Center for Human Rights with four targeted sub-projects: Multidisciplinary Human Rights Teaching and Training; Policy and Practice Collaboration and Diffusion; Community Based Human Rights Promotion and Protection; and Learning and Capacity Development. The overall goal is to increase the capacity of state agencies to respect human rights and to better protect the rights of women, children, persons with disabilities, workers and migrants.

Support is also channeled through a Commissioned Education Program (CEP), which is a post-graduate certificate program focusing on leadership training. The program can best be described as a mid-career program. The main objective of the program is to contribute to the development of a capacity-building training program for top and middle managers within Ethiopian Civil Society Organizations and a training course for trainers targeting AAU and other already qualified trainers. Its aim is to develop “a more reflective, participatory and inclusive CSO leadership culture”.

There are strong synergies between the strategies, and Sida is taking every opportunity to enhance them in all relevant areas. There are two new forthcoming strategies; one on research cooperation covering the period 2022-2028 and one on bilateral cooperation with Ethiopia covering the period 2022-2026.

” The overall goal is to increase the capacity of state agencies to respect human rights and to better protect the rights of women, children, persons with disabilities, workers and migrants.



## EXAMPLES OF RESULTS AND IMPACTS OF SUPPORTED PROGRAMS



The cover page of the book "Aromatic Plants of Ethiopia by Nigist Asfaw & Sebsebe Demissew" (2009) - *Thymus schimperi* Ronniger.



Tewolde-Berhan Gebre-Egziabher and Olov Hedberg.

### The Ethiopian Flora

1. Inga Hedberg and 2. Sebsebe Demissew.

1. Department of Organismal Biology, Evolutionary Biology Centre, Uppsala University, 2. National Herbarium, Department of Plant Biology, CNCS, Addis Ababa University

Preliminary discussions about the writing of the Flora of Ethiopia were held at the seventh plenary meeting of the Association pour L'étude Taxonomique de la Flore d'Afrique Tropicale (AETFAT) in Munich 1970.

Following these initial discussions, the urgent need for a Flora of Ethiopia (later Ethiopia and Eritrea) was brought up at a meeting between Professor Tewolde Berhan G. Egziaber at Addis Ababa University and Professor Olov Hedberg at Uppsala University. However, for various reasons funding turned out to be difficult. For instance, Sida saw the efforts as research, which they did not support. The project was made possible when Sarec (Swedish Agency for Research Cooperation with Developing Countries) was created, and money became available. The project was launched in 1980.

The staff at the National Herbarium in Addis Ababa was ready to take responsibility on the Ethiopian side and a small secretariat was created at the Department of Systematic Botany at Uppsala University to handle the activities outside Ethiopia.

The objectives of the Ethiopian Flora project were to:

1. Write up a Flora of Ethiopia within the shortest time possible
2. Build up a National Herbarium and a related library to be used as reference centers
3. Training to promote scientific activities in taxonomic botany, forestry, plant ecology, etc.

### 1. Write up a Flora of Ethiopia within the shortest time possible

In the project proposal this objective was initially supposed to be completed in about 15-20 years from the start of the project in 1980. However, the completion of the Flora took about 29 years between 1980 and 2009. The complete Flora, covering Ethiopia and Eritrea, was ultimately available in 8 volumes comprising 10 books (volumes 2 and 4, were so big that they had to be divided into two parts) in A4 format. The Flora includes 243 vascular plant families with 6,027 species (including subspecies) with 10% endemism. The writing of the Flora of Ethiopia and Eritrea was an international collaborative effort, involving the participation of 90 botanists from over 17 countries in Africa, Europe, USA and Australia. It is one of the few completed Flora of a country in Africa, carried out with the full participation and engagement of local expertise and published in the country.

### 2. Build up a National Herbarium and a related library to be used as reference centers

The National Herbarium (ETH) at AAU was established in 1959 with the donation of about 6,000 specimens by an Irish forester, Herbert F. Mooney. When the Flora project started there were only 18,000 plant specimens; currently the number has reached over 100,000. During the project period, a number of important reference books were bought and donated to the Herbarium Library.

### 3. Training

The third objective, “Promote scientific activities in taxonomic botany, economic botany, forestry, plant ecology, plant physiology, etc. through training” was the first to be tackled as it was considered paramount for the sustainability of the project - during its lifetime and beyond. Eleven PhDs and one illustrator were directly and indirectly trained by the Flora project.

In 2009, all the objectives were met. Ethiopian nationals were successfully trained and now, in turn, train more Ethiopians in the country and from neighbouring countries; the Ethiopian Flora Project was completed through international support and collaboration and



A. Pulcerima.



Some of the participants in the workshop on the flora project at Gulelle Botanic Garden (from right to left). Front row: Mesfin Tadesse, Sylvia Philips and Inger Nordal; middle row: Ib Friis, Jan Rameloo, David Mabberely, Mike Gilbert, Inga Hedberg, Sally Bidgood, Kaj Vollesen, Ensermu Kelbessa; back row: Thomas Borsch and Sebsebe Demissew.



The complete Flora covering Ethiopia and Eritrea.

	Name	Subject	Area	Graduated from
Training with direct support by the EFP	Mesfin Tadesse	Plant Taxonomy	1984	Uppsala University
	Sebsebe Demissew	Plant Taxonomy	1985	Uppsala University
	Endashaw Bekele	Plant Genetics	1986	Lund University
	Legesse Negash	Plant Physiology	1988	Lund University
	Zemedede Asfaw	Ethnobotany	1989	Uppsala University
	Ensermu Kelbessa	Plant Taxonomy	1990	Uppsala University
	Elisabeth Kebede	Limnology	1998	Uppsala University
	Damtew Tefera	Illustr. & publishing	1994	UK
Indirect support for Training	Zerihun Woldu	Plant Ecology	1985	Uppsala University
	Tamrat Bekele	Plant Ecology	1994	Uppsala University
	Demel Teketay	Forestry	1994	Umea University
	Sileshi Nemomissa	Plant Taxonomy	1996	Vienna University

Eleven PhDs and one illustrator were directly and indirectly trained by the Flora project.

outstanding contributions by a number of individuals and institutions; the National Herbarium (ETH) collections grew from 16,000 to 100,000 and scientific activities in taxonomic botany, economic botany, forestry, plant ecology, plant physiology, etc. have been achieved through training.

The finalization of the Flora project was celebrated in a symposium in Uppsala and a workshop in Addis Ababa

### **The Butajira Rural Health Program – an Infrastructure for Research and Policy 1987-2021**

*Mitike Molla, Addis Ababa University and Stig Wall, Umeå University*

The Butajira Rural Health Program (BRHP) started as an epidemiological field laboratory in 1986. It is located in the Guraghe and Silti zones of the Southern Nations Nationalities and People Region. The BRHP includes one urban and nine rural villages/kebeles that were selected randomly from four urban and 82 rural kebeles.

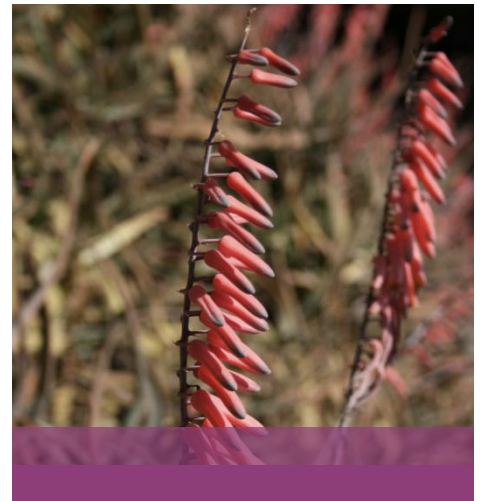
BRHP was fathered by the late Desta Shamebo together with strong mentorship from such iconic figures as Professor Demissie Habte and the late Professor Nebiat Tafari.

The underlying rationale for establishing a demographic surveillance site in rural Ethiopia was to generate epidemiological data about its people that stakeholders could relate to and also show how a field site could foster interdisciplinary research and South-North collaboration.

Based on the 2007 census the Butajira district is the home of more than 430,949 people.

Initially, a baseline census was conducted resulting in a counted population of 28,000 persons as of January 1st, 1987. Half the population were under 15 years of age, while 45% were aged 15-59 years. Currently more than 55,000 people are residing in the ten selected kebeles. The population of BRHP varies regarding ecological, ethnic, religious and residential area.

The baseline census was followed by monthly registration of vital events including births, deaths, marital status, registration of new households, in- and out-migration, and internal moves within the study area, using a structured questionnaire at a household level. In 1995, 1999 and 2003, the census was repeated for quality control purposes. The data were initially collected monthly but since 1999 have been collected quarterly. Trained high school graduates living in the villages collect the information which makes the identifying and



Aloe welmelensis, Sebsebe@Nordal showing part of the inflorescence.



Butajira market.



Data collection in one of the rural villages in Butajira.

reporting of events easier. The data collected by the village enumerators are routinely checked by supervisors and researchers. In addition, since 2002, verbal autopsies have been collected from the immediate carers of the deceased.

### Results

Starting with the posthumous PhD thesis by Desta Shamebo, a large number of PhD and MPH theses have been produced at Ethiopian and Swedish universities based on the Butajira data. Over 100 scientific papers involving direct and indirect use of the BRHP facilities and infrastructure have been published or are in press. Researchers studying acute respiratory diseases, malnutrition, reproductive health problems including HIV and AIDS, common viral diseases, drug utilization patterns, domestic violence, mental health problems, helicobacter pylori infection, indoor air pollution projects have all used this ‘population lab’. Recently a tri-valent meningitis vaccine trial was finalized. The surveillance site has provided a unique opportunity for clinical trials since it gives accurate ages for persons who were born after the establishment of the Program in 1987.

The project helped to install the first health posts in the country facilitating the scaling up throughout the country of the idea, which is the flagship of the Ministry of Health. The BRHP has also served as a basis for research capacity-building both for local and European students, as evidenced by more 15 completed and five ongoing PhD theses and more than 50 MPH theses. BRHP is also one of the field training sites for mid-level health professionals within the Faculty of Medicine at AAU.

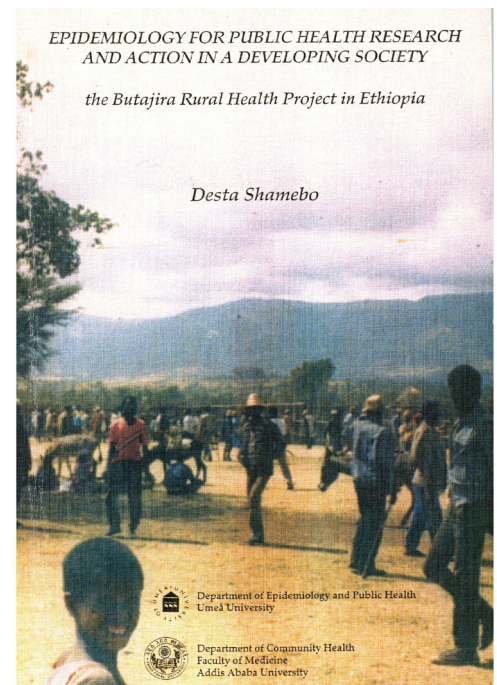
### Impact

Several studies worth mentioning include the ARI study which has contributed to reducing childhood mortality through the introduction of an appropriate case management protocol for cases of pneumonia at grass-root levels. Similarly, the mental health study has also established a psychiatric clinic in Butajira Health Centre and is contributing in the training of psychiatric nurses. The continuation of the study base leads to more benefits being incorporated into planned intervention studies. The study base has also contributed to the establishment of a hospital in the town of Butajira where the base supports the electronic recording system of the entire activities of the hospital, including internet use.

The Butajira Health and Demographic Surveillance Site (HDSS) was a founding member of the INDEPTH Network ([www.indepth-network.org](http://www.indepth-network.org)) and contributed to its vision that “Counting everyone shows that everyone counts”, with major implications for transnational collaboration and understanding. In Ethiopia, the BRHP has contributed to the replication of similar sites at about 10 universities, seven of which have formed a network of HDSS sites (Health and Demographic surveillance sites) in the country.

Longitudinal epidemiological data mirror the development of a society and urban-rural and social dimensions have been revealed through the lens of hard data. Applications initially concerned child and reproductive health but were later extended to areas such as cardiovascular and mental health and domestic violence.

Over time the Butajira data have helped to draw a public health map and have contributed to disclosing major healthcare needs. Collaboration in research has a dual benefit across cultures and was also instrumental in capacity-building in the Swedish universities.



The posthumous thesis by Desta Shamebo Loas published in 1993.

” Counting everyone shows that everyone counts.



Citronella grass at Ermias & Familygarden near Addis Ababa.



Conservation of the rare and endemic Aloe pulcherrima plant in ALNAP Garden.

## Natural Products Chemistry Research in Ethiopia

*Berhanu Abegaz (BA) and Ermias Dagne (ED) Emeriti Professors; Department of Chemistry, Addis Ababa University, Ethiopia*

We received support for our research in Natural Products Chemistry as early as in 1984. Our initial research focus was on plants that have gained cultural prominence or are used as traditional medicines with the aim of understanding the scientific rationale for their use. The research also enabled us to discover several new compounds to which we assigned chemical structures and gave unique names.

A serious problem associated with the selected local plants was determining the botanical identity of some of those we were working on. This is illustrated by the following two examples. Berhanu was interested in looking into a very common medicinal plant, known locally as Kebericho, the roots of which are readily available in markets and are smoked for a variety of medicinal and ritual uses. Although this plant is very familiar and is used so often by the public, its botanical identity was completely unknown. Obtaining proper botanical specimens of the plant, therefore, required field research (by BA), in collaboration with the botanist of the Flora Project (Mesfin Tadesse). It was then unequivocally established that this plant was a new species, without any prior scientific name. The botanist named it Echinops Kebericho Mesfin. For more information on the botany and the chemical studies by B. Abegaz et al. please see database [alnapnetwork.com](http://alnapnetwork.com).

The second fascinating example is the story of the plant known locally as Dingetegna. The roots of this plant are also sold in markets throughout Ethiopia. The name, which is indicative of its use, means medicine for sudden attack or illness. It is chewed to relieve fever, headaches and stomach problems. Prior to our research (led by Ermias) there was no link between this common medicine and its botanical name. Field work and a literature search led to the identification of the plant as *Taverniera abyssinica*. In addition to chemical studies, both crude extracts and purified substances of this plant were tested on animals and the study shows that the plant significantly reduced fever and has anti-pain or analgesic properties. The chemical studies revealed the presence of isoflavonoids. Follow the link for more information. See [alnapnetwork.com](http://alnapnetwork.com) for more information.

Our narrative of the study of the chemistry of khat (by ED's group) is another illustration of the relevance of our research in shedding light on plants commonly used in our society. The leaves of Khat or *Catha edulis* are chewed for stimulation or to keep one awake at night. It is customarily the young tender leaves of khat (*Catha edulis* Forsk) that are ingested through chewing, and the stimulant effect is caused mainly by two simple alkaloids known as cathinone and cathine. Several

papers in the literature indicate that cathinone is “unstable” and “labile”, particularly after the khat leaves are harvested and dried. However, our studies, using TLC (Thin Layer Chromatography), UV (Ultraviolet) and NMR (Nuclear Magnetic Resonance) methods, show that the main active compound of the plant, cathinone, remains unchanged for several months in dry leaves and even after it is isolated from the leaves. In order to bring the results of science to public knowledge, ED collaborated with the Ethiopian Ministry of Posts and Telecommunications in issuing khat stamps. The article written by ED when the khat stamps were released, circulated worldwide and can now be accessed at the website below. The pictures of the khat plant shown on the stamps were taken of khat plants in ED’s garden. ED’s fingers appear on one of the stamps as the artist intended to show the human link to this socially significant plant, see [alnapnetwork.com](http://alnapnetwork.com).

Another interesting example from Berhanu’s Research Group is the study of Artemisial rehan. See description of *A. rehan* at [alnapnetwork.com](http://alnapnetwork.com).

At the time the Flora of Ethiopia was published it was believed that *A. rehan* was synonymous with the well-known European plant *A. absinthium*. However, Berhanu’s chemical studies show that *A. rehan* is distinct from the well-known and indeed very popular European *Artemisia absinthium*, which is also known by its common name of wormwood (See [Wikipedia.org](http://Wikipedia.org)). In short *A. rehan* is the local Ariti plant and not the same as *A. absinthium*, which is the European absinthe or wormwood that is used to make mind-altering beverages such as that which influenced the famous Dutch painter van Gogh. Ariti and Absinthe are now cultivated side by side in the ALNAP (African Laboratory of Natural Products) Garden at 4 Kilo Campus A.A. University and all can see that they are quite distinct from each other. The pictures on the right show the two plants.

The most serious challenge we encountered was to make sure that major analytical instruments continued to work properly. We recruited talented chemistry and electrical engineering graduates who were given additional training in looking after these instruments. The most difficult task was to ensure the uninterrupted running of our 400 MHz Nuclear Magnetic Resonance Spectrometer. This instrument requires filling every week with 50 liters of liquid nitrogen and with about 100L of liquid helium once a year. The liquid nitrogen is produced in-house by a generator but the liquid helium has to be imported annually from Dubai. These two liquids help to maintain the ultra-low temperature of around -270°C which is required to maintain the high field status of the magnet. We have succeeded in keeping the NMR machine running without interruption since its installation in September 2000.



The Artemisial rehan plant.



The van Gogh’s absinthe plant.





A Natural Products Chemistry Laboratory at the Department of Chemistry, Addis Ababa University.



HPLC (high performance liquid chromatography) equipment at the Environmental Chemistry Laboratory.

## Basic Sciences

*Peter Sundin, International Science Programme (ISP), Uppsala University*

In the Sida bilateral program between 1988 and 2012, more than 20 “sandwich” PhDs graduated in the basic sciences, mostly in fields related to biology and chemistry. The main Swedish host institutions were Lund University and the Swedish University of Agricultural Sciences, with a few students also at the universities of Gothenburg and Uppsala.

The research activities in chemistry, mathematics and physics at AAU, supported separately by the International Science Programme at Uppsala University funded by Sida, led to the graduation of more than 60 PhDs between 1990 and 2019, about half of them from the AAU Department of Mathematics, and a majority on local PhD programs. The ISP-supported sandwich students were hosted by Chalmers University of Technology, Gothenburg, and the universities of Linköping, Lund, and Stockholm.

### Sida bilateral support in the basic sciences

Sida bilateral support for a sandwich-model PhD program at AAU began in 1987/88, in the basic sciences including in particular chemistry and biology, with Swedish institutions acting as hosts. The International Science Programme (ISP) at Uppsala University was engaged as coordinator, and has in addition provided separate support in chemistry, mathematics and physics – operated in parallel, and also using Sida funding.

By 2002, in total twelve Sida-bilateral basic sciences-related PhD students had defended their theses,<sup>1</sup> in biology-related fields such as fish physiology (four students), immunoparasitology, microbial microbiology, sorghum genetics, and tuberculosis drug resistance, and in chemistry, in the fields of biosensors, coordination chemistry and analytical chemistry. Their Swedish hosts were at the Departments of Analytical Chemistry, Food Technology, Inorganic Chemistry and Limnology at Lund University, at the Department of Medical Microbiology and Immunology at Gothenburg University, at the Department of Plant Breeding at the Swedish University of Agricultural Sciences (SLU), Svalöv, and at the Swedish Institute for Communicable Disease Control, Stockholm.

In the years 2002-2004, the program entered a new phase, with support to research groups and a new batch of local MSc and sandwich

<sup>1</sup> IPICS (2004). International Programme in the Chemical Sciences, Project Catalogue 2003. International Science Programme, ISP. Universitetsstryckeriet, Uppsala.

PhD students.<sup>2</sup> The basic sciences-related PhD students graduated in the following fields:

- Biology of drought resistance in indigenous crops;
- Ecology, biology and management of sorghum chaffer - both with the Department of Crop Sciences, SLU, Alnarp as the Swedish host;
- Applied and basic genetic studies of Ethiopian crops;
- Heavy metals in Ethiopian soils (two graduates) - both with the Department of Forest Soils, SLU, Uppsala as the Swedish host ;
- Microbial input in coffee, with the Department of Microbiology, SLU, Uppsala as the Swedish host;
- Studies on species composition: phytoplankton in the Rift Valley, with the Department of Limnology, Uppsala University, Uppsala as the Swedish host; and
- Analysis of Pesticide Residues and Degradation Products in the Water Systems of the Lower Rift Valley of Ethiopia (two graduates), with the Department of Analytical Chemistry, Lund University, Lund as the Swedish host.

Parallel to the PhD program at the then Faculty of Science, another PhD program was initiated separately by Sida in 2008, at the then School of Pharmacy. Four candidates were recruited, and received sandwich training at the Biomedical Center, Uppsala University. However, only two graduated, a male in 2011 and a female in 2012. Soon after her dissertation, the woman PhD graduate returned to her institution at AAU to serve as a teacher and researcher, while the male PhD graduate took up a postdoc position abroad, and, as far as is known, still remains there.

A new, overall AAU-Sida agreement in 2009 introduced another mode of support, constituting a “block grant” approach, where the funding and management of the program was entirely entrusted to AAU. Consequently, ISP’s role as coordinating unit was suspended, apart from the engagement with the School of Pharmacy until the conclusion of that program. From 2018, however, the general program operational strategy of previous years was reinstated, after a limited open call based on an AAU concept note, and out of four currently run projects two are related to the basic sciences, in biotechnology (with 19 PhD sandwich students), and in electrical and power engineering (with twelve PhD sandwich students).



Dr. Mariamawit Yonathan with a colleague labelling an instrument at Department of Pharmaceutical Chemistry and Pharmacognosy.

” The female PhD graduate returned to her institution at AAU to serve as a teacher and researcher.

<sup>2</sup>Mouton, J., Fagerström, T., Louw, A., Tsubira, F.F. & Volmink J (2007). The Swedish Research Cooperation with Ethiopia. Sida Evaluation 07/36, Edita Communication AB, Art. no. Sida40233en, ISBN 978-91-586-8162-0, ISSN 1401-0402.



Pictures from the laboratory of the Pharmaceutical Chemistry and Pharmacognosy Unit, College of Health Sciences, Black Lion Hospital, Addis Ababa University.

## Support for the basic sciences by the International Science Program, Uppsala University

### Materials physics and Chemistry

The Department of Physics at AAU received minor ISP support from 1987-1990, in the field of condensed matter, and support for a research group in the area of conjugated polymers started in 1991.<sup>3</sup> In 1995, an organic chemist was invited to join the group, and received training in polymer synthesis at Chalmers University of Technology, Gothenburg, Sweden.

A chemistry laboratory devoted to the synthesis of conducting polymers became functional in 1997, and was soon the major supplier of polymeric materials for research in organic semiconductors at the Department of Physics. Staff at this chemistry laboratory were invited to apply for separate research funding from 2003.

The physics group has, from 1990 to 2019, produced 18 PhDs and 117 MScs, most of them locally, has published 82 articles, mostly in high quality, peer-reviewed scientific journals, and has made 64 contributions to scientific conferences. The sandwich PhD students have been trained in cooperation primarily with Linköping University. The chemistry group reported the first three PhD graduations in 2019 and another two in 2020, and from 2003 to 2020 has produced 45 MSc graduates, published 95 articles, most in high quality, peer reviewed scientific journals, and has made 38 contributions to scientific conferences. The sandwich PhD students have been trained in cooperation primarily with Chalmers University of Technology, Gothenburg, and with Linköping University.

### Geophysics

In 1985, Sida support for building capacity in earthquake and volcanic risk mitigation was started. However, in the application to Sida for continued support from 2001, the group's proposal was turned down, and Sida support ended in 2000. To prevent a decline in the capacity built by Sida, ISP initiated support for the group in 2005. From 2005 to<sup>4</sup> 2019, the group has trained six MScs to graduation, has published 64 articles in internationally reputable journals, including Nature, and has made 33 contributions to scientific conferences. Since 2016, the group has also had the possibility of training PhD students, and has so far enrolled four PhD students.

<sup>3</sup>Mammo, W. (2012). The Role of IPICS in Enhancing Research on the Synthesis and Characterization of Conducting Polymers at Addis Ababa University. In A. Gurib-Fakim & J. N. Eloff (eds.), *Chemistry for Sustainable Development in Africa*, DOI: 10.1007/978-3-642-29642-0\_10, Springer-Verlag Berlin Heidelberg 2012. See also p. 38.

<sup>4</sup>Ayele, A. (2018). Monitoring Seismic and Volcanic Activity in Ethiopia. Oral presentation (ppt) at the AAU-Sida meeting 7 – 9 Nov. 2018, Getfam Hotel, Addis Ababa.

## Environmental Chemistry

One of the graduates of the first phase of the Sida bilateral PhD student support, developed a strong research laboratory in environmental analytical chemistry at the AAU Department of Chemistry. He was the local supervisor of two PhD sandwich students in the next phase of the Sida program. They were trained in cooperation with Lund University, and graduated in 2008. In parallel, he supervised a local PhD student who graduated from AAU in 2009. In addition, between 2001 and 2009, twelve local MScs graduated from the laboratory. The laboratory received no support under the block grant, but nevertheless from 2010-2016, seven PhDs and 14 MScs graduated under his supervision.<sup>5</sup> To secure the continued performance of this environmental analytical chemistry laboratory, the group was invited to further develop research and training activities with ISP support from 2013. Unfortunately the cooperation had to be concluded early, in 2018, because of the impaired health of the research group leader. From 2014 to 2018, the group has produced nine PhD graduates (two in sandwich programs with Lund University, the others locally) and seven MScs, has published 14 articles, mostly in high quality, peer-reviewed scientific journals, and has made six contributions to scientific conferences.

## Natural Products Chemistry

The Natural Products Network of Eastern and Central Africa (NAPRECA) was conceived in 1984, borne from the realization that Africa is rich in biodiversity but poor in research and development in natural products chemistry. The network was supported by ISP from 1988, and was coordinated from the Department of Chemistry at AAU from its inception until 1996.

When NAPRECA coordination was moved elsewhere, the Ethiopian scientists were supported by ISP to start another regional network, the African Laboratory of Natural Products (ALNAP), see [alnapnetwork.com](http://alnapnetwork.com). For many years, ALNAP was responsible for arranging workshops attached to the biannual NAPRECA symposia. Apart from networking activities, ALNAP graduated ten MScs and one PhD from AAU between 2010 and the termination of ISP support in 2016. In this period, besides numerous popular publications and a few book chapters, three research articles were also published in scientific journals, and twelve contributions were made to scientific conferences.



A Natural Products Chemistry Laboratory at the Department of Chemistry, Addis Ababa University.

<sup>5</sup> Megersa, N. & Sundin, P. (2016). Analytical Chemistry Research Development at Addis Ababa University through Swedish Sida bilateral and ISP Support. Oral presentation (ppt) at the PACN Congress on Sustainable Water Resources for Africa, 30 Nov. – 2 Dec., University of Nairobi, Nairobi, Kenya.



Prof. Ermias Dagne and a colleague considering NMR data.

### Pharmacological Chemistry

The female PhD graduate from the Sida bilateral program with the School of Pharmacy had already been invited by ISP in 2011 to start a research group in pharmacological chemistry, building on Sida's investments, and support started in 2013. (The male PhD graduate was also invited by ISP to apply for research group support, but decided not to return to AAU to take up the research group grant awarded.)

The group is developing strongly, presently at the Department of Pharmaceutical Chemistry and Pharmacognosy, the College of Health Science, AAU. A local PhD program was started in 2018, and the first PhD student was enrolled in 2019. Six MScs have already graduated, eleven scientific articles have been published, the majority in high-quality journals, and four contributions have been made to scientific conferences.

### Mathematics

The collaboration between ISP and Addis Ababa University (AAU) in Mathematics started in 2005.

Up to 2020, 33 PhDs on local programs and four on sandwich programs with Stockholm University had graduated from the Department of Mathematics. The department has reported the publication of 80 articles in scientific journals, many of them high-ranking, and more than 40 contributions to scientific conferences. The number of MSc graduations reported to ISP is 21, but the actual number well exceeds 100.

## Capacity Building in Ethiopian Electrical Power Engineering Education and Research

*Mengesha Mamo, AAU, Erik Ahlgren, Chalmers*

### Engineering

The project launched a PhD program in Electrical Power and Control Engineering in July 2018 and has now enrolled twelve PhD students. The project also has a capacity-building component in the form of equipping two laboratories and training four Ethiopian professors in PhD supervision to ensure the sustainability of the program. The project participants are Addis Ababa University (AAU), Chalmers University of Technology, KTH - Royal Institute of Technology, ABB, Ethiopian Electric Power (EEP), Ethiopian Electric Utility (EEU) and the funding agency, the Swedish International Development Cooperation Agency (Sida). The final outputs are expected to be twelve PhD graduates, two laboratories equipped for PhD studies and four Ethiopian professors trained to independently supervise PhD students.

### Selection of PhD Projects

The PhD students' research projects are selected carefully, based on the professors' research interests and the relevance to real Ethiopian problems, related to the Government of Ethiopia's need for electrical engineers in relation to power generation and transmission from the Renaissance Dam. The projects involve the two Ethiopian electric companies EEP and EEU. They are distributed over five essential aspects of electrical power and energy knowledge/skills required to improve the reliability, quality, sustainability and diversity of the Ethiopian power system. The first two PhD projects deal with electric transmission and distribution systems and are entitled "High Voltage Direct Current (HVDC)" and "Mapping of natural and industrial pollution severity at locations of planned transmission corridors".

The second group of PhD projects comprises three working on electric power and energy planning entitled "Long-term strategic electricity and energy systems planning and modeling", "Geo-spatial power planning for remote areas" and "Hydro power operation and planning". Two further PhD projects in this group deal with consumer side issues of electric power and are entitled "Energy and production efficient cement industry" being worked on by two PhD students and "Multiphase electric machines modeling and control". The third group of projects includes two PhD projects dealing with off-grid power and mini-grid issues entitled "Operation of standalone systems with privately owned generators" and "Ethiopian smart mini-grids – optimized designs based on demand patterns and profiles". The last group of projects has two PhD projects dealing with the integration of modern renewable technologies with the conventional electricity grid. They are entitled "Balancing and grid integration of wind power" and "Power electronics intensity and stability of grids". PhD students were selected competitively, based on their academic credentials, their interest in particular projects and interviews carried out by the supervising Ethiopian and Swedish professors.

### Project outputs so far

In 2019/20 PhD students produced the papers shown in the table below for international professional conferences and journals. This year, 2021, there are four third year and eight second year PhD students. The third year students are focusing on their research while auditing their remaining mandatory courses. The second year PhD students are mainly working on their courses while refining their project proposals. The table shows papers produced by the third year students.

Two Ethiopian professors, Mengesha Mamo and Getachew Bekele, have taken a PhD student supervision course at KTH and have also published two and three papers, respectively, in international conference proceedings as part of the capacity building.



Annual meeting, KTH, 2019.



Online Student recruitment interview, KTH, 2018.

S. No.	Paper/Article Title	Journal/Conference
1.	Assessment of External Insulation Problems Related to Pollution and Climatic Conditions in Ethiopia (Berhanu Zelalem and Mengesha Mamo)	IEEE Electrical Insulation Magazine (Featured Article July / August — Vol. 36, No. 4, 2020)
2.	Prediction of Ethiopian Wind Power Production Using ERA5 Reanalysis Data: Case of Adam Wind Farm II (Kena Likasa)	Submitted for publication
3.	Deterministic Hydro-power Planning Model for Ethiopia Firehiwot Girma	Paper for 2021 IEEE PES Spain accepted for publication
4.	Assessment of Resource Adequacy in Power Sector Reforms of Ethiopia (Dawit Gebremeskel, Getachew Bekele and Erik O. Ahlgren)	2019 IEEE PES/IAS PowerAfrica 2019   Conference Paper
5.	Energy System Modeling Tools: Review and Comparison in the Context of Developing Countries (Dawit Gebremeskel, Getachew Bekele, and Erik O. Ahlgren)	2020 IEEE PES/IAS PowerAfrica 2020   Conference Paper   Publisher: IEEE
6.	Long-Term Evolution of Energy and Electricity Demand Forecasting: The case of Ethiopia (Dawit Gebremeskel, Erik O. Ahlgren and Getachew Bekele)	Submitted for publication
7.	Modelling of Ethiopian wind power production using ERA5 reanalysis data (Kenal Likasa, Lennart sodder and Mengesha Mamo)	Submitted for publication



Co-supervisor Prof. Stanislaw, PhD student Berhanu and supervisor Mengesha at Dire-Dawa Substation, Ethiopia.

### Effect of COVID-19

COVID-19 has affected the project in many ways. Travel to international professional conferences was replaced by online presentations. Face-to-face participation in conferences is, nevertheless, better for networking and more effective for getting peer feedback on the research papers presented than the online alternative.

One major component of the project, industrial internship, could not be implemented at ABB. Supervising engineers are working from home and were unable to receive our PhD students.

Student supervision has been carried out at a distance instead of face-to-face; the two are not the same and supervision quality and efficiency is declining. This is especially the case when student and supervisor do not yet know each other, which is still true for all our students and supervisors. Internet connections have been an additional challenge during the students' stay in Ethiopia. The pandemic has also impacted on the general mood of the students; being alone in Sweden, with a minimum of physical meetings, certainly does not create the best conditions for research studies in a foreign country. On the positive side, Covid restrictions brought about the possibility

of joint supervision by Ethiopian and Swedish professors at the same time. According to the initial plan, when the student is in Sweden the Swedish Professor supervises and when the student is in Ethiopia the Ethiopian professor takes over. Now, most Ethiopian and Swedish professors have regular meetings together, with their PhD students (on average once a month), and are able to follow the students' research work closely. It is now possible for the students to take courses online from Sweden or from Addis, anywhere where a computer network is available. Our students are getting the best out of the situation.

### Final Comment

In spite of all the challenges, the project is running successfully due to the strong commitment of the partners. The final outcome of the project is expected to impact positively the quality of Ethiopian higher education in the field and also the country's electrical power sector.

### International and comparative education

*1) Alebachew Kemisso Haybano, 2) Sverker Lindblad and 3) Gun-Britt Wärvik  
1) Addis Ababa University 2) University of Gothenburg*

#### Description of the project/program

The College of Education and Behavioural Studies at Addis Ababa University started a doctoral program in international and comparative education in 2011. Ten doctoral students were admitted with support from Sida and Stockholm University. A few years later, in 2014, the Centre for Comparative Education and Policy Studies (CCEPS) was established to run the program with Professor Teshome Nekatibeb as coordinator and, after him, Dr. Temesgen Fereja. The first to graduate from the doctoral programme was Alebachew Kemisso Haybano who is the present head of the center. Since 2018 CCEPS has been included in Sida's Research Training Partnership Program, in collaboration with researchers from the University of Gothenburg. Seventeen doctoral students have so far participated in this program during the final two years of their four-year doctoral education. The doctoral students spend up to three months in Gothenburg on three occasions during the two years. To date, 19 Sida-supported PhDs have graduated while eight doctoral students are in the final stage of their PhD work. The comparative perspective is used to analyse and to contextualize a range of aspects of the Ethiopian educational system, internationally and nationally.

### Results of the research

Research in the PhD program is organized into five major themes that

” To date, 19 Sida-supported PhDs have graduated while eight doctoral students are in the final stage of their PhD work.



Alebachew Kemisso Haybano defending his doctoral thesis. He was the first to graduate in the doctoral program in International and Comparative Education.





Midsummer celebrations in Trädgårdsföreningen, Gothenburg.



Midsummer celebrations with Prof. Karin Rönnerman, PhD student Frazier Techane, Dr. Aimce Haley and PhD student Eyerusalem Almeran Almese.

all have relevance for the conditions of education and educational policy making in Ethiopia, ranging from preschool to higher education. These are:

- a) The right to education for the disadvantaged – studies of refugee education, education for the pastoralists, education for children with special needs, and early childhood education and care.
- b) Education and employment/jobs – studies on graduate employment, entrepreneurship education, and public/private development partnerships in TVET (Technical and Vocational Education and Training).
- c) Quality of education – several studies on higher education quality assurance mechanisms, and on classroom teaching, and donor coordination in school improvement programs in the general education sub-sector.
- d) Teacher education – studies of the structural quality of the education of early childhood teachers and of teacher educators' experiences of dealing with diversity.
- e) Internationalization of education – studies on university ranking practices in Ethiopia, international large-scale assessments in education, and international partnerships in education.

All studies are placed in the nexus between educational practices and policy making and are connected to sustainable development goals,

in particular goal 4 - quality education - but goals 1- no poverty, 5 - gender equality, and 8 - decent work, are also important. An overarching result of the studies is that context matters. There is a need to pay close attention to the inherent multiple and complex local factors in order to better understand the processes within, and the development of, the Ethiopian educational system regarding national policy making, international large-scale interventions (such as university rankings and the development of conceptual understandings) and the implementation of policies.

### Results of the capacity-development component

PhD supervision is the main capacity-development component in this project. For example, all supervision meetings were used as quasi-supervision training sessions wherein important issues in the supervision process were identified and senior professors from the University of Gothenburg (GU) shared experiences and promoted cross-cultural discussions. CCEPS and GU staff members are currently collaborating in research regarding cross-cultural experiences. An international conference was organized in Addis Ababa where PhD students in CCEPS and their supervisors presented joint research papers. Keynote speakers were invited from among the leading scholars in the field of comparative education and policy studies. The opportunity was used to improve the quality of the PhD program in CCEPS and also to broaden the centre's international network. These periods of partnership have improved staff research engagement and one staff member has been promoted from assistant professor to associate professor. In addition, CCEPS has also launched a new Master of Arts program in international and comparative education which will further stabilise the activities at the center.

### (Long-term) impact of the results

The collaborative PhD program in international and comparative education has had some significant impact in the Ethiopian education system. A Master of Arts program has been started in Bahir Dar University by two PhD graduates from CCEPS. Another two PhD graduates are serving as presidents of higher education institutions: one is president of a university and the other of a university college. A PhD graduate from CCEPS is currently serving as director for a center of excellence in teacher education and leadership development in one of the public universities in Ethiopia. Other graduates from the PhD program in CCEPS are serving on policy advisory bodies in the Ministry of Education (MoE) and its agencies in Ethiopia. There are also graduates from CCEPS serving as Directors and Director Generals in the MoE, Higher Education Quality and Relevance Agency (HERQA), Higher Education Strategic Centre (HESC), and in the National Educational Assessments and Examination Agency. Other graduates from the PhD program are working in public universities as academic staff.



A joint research seminar for the doctoral students and supervisors, University of Gothenburg.



"Half-way"— Syiane Aniley discusses her thesis manuscript during an open seminar at the University of Gothenburg.

## SOME VOICES ON THE IMPORTANCE OF THE COOPERATION



The photo shows Yikaalo Welu (far right), the first PhD in Management to graduate from an Ethiopian university, with his family and supervisors Lucia Naldi (far left) and Ethel Brundin (3rd from left). Photo: Olof Brunninge.

*Prof. Anders Carlsson and Prof. Rickard Ignell, SLU Alnarp*

Collaboration between the SLU Department of Plant Protection Biology and the AAU Department of Zoological Sciences was initiated by Dr Ylva Hillbur and the late Dr Emiru Seyoum in 2007, resulting in a long-term bilateral Linné-Palme exchange program for teachers and students (2008-2018): 14 PhD student, 5 postdoc, plus 20 teacher and student exchanges. This program, which continues to date, funded by Sida and the Swedish Research Council and involving joint PhD students and postdocs, laid the foundation for shared research projects, aimed at identifying innovative control options for plant pathogens, as well as insect pests and vectors of human disease.

The last 40 years have seen many pre-breeding and breeding research projects between the Department of Plant Breeding, SLU and AAU, the majority funded through Sida grants/programs. More than 25 students from AAU, most at PhD level, have been involved in these projects over the years. Of these, nine are presently pursuing their PhD education and, while previous students graduated at SLU, the present students will be graduating from AAU. The collaboration projects have included a number of crops and plant species such as barley, wheat, sorghum, coffee, Abyssinian banana, nough, Abyssinian cabbage, hagenia tree, pea, and finger millet. Recent projects include research on endophytes in plants as well as on enzymes in micro-organisms e.g. alkaline environments and hot springs.

*Prof. Olof Brunninge, Jönköping International Business School (JIBS)*

The cooperation between AAU and JIBS dates back to 2012, when JIBS supported AAU's PhD program in Economics. This was soon to be followed by the start-up of a PhD program in management, the first such program in the history of Ethiopia. Our partnership is based on mutual learning and has created trusted relationships, not only between the institutions but also between individual faculty members. While AAU's ownership of the cooperation as a whole is fundamental, we believe that the Swedish side also needs to experience ownership in the sense of a genuine commitment to our joint efforts. Mutual commitment encourages joint activities that go beyond formal agreements. Such commitment has been manifested in joint projects and research applications by JIBS and AAU faculty. A key challenge for the AAU/JIBS collaboration is the building of a sustainable research culture at AAU, going beyond the training of individual scholars. This will require support from all parties involved.

*Lulu Muhe, Honorary Professor, Dept. of Pediatrics, AAU*

A Swedish team from Umeå University visited my department, then called the Ethio-Swedish Children's Hospital, in 1986 and together



The photo shows the late Dr. Kifle Dagne inspecting a nough field.

with Ethiopian University staff, including the late Dr Desta Shamebo, identified Butajira, a district 150 kilometers from Addis Ababa, the capital of Ethiopia, as the area of interest. The main reason was its proximity to the site where medical students learn community public health practice. They planned the Butajira Rural Health Project. Its objectives were to undertake continuous demographic surveillance of vital events and to use the surveillance as a sampling frame for health-related research, such as the Project on Control of Acute Respiratory Infections (ARI) that I was leading and which was the subject of my PhD.

The surveillance system and my PhD training and research were supported technically by many colleagues from the universities of Umeå and Gothenburg and financially by what was then “Sarec”.

My PhD studies were a product of hard work and cooperation between the staff of the Ethiopian and Umeå departments and other colleagues across other departments and even countries. The fact that the World Health Organization was involved in some aspects of my studies means that my PhD helped me to serve the WHO at the African level as well as at the global level.

My PhD studies demonstrated the importance of cooperation. They showed that ARI is the leading cause of morbidity and mortality among under 5-year-olds in developing countries; contributed to the concept of control of ARI programs and eventually to the concept of management of the “sick child” later called the Integrated Management of Childhood Illness (IMCI).



Lulu Muhe, Honorary Professor, Dept of Pediatrics, AAU.



The Butajira Research Team in 2006.



The friendships and the mutually respectful attitudes encountered had a lasting impact as well as making the research process fruitful.

*Prof. Yemane Berahne, Director of Addis Continental Institute of Public Health*

Ethio-Swedish cooperation: nurturing south-north collaboration for sustainable scientific achievements.

One of the most important aspects of Ethio-Swedish research cooperation is the north-south collaboration that focuses on building mutually beneficial research training opportunities. The collaboration fostered a rigorous and sustainable scientific culture. Building cultural competences to work and communicate well in both the north and south, respectively, was a core element of the collaboration. I personally feel compelled to attribute my competence in international research to this cooperation. The friendships and the mutually respectful attitudes encountered had a lasting impact as well as making the research process fruitful. The cooperation nurtured a scientific culture and capacity-building in research training with little administrative burden being placed on the researchers, unlike many other research grants these days. That simplicity allowed researchers to focus on the science.

Many of the research projects supported by the cooperation have continued to date, the Butajira Rural Health Program I actively participated in is still on-going with additional financial commitment from the Ethiopian Government. Ethiopia has produced many world-class researchers through this cooperation who, in turn, continue to generate evidence critical for the policy and practice as well engaging in research training. The domino effect was quite enormous - the impact of the cooperation, in my opinion, is unparalleled.



Micro-gasifier stove and Injera baking biomass gasifier and reactor by Dr. Kamil.

*Dr. Shumey Berhie Teshome, Director, Industry Linkage and Technology Transfer, AAU*

The Office of Industry Linkage and Technology Transfer (ILTT) is striving to be a solution center for all the adaptive, innovative and consultancy needs of industry. This has been achieved through cultivating a culture of innovation, technology transfer and strengthening the linkage and partnership with industry, with the resulting transfer of technology to the community.

ILTT both hosts and incubates (the technology Start Ups of researchers are being incubated in our Technology Incubation Center mainly with the support of Sida). In a Technology Business Incubation Center (AAU-TBIC) periodic innovation competitions are held for researchers and incubation services are provided during their stay in the Center, which can last from 3 to 4 years. Currently, there are more than 16 technology businesses hosted in the AAU-TBIC, substantially funded by AAU-Sida, and 10 of them (three developed by AAU students) have developed prototypes for mass production and are ready for commercialization. A selection is listed below:

- Production of native and modified “enset”, diocorerea and cassava for industrial applications: pharmaceutical, food, textile and paper industries
- Production and distribution of a micro-gasifier and injera baking gasifier stove
- Solar charging station for rural schools
- Ergonomic street cart
- Bio-fungicide production for coffee wilt disease control
- Yarn processing and supply factory
- Alpha broom manufacturing
- BMR civil engineering technology
- OutsourceET.com
- Gigs Ethiopia

Several additional interesting and promising projects are on-going – for more information visit the ILTT website [iltt.aau.edu.et](http://iltt.aau.edu.et).



BiFace Shield by AAIT - More than 3000 face shields distributed to health workers fighting COVID-19 in public hospitals (2020).



Prof. Wendimagegn Mammo.

*Professor Wendimagegn Mammo, Dept of Chemistry, AAU*

The overall goals of our project, as also described on p. 26, have been to synthesize and characterize novel  $\pi$ -conjugated small molecules, conjugated polymers and polymer/nanomaterial and biomaterial composites to improve the power conversion efficiency of organic solar cells and the charge storage capacities of supercapacitors and batteries. The sustained support we received enabled us to build a strong research capacity, to conduct high-level research and train capable candidates at the postgraduate MSc and PhD levels. Cooperation with Chalmers University of Technology meant that sandwich PhD training in the area of materials chemistry could be pursued. This exposed our students to advanced research techniques and modern facilities and as a result they could conduct high-level research and produce PhD theses of good quality.

Chemical research is a resource-intensive and challenging undertaking. Through the multifaceted support, we could overcome our difficulties and were able to organize excellent synthetic organic chemistry and electrochemistry laboratories and equip them with modern facilities. This allowed us to conduct internationally competitive research, enhance our training capacity and promote our department as a focal point for researchers in sub-Saharan Africa. The research-grade equipment and facilities we acquired also supported the advancement of scientific research at the departments of chemistry and physics.

Strong research collaborations could be established with researchers at Chalmers and Linköping University. The joint research undertakings led to the publication of many scientific papers in international journals of repute. We have also benefited from the exchange of a researchers' scheme which helped us to break our isolation from the world community of scientists and to keep abreast of current developments in our areas of research. Through participation in international conferences, workshops and symposia, we could showcase research findings, increase our visibility on the world stage and interact and exchange ideas with world-renowned scientists.

Our research endeavors have led to the publication since 2003 of more than 120 articles in internationally respected journals. We have also been able to provide high quality training in the same time period for more than 45 MSc and 12 PhD candidates working on the synthesis and characterization of conjugated polymers, solar energy conversion, energy storage, sensory properties of polymers and water purification systems. We organized workshops and symposia on solar energy conversion and energy storage systems. We and our students were granted the opportunity to present our research findings in national, regional and international conferences.

Ever since Addis Ababa University (AAU) was established by



Queue for registering at the Conference 2017.



Emperor Haile Selassie I in 1950, consecutive governments in Ethiopia have provided it with the full support it needed to continue growing in a country known to be one of the low-income countries of the World. Alongside this government support, international development organizations, such as the Swedish International Development Cooperation Agency (Sida), have kept pace and supported AAU in all its ventures to achieve academic excellence. For its part, AAU duly valued all the national and international support and turned it into usable outcomes. The fruits are out there for everyone to see, and their existence increases Ethiopia's visibility globally.

Today, AAU is recognized as the tenth best university in Africa, number one in Eastern Africa, and 553rd in the World. While celebrating these achievements, AAU is working hard on the responsibilities they entail and at the same time venturing strategically into the future.

To that end, AAU has developed its strategy for the next ten years, captured in its Ten-Year Strategic Plan: 2020-2030, published in October of 2020 (available on the AAU website [www.aau.edu.et](http://www.aau.edu.et)). This plan lays down new strategic aims in the light of the latest trends and directions both in the Ethiopian Government's higher education development plans and in global perspectives. Accordingly, AAU,

## AAU'S VISION OF THE FUTURE





To excel in learning and teaching to ensure that future generations carry forward the academic aspirations of AAU and the gains thereof.

through strategic intent and deliberate actions, aims to become a world-class university and a leading regional research university.

The strategy whereby this will be achieved is:

1. to excel in learning and teaching to ensure that future generations carry forward the academic aspirations of AAU and the gains thereof;
2. to excel in research and managing the transfer of knowledge and technologies to the Ethiopian public and the world at large;
3. to excel in engagements and partnerships within the scholarly community to support the people of Ethiopia, who put it there in the first place;
4. to excel in the good governance and management of diversity that is to be expected of an institution which is the first in the country and among the ten leading universities in the African context.

In addition to the above strategic goals, and facilitating the university's continued motivation to contribute extensively to national development, AAU will become the first autonomous university in the country, itself running its academic, financial and administrative activities and thus serving as a model for other Ethiopian public universities. This upgrading of AAU to an autonomous institution by the Ethiopian Government will be greatly instrumental in achieving the above key strategic aims of the university and in the realization of its visions and mission, in the best interests of the Ethiopian people. AAU therefore seizes this opportunity to acknowledge the continued support of the Ethiopian Government in all its endeavors to promote academic excellence and of international organizations such as Sida/Sweden, the Swedish Government and the people who have been with Ethiopia in the good and the challenging times, sustaining the commitment to excellence and promoting the interests of developing countries such as Ethiopia.

